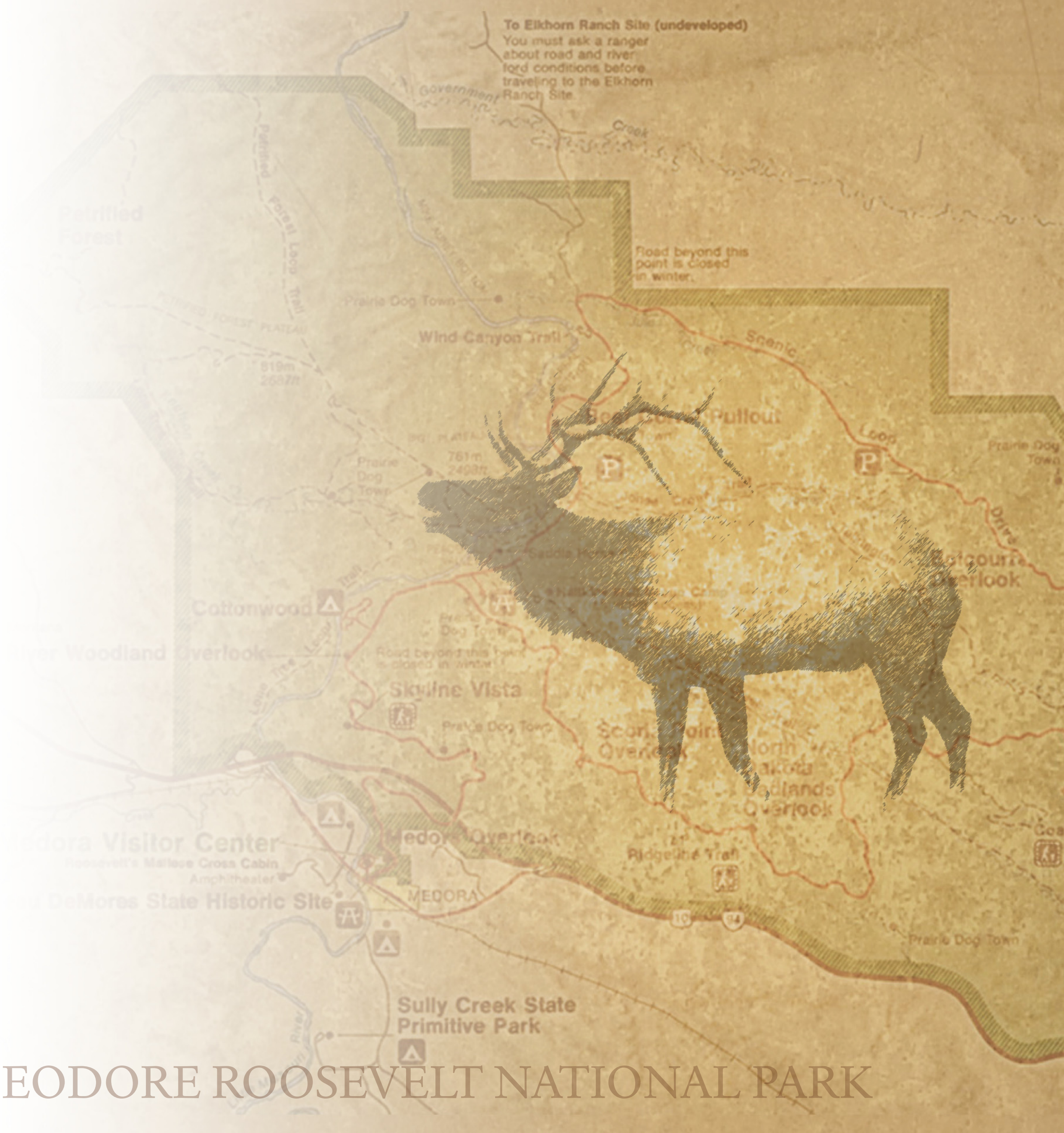
AFFECTED ENVIRONMENT



THEODORE ROOSEVELT NATIONAL PARK

CHAPTER 3: AFFECTED ENVIRONMENT

INTRODUCTION

The "Affected Environment" describes existing conditions for those elements of the natural and cultural environments that would be affected by implementing the actions considered in this environmental impact statement. Because elk activity is centered in the South Unit, which is located 35 miles south of the Elkhorn Ranch Unit and 45 miles south of the North Unit, management actions proposed in this plan/EIS would only be applied in this unit of the park. Therefore, the discussion of the affected environment is limited to only those resources that may be affected by actions taken in the South Unit, including management of the adjacent lands. The natural environment components addressed include soils and water, vegetation, the elk population, other wildlife and wildlife habitat, federally listed threatened and endangered species, species of special concern, and wilderness. The cultural components include archeological and ethnographic resources. Socioeconomic conditions, visitor use and experience, employee and visitor health and safety, and park operations and management are also addressed.

The "Affected Environment" describes natural and cultural environments that would be affected by implementing the actions considered in this environmental impact statement.

GENERAL PROJECT SETTING

Theodore Roosevelt National Park (hereafter park) is located in the Missouri Plateau and North Dakota Badlands section of the Great Plains physiographic province. The park encompasses rugged badlands composed of deposits from the Paleocene epoch (about 65 to 55 million years ago), and is characterized by canyons eroded over time by the Little Missouri River and other streams, which also shaped a variety of resultant landforms including buttes, ridges, and rolling hills.

The park is located within the mixed-grass prairie region of the Northern Great Plains, where vegetation is influenced by the topography and variety of soils. Plant communities in the South Unit generally consist of badlands sparse vegetation, sandbars, grasslands, herbaceous wetlands, shrublands, woodlands, black-tailed prairie dog town complexes, and exotic herbaceous vegetation (Von Loh et al. 2000). These are described in more detail in the "Vegetation" section of this chapter.

Theodore Roosevelt National Park is located in an area with a semi-arid, continental climate of short, hot, dry summers, and long, cold, dry winters. Climate data for Medora, North Dakota, has been recorded since 1948 and show that temperatures range from an average of 15 degrees Fahrenheit (°F) in winter to 71°F in the summer. The average annual temperature during this time is 44°F. The highest recorded temperature was 107°F in June of 1988, while the lowest was -49°F in January of 1950 (WRCC 2007). Temperatures in the spring and fall seasons can vary dramatically and change abruptly within a short period. Precipitation for this region is usually heaviest in late spring and early summer (75% falls between April and September), with a total annual average of 13.9 inches recorded in Medora (Von Loh et al. 2000).

Theodore Roosevelt National Park is located in an area with a semi-arid, continental climate of short, hot, dry summers, and long, cold, dry winters.

SOILS, EROSION, AND WATER RESOURCES

During scoping, the interdisciplinary team identified the potential for soil erosion in the South Unit and the associated potential for water quality impacts from increased sedimentation as an issue for this plan/EIS. Other impacts to geologic and water resources (including water quantity and groundwater) were dismissed from further consideration as described in chapter 1. As a result, the soils and water resources affected environment are described together, with a focus on the erosion potential of the soils and the current water quality conditions of the South Unit.

SOILS

Many of the soils in the South Unit are susceptible to erosion, and elk management activities could potentially increase sedimentation to surface waters, including the Little Missouri River. For example, of the 60 soil types identified within the South Unit, 49 have a moderate (43) or high (6) erosion hazard, based on classification of the soil erodibility factors from the U.S. Department of Agriculture, Natural Resources Conservation Service (USDA-NRCS 2005; Michigan State University 2002). Soils with moderate or high erosion hazard cover approximately 92.1% of the land in the South Unit (67.2% and 24.9%, respectively; see map 4), and are found in a variety of locations, on slopes of 0 to 75%. Soils with moderate erosion hazard are generally found on alluvial fans/flats, pediments (broad, gently sloping rock surfaces at the base of a steeper slope), paleoterraces (ancient floodplain terraces), and some floodplains. Soils with high erosion hazards are primarily found on the backslopes and shoulders of ridges within the park.

WATER RESOURCES

The Little Missouri River (see map 4) is the major surface water resource in the park, flowing through approximately 8.7 miles of the South Unit, before continuing northeast until it reaches the Missouri River at Lake Sakakawea. This free-flowing river is 560 miles long, drains an area of about 4,750 square miles, and has a relatively low gradient of 4.6 feet per mile. The channel undergoes constant bed scour, a condition not expected given the relatively low gradient of the river. The bed scour is probably a result of the highly erodible bed material derived from the surrounding badlands (NPS 2002d).

Sections of the Little Missouri River flowing through the park are eligible for listing as a national wild and scenic river, though it is not listed at present. The Little Missouri River is identified on the Nationwide Rivers Inventory prepared by the NPS because of its unaltered condition; outstanding scenic, historic, and recreational values; and its value as fish and wildlife habitat. In addition, the Little Missouri River has been determined a non-navigable river and is therefore not subject to the requirements of section 404 of the Clean Water Act.

The volume of flow in the Little Missouri River system varies greatly, from as low as zero to as high as 65,000 cubic feet per second. The lowest flows typically occur in winter (December and January), whereas peak flows come in March and April, the result of snowmelt runoff and spring rains. A secondary peak in June coincides with the beginning of summer thunderstorms. Flow in the Little Missouri River can cease completely in dry seasons, leaving only disconnected pools in the streambed (NPS 2002d).

Numerous tributaries to the Little Missouri River, including Paddock Creek, Jones Creek, Jules Creek, and Knutson Creek, are also found within the South Unit. These and other non-tributary streams are generally considered intermittent or ephemeral surface waters. Intermittent, or seasonal, streams are those in contact with the groundwater table that flow at certain times of year. Flows in intermittent streams are typically limited to times when the groundwater table is high, from springwater, or from a surface source such as melting snow. Ephemeral streams are those that flow briefly only in direct response to precipitation in the immediate locality and whose channels are at all times above the water table (NPS 2002d).

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North Dakota

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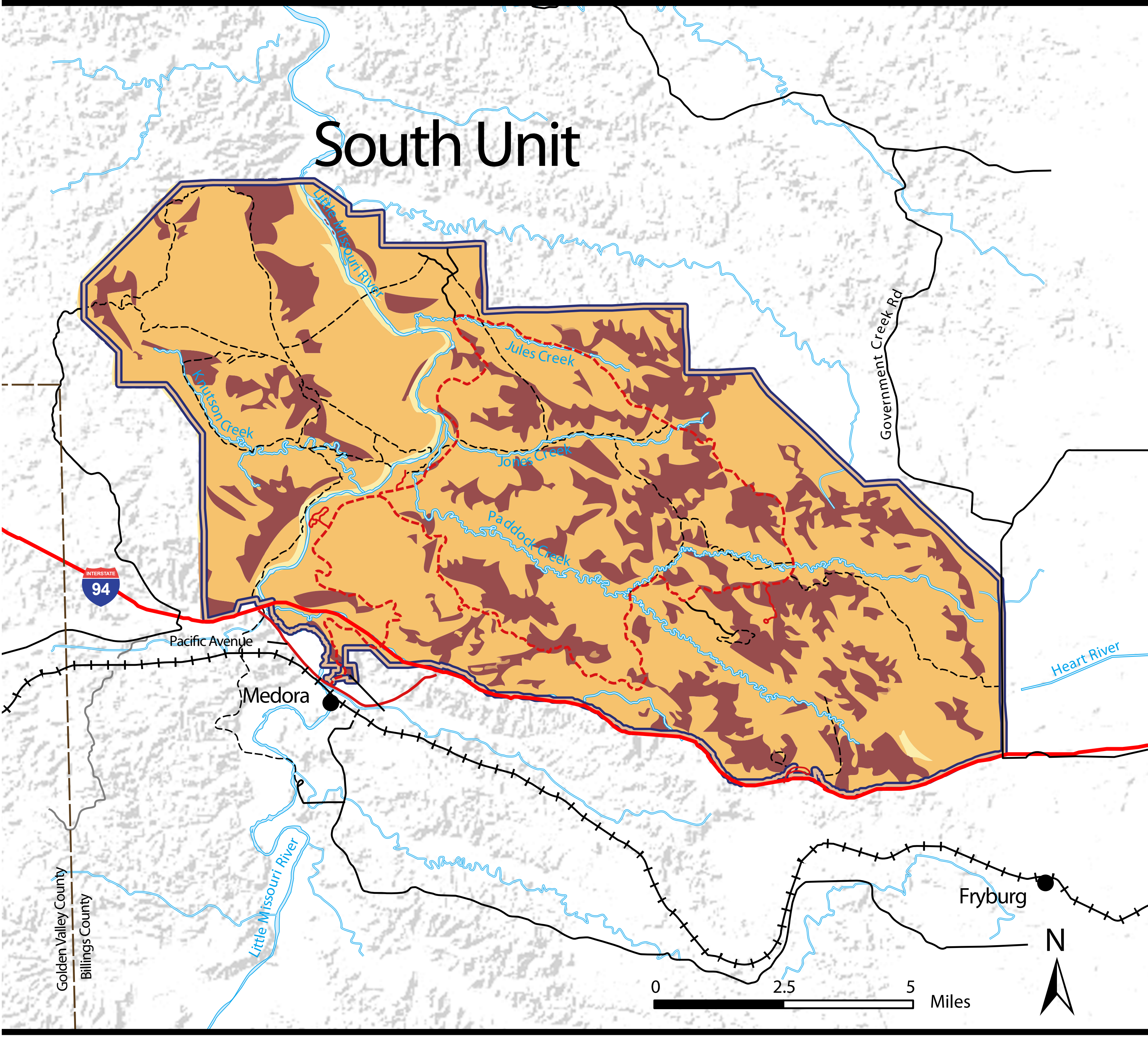

Interstate

Roads

Scenic Loop Drive

Trails

Railroads

Streams

Park Boundary

Soil Erosion Hazard

Slight

Moderate

High

Map 4:
Soil Erodibility and Surface Water in the South Unit

Seeps and springs are found in the South Unit of the park as well. Seeps include surface waters with minimal flows and no defined channel or opening where discharge concentrates. The sources of water supplying seeps may be local, in which case the seeps respond rapidly to rainfall or drought. Seeps may also be the outlet for underground water that has traveled for long distances. Springs are a special class of surface water characterized by well-defined flow paths that lend them to water capture and further development. Like seeps, springs may be fed by bodies of permeable materials recharged by local precipitation, or fed through long pathways from distant recharge points (NPS 2002d).

Overall, water quality monitoring data from the U.S. Environmental Protection Agency indicate surface waters within the Little Missouri River surrounding the park have been impacted by human activities, including wastewater discharges, livestock grazing, and oil and gas activities. Turbidity, sulfate, and several metals that have exceeded criteria in the past are probably explained by natural characteristics of the soils and surficial geology in the Little Missouri River basin. Agricultural practices and petroleum exploration and production activities in the area exacerbate this problem (NPS 2002d).

The Clean Water Act (CWA) requires states to compile a list of water bodies, known as the 303(d) list, that do not fully support their beneficial uses. Based on the most recent report submitted to the EPA in 2006, no surface waters in the South Unit of the park are on the 303(d) list (North Dakota Department of Health 2006). In addition, there are no 303(d) waters downstream of the South Unit that would be affected by elk management.

VEGETATION

As described in the “General Project Setting” section, the park is located within the mixed-grass prairie region of the Northern Great Plains. Approximately 619 species of vascular plants are found in the park, most of which are adapted to a semi-arid climate; 90 of these species are exotic (NPS 2007a). At least 109 species of bryophytes (mosses, liverworts, and hornworts) and 208 species of lichens (a combination of fungi and algae) are documented in the park. All plant species identified in the park are listed in appendix F of this plan/EIS, although all of these species may not occur in the South Unit.

Under the current park Fire Management Plan, prescribed fire is an important component of ecosystem management and is used to reduce fuel loads, as well as restore plant community structure and composition, to ranges of natural variability comparable to pre-European settlement (THRO 2008). Some of these plant communities are influenced by the presence of large ungulates and black-tailed prairie dogs, through herbivory and other impacts (e.g., trampling).

VEGETATION CLASSIFICATION FOR THE SOUTH UNIT

Vegetation communities in the park have been classified and mapped on several occasions, most recently in the late 1990s as part of the USGS-NPS Vegetation Mapping Program (Von Loh et al. 2000). Using the National Vegetation Classification System (NVCS), approximately 31 vegetation types and six land use/land cover types were classified for the South Unit of Theodore Roosevelt National Park. The NVCS contains seven classification levels with the two finest (lowest) being the alliance and association (community) levels. For the purposes of this plan/EIS, these vegetation types were grouped into eight broad mapping units, including badlands sparse vegetation; sandbars; grasslands; shrublands; herbaceous wetlands; woodlands; black-tailed prairie dog town complex; and exotic herbaceous vegetation. The alliances and associations that make up each of these map units are described in more detail in the following sections and distribution is shown in map 5. The land use/land cover types have also been grouped for this EIS into three mapping units, including agriculture; developed/disturbed areas; and water. Although not described in detail below, these types are graphically depicted in map 5.

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North Dakota

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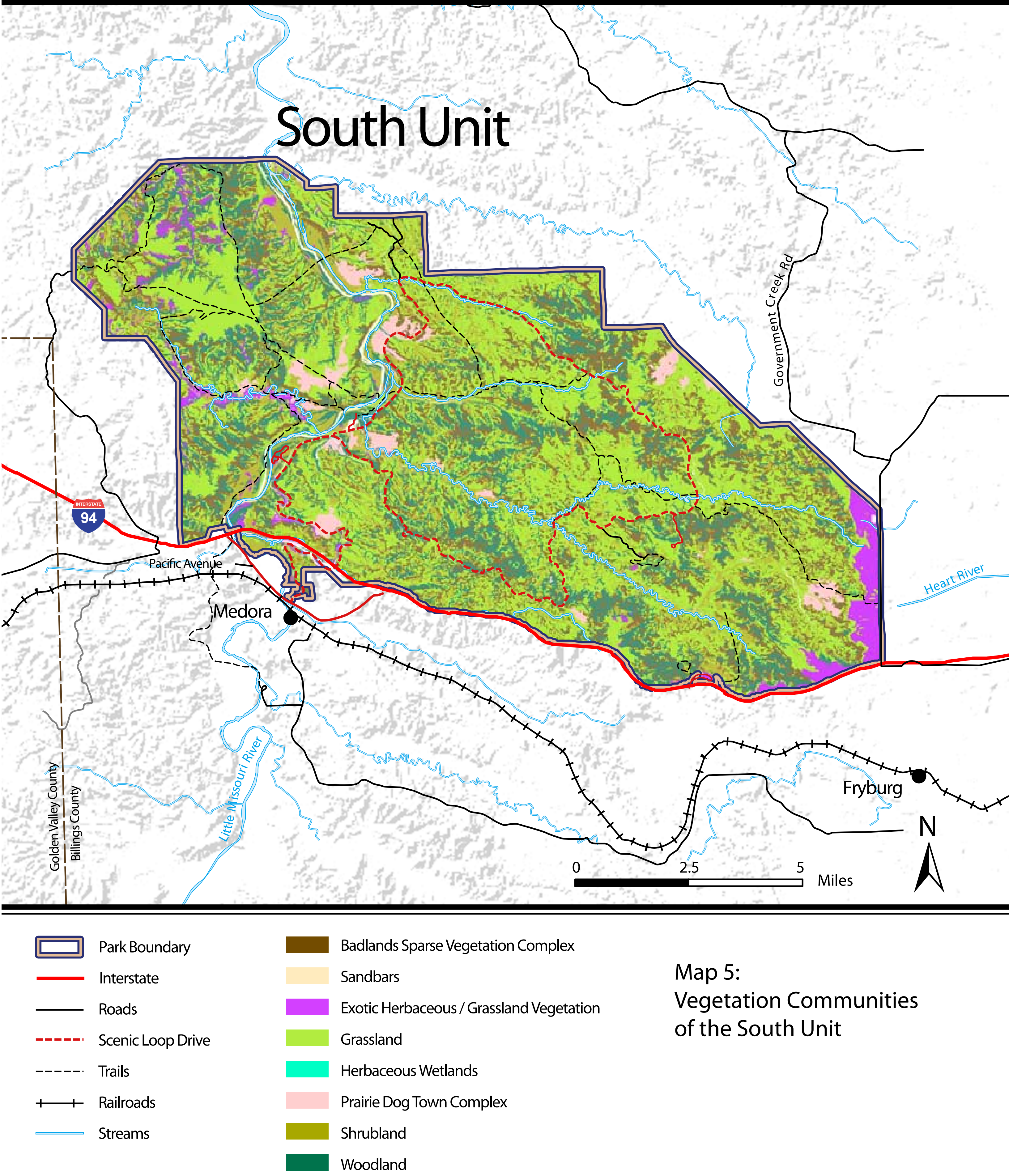
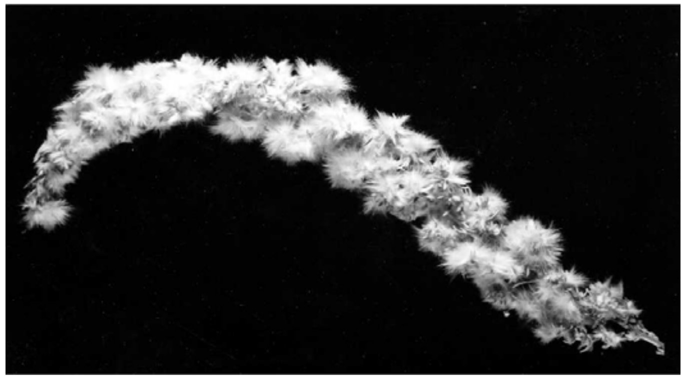


Map 5:
Vegetation Communities of the South Unit

Badlands Sparse Vegetation


winterfat (*Krascheninnikovia lanata*)

This complex is characterized by a sparse (typically 5% to 10% cover) mixture of low-growing shrubs, forbs (broad-leaved herbs other than a grass), and grasses. It is found in the badlands of the park, on exposed cliffs, ridges, slopes, narrow gorges, buttes, mounds, fans, and drainages. The most abundant shrubs in the badlands sparse vegetation complex at the park include broom snakeweed, Wyoming big sagebrush (*Artemisia tridentata*), spiny saltbush (*Atriplex confertifolia*), and winterfat. American sea-blite (*Sueda depressa*) and inland saltgrass (*Distichlis spicata*) are the most common grasses found in this complex in the park, while Barr's milkvetch (*Astragalus barrii*), Dakota wild buckwheat (*Eriogonum visheri*), and tufted evening-primrose (*Oenothera caespitosa*) are typical forbs (Von Loh et al. 2000).

Relatively rare long-leaved sagebrush (*Artemisia longifolia*) communities, as well as clinker sparse vegetation, have been mapped as part of the Badlands Sparse Vegetation. The long-leaved sagebrush community is very sparse (foliar cover is typically less than 5%), and the sagebrush is often the only species present. Other species that were identified in some sites included rabbitbrush (*Ericameria nauseosa*) and western wheatgrass (Von Loh et al. 2000).

Sparse vegetation communities dominated by three-leaved sumac or sparse Rocky Mountain juniper stands are located on landscapes with exposures of clinker. Clinker consists of reddish to purplish layers and brick-like masses of baked and fused clay, shale, and sandstone. These layers formed when lignite coal (a soft coal consisting of plant fragments deposited in Paleocene swamps) burned, producing heat that baked the adjacent sediments. Exposures of clinker within the park are typically small and lie atop larger badland erosional features or within shrub communities (Von Loh et al. 2000).

These communities within the badlands sparse vegetation complex provide preferred habitat for elk, including important forage species such as winterfat (see "Elk Use of Vegetation in the South Unit" and "Ungulate Diets in the South Unit" sections later in this chapter). Rocky

Sandbars

This is a very sparsely vegetated, weedy community found on newly exposed and deposited sandbars created by the changes of water levels in the Little Missouri River. Because of the dynamic environment in which this community is located, species richness (the number of species in an area) is relatively low and consists primarily of the exotic spiny cocklebur (*Xanthium spinosum*) or lesser burdock (*Arctium minus*) (Von Loh et al. 2000). As described in the "Elk Use of Vegetation in the South Unit" and "Ungulate Diets in the South Unit" sections later in this chapter, elk are not known to use riparian areas extensively, which is where these sandbars occur, likely because of the presence of people in these areas of the South Unit.

Grasslands

Grasslands are distributed across deeper soils, including plains, valleys, buttes, and sand hills and ridges. Grasslands occupy thin soils on gravelly slopes and hills that do not hold water. In the South Unit, these grasslands are classified in one of four NVCS types, including the Little Bluestem-Sideoats Grama (*Schizachyrium scoparium - Bouteloua curtipendula*) Herbaceous Alliance; the Needle-and-Thread Herbaceous Alliance; Prairie Sandreed (*Calamovilfa longifolia*) Herbaceous Alliance; and the Western Wheatgrass Herbaceous Alliance.

The Little Bluestem-Sideoats Grama Herbaceous Alliance at Theodore Roosevelt National Park is characterized by 75% to 100% ground cover and is dominated by little bluestem. Threadleaf sedge (*Carex filifolia*) is usually another common gramminoid (a grass or grass-like plant) species found on most sites while sideoats grama is a minor secondary species (Von Loh et al. 2000).


western wheatgrass (*Pascopyrum smithii*)

The largest stands of the Needle-and-Thread Herbaceous Alliance in the South Unit of Theodore Roosevelt National Park are located on the Petrified Forest Plateau. Ground cover is typically very high (75% to 100%) and sites are dominated by both needle-and-thread and blue grama. Threadleaf sedge, fringed sage (*Artemisia frigida*), and prairie junegrass (*Koeleria macrantha*) are usually major contributors within these grasslands (Von Loh et al. 2000).

The Prairie Sandreed Herbaceous Alliance is characterized by 15% to 30% ground cover and is dominated by prairie sandreed. Threadleaf sedge is the other gramminoid most commonly associated with this community, while porcupinegrass (*Hesperostipa spartea*) is less common (Von Loh et al. 2000).

The Western Wheatgrass Herbaceous Alliance is dominated by western wheatgrass, which can appear to form pure stands. Depending on moisture availability, this alliance in the park supports other major grasses such as blue grama (drier sites), fringed sage (drier sites), green needlegrass (wetter sites), and western sagewort (*Artemisia ludoviciana*) (wetter sites). Ground cover for this type, which is often closely associated with western snowberry communities, varies from less than 25% to greater than 50% (Von Loh et al. 2000).

All of these grasslands, especially the needle-and-thread and western wheatgrass herbaceous alliances, support important habitat and forage used by elk. Species such as western wheatgrass, sedges, fringed sage, and green needlegrass are important in diets of elk (see “Elk Use of Vegetation in the South Unit” and “Ungulate Diets in the South Unit” sections later in this chapter).

Shrublands

Shrublands occupy all major drainages, heads of draws (small natural drainage areas), hill slopes, and flats at the park. Shrublands fall into one of several NVCS classifications, including the Greasewood (*Sarcobatus vermiculatus*) Shrub Herbaceous Vegetation association; Horizontal Juniper (*Juniperus horizontalis*) Dwarf Shrub Alliance; Rabbitbrush Shrubland Alliance; Sandbar Willow (*Salix exigua*) Temporarily-flooded Shrubland Alliance; Silver Buffaloberry (*Shepherdia argentea*) Shrubland Alliance; Silver Sagebrush – Western Wheatgrass (*Artemisia cana - Pascopyrum smithii*) Shrubland; Three-leaved Sumac (*Rhus trilobata*) Shrubland Alliance; and Western Snowberry Temporarily-flooded Shrubland.

The Greasewood Shrub Herbaceous Vegetation, perhaps the rarest shrub type in the park, has been observed at only two areas in the South Unit. It is characterized by widely spaced greasewood plants with a well developed layer of grasses and forbs dominated by western wheatgrass (Von Loh et al. 2000). The Horizontal Juniper – Dwarf Shrub Alliance is a dwarf shrubland (less than about 12 inches [30 centimeters]) often found in continuous mats that stabilize gravel and clinker slopes. A wide variety of shrubs are found with the horizontal juniper, including chokecherry, shrubby cinquefoil (*Pentaphylloides floribunda*), and three-leaved sumac. The sites may also contain a few, short green ash and Rocky Mountain juniper trees. Little bluestem and prairie sandreed are the most common grasses in this alliance, which is often characterized by exceptionally high species richness, probably the highest in the park (Von Loh et al. 2000). The Rabbitbrush Shrubland Alliance is commonly found in small patches along road cuts and slumped areas. Chokecherry, western snowberry, and Rocky Mountain juniper are other shrubs present, while western wheatgrass is the dominant grass in the herbaceous layer of this alliance (Von Loh et al. 2000).

The Sandbar Willow Temporarily-flooded Shrubland Alliance is found immediately adjacent to the Little Missouri River on the more stabilized point bars, where moist sandy sediments collect. The stands are typically small (less than 1.2 acres), but the willow forms very dense cover (greater than 75%). Young cottonwoods are also present, while the exotic yellow sweetclover (*Melilotus alba* and *M. officinalis*), rough cocklebur (*Xanthium strumarium*), and prairie cordgrass (*Spartina pectinata*) are the most common forb and grass species (Von Loh et al. 2000). The Silver Buffaloberry Shrubland Alliance is found in small patches in upland draws. These shrublands, which also frequently support western snowberry and, to a lesser extent, chokecherry, can be so dense that large animals cannot pass through them. The understory includes a diversity of grasses and forbs, with no obvious dominant species (Von Loh et al. 2000).

The Silver Sagebrush – Western Wheatgrass shrublands form the prominent and relatively large “sagebrush flats” of nearly flat and gently sloping floodplains, as well as the slightly elevated terraces, along the Little Missouri River and its major tributaries. In addition to silver sagebrush, other shrubs in this community include chokecherry and western snowberry. Western wheatgrass is the dominant understory grass and the exotic smooth brome (*Bromus inermis*) and leafy spurge (*Euphorbia esula*) are also found frequently (Von Loh et al. 2000). Steep clinker slopes that show little, if any, soil development support the Three-leaved Sumac Shrubland Alliance. Chokecherry may also be present in the shrub layer. Plains muhlenbergia (*Muhlenbergia cuspidate*) is the dominant grass in a sparse herbaceous layer that often also supports yellow sweetclover (*Melilotus officinalis*). The Western Snowberry Temporarily-flooded Shrubland association is common throughout the area in swales, draws, and small depressions. Western snowberry stands are found in close association and often intermixed with a wide variety of other vegetation types. The shrub occurs in such dense stands that it limits species diversity, although chokecherry may be present. Grasses present include western wheatgrass, green needlegrass, and the exotic Kentucky bluegrass (*Poa pratensis*) (Von Loh et al. 2000).

All of these shrublands, with maybe the exception of the Greasewood Shrub Herbaceous Alliance, support habitat and forage for elk, including western snowberry and/or chokecherry which are important in the diet of elk (see “Elk Use of Vegetation in the South Unit” and “Ungulate Diets in the South Unit” sections on in this chapter). However, some of these (Sandbar Willow Temporarily Flooded Shrubland Alliance) are located in riparian areas that elk do not use extensively, likely because of the presence of people in these areas of the South Unit.

green ash
(*Fraxinus pennsylvanica*)

Herbaceous Wetlands

Wetlands, relatively rare within the park boundaries, are found in depressions, meandering drainages, seeps, springs, and old oxbows, and are dominated by broad-leaved cattail (*Typha angustifolia*) communities. In many cases, ponds developed for livestock support wetland vegetation in the shallower water and in the seepage zone below the dam structure. As discussed in the “Issues Dismissed from Further Consideration” section of chapter 1, the potential for impacts to wetlands is low and, therefore, wetlands are not analyzed further in this plan.

Woodlands

Deciduous and evergreen woodlands (communities dominated by trees with less than 60% canopy cover) are found throughout the park (Von Loh et al. 2000); however, of those that occur in the South Unit, only one is dominated by an evergreen species. These woodlands include Cottonwood – Peachleaf Willow (*Populus deltoides – Salix amygdaloides*) Floodplain Woodland; Cottonwood – Rocky Mountain Juniper Floodplain Woodland; Cottonwood Temporarily Flooded Woodland Alliance; Green Ash – American Elm (*Fraxinus pennsylvanica – Ulmus americana*) Woodland Alliance; Green Ash – American Elm Temporarily-flooded Woodland Alliance; Quaking Aspen Woodland Alliance; and Rocky Mountain Juniper Woodland Alliance.

yellow sweetclover (*Melilotus officinalis*)

The three woodlands characterized primarily by the presence of cottonwoods are commonly found in association with each other. The Cottonwood – Peachleaf Willow Floodplain Woodland is typically found on the floodplain terrace immediately above the Little Missouri River and sometimes on well stabilized point bars. Eastern cottonwood is the dominant tree species, yet peachleaf willow (*Salix amygdaloides*) also contributes to the tree canopy. Although not always present, short shrubs in the understory include sandbar willow and western snowberry. Grasses and forbs are fairly species rich with no clear dominant species, although wild licorice (*Glycyrrhiza lepidota*) and the nonnative yellow sweetclover usually appear as the most obvious herbaceous species (Von Loh et al. 2000). The canopy of the Cottonwood – Rocky Mountain Juniper Floodplain Woodland, also found on floodplains of the Little Missouri River, is dominated by eastern cottonwood, with Rocky Mountain juniper and green ash as secondary tree species, including younger saplings that contribute to the shrub layer. Other shrubs include chokecherry and western snowberry, while the most abundant grasses include the exotic Kentucky bluegrass and smooth brome (Von Loh et al. 2000). The Cottonwood Temporarily Flooded Woodland Alliance is common along the floodplain of the Little Missouri River throughout the park. Large and mature eastern cottonwood trees form a distinctive emergent canopy, while green ash and Rocky Mountain Juniper may be found as secondary species. Shrubs in the understory are usually quite diverse with western snowberry and chokecherry being most abundant. The exotic yellow sweetclover and leafy spurge are common herbaceous species found in the understory of this alliance in the South Unit (Von Loh et al. 2000).

The Green Ash – American Elm communities are common along upland drainages where they are often found in long, narrow draws. Green ash is the dominant tree species, with American elm and box-elder (*Acer negundo*) as secondary species. Chokecherry is the most common shrub, although Wood's rose (*Rosa woodsii*), three-leaved sumac, and serviceberry are also present. The most common gramminoids and forbs include the exotic Kentucky bluegrass, as well as longbeak sedge (*Carex sprengelii*), and northern bedstraw (*Galium boreale*) (Von Loh et al. 2000). The Quaking Aspen Woodland Alliance woodland is relatively rare in the south unit, at the top of a few north facing slopes. The canopy provides about 43% cover, and most quaking aspen appear to be older with few, if any, new shoots in the understory. The understory is dominated by shrubs such as chokecherry, three-leaved sumac, and serviceberry, as well as a diversity of grasses (Von Loh et al. 2000).

The Rocky Mountain Juniper Woodland Alliance occurs throughout the clinker hills, in transition zones between grasslands and old river terraces, and sometimes at the upper reaches of hardwood draws. Rocky mountain juniper forms an interlocking canopy in these woodlands, which also support green ash in low densities (especially on the upper reaches of upland draws). Chokecherry is a frequent understory shrub, often forming dense patches. Littleseed ricegrass (*Oryzopsis micrantha*) is the characteristic grass species, while starry false lily of the valley (*Smilacina stellata*) is a characteristic forb species (Von Loh et al. 2000).

Wooded draws that support Green Ash-American Elm and Rocky Mountain Juniper woodlands provide important cover, especially in the summer, as does the quaking aspen community. Chokecherry, an important forage species for elk (see "Elk Use of Vegetation in the South Unit" and "Ungulate Diets in the South Unit" sections in this chapter), is found in the shrub layers of these communities. The shrub layer of the cottonwood communities also contains chokecherry; however, these are typically in riparian areas that elk do not use extensively.

Black-tailed Prairie Dog Town Complex

Black-tailed prairie dog towns are distributed on appropriate soils (those deep enough and with structure capable of supporting burrows), and are dominated by early successional forbs, many of them exotic. The prairie dog towns occur throughout Theodore Roosevelt National Park and are especially prominent along roadsides in the South Unit. Although several plant species are consistently found in the prairie dog towns, overall vegetation characteristics are highly variable depending upon size and age of the town and its position on the landscape. The more common patches of vegetation within towns include purple three-awn (*Aristida purpurea*), fetid dogweed (*Dyssodia papposa*), the exotic field bindweed (*Convolvulus arvensis*), and large-bract vervain (*Verbena bracteata*). Ground cover varies from less than 25% to almost 100%, and, compared to the more isolated towns, those located adjacent to roadsides and on the sage brush flats associated with the Little Missouri River often contain more exotic plant species, especially smooth brome (Von Loh et al. 2000).

Elk are known to use prairie dog towns and do forage on smooth brome (see "Elk Use of Vegetation in the South Unit" and "Ungulate Diets in the South Unit" sections in this chapter).

Exotic Herbaceous / Grasslands Vegetation

Exotic plant species are wide-spread in some areas of the park, including the exotic species found in the other vegetation types described previously. However, there are also three alliances dominated by exotic species that occur in the South Unit: the Leafy Spurge Herbaceous Alliance, the Canada Thistle (*Cirsium arvense*) Herbaceous Alliance, and the Introduced Grassland Herbaceous Alliance.

The Leafy Spurge Herbaceous Alliance covers large areas of the South Unit, on floodplains, in draws, on slopes, and in upland swales, especially along the Little Missouri River. It is dominated almost completely by leafy spurge, which provides 100% ground cover, although some native species like threadleaf sage may be able to persist (Von Loh et al. 2000). Small pockets of the Canada Thistle Herbaceous Alliance are also present in the South Unit. Canada thistle is the dominant species, but some native species, such as western wheatgrass and green needlegrass, are present (Von Loh et al. 2000). The Introduced Grassland Herbaceous Alliance is dominated by species such as crested wheatgrass, Kentucky bluegrass, and smooth brome. This alliance is found throughout the South Unit in a variety of environments and may support some native species, such as western wheatgrass (Von Loh et al. 2000).

Elk use introduced grasslands for forage, especially crested wheatgrass, bluegrass, and smooth brome (see “Elk Use of Vegetation in the South Unit” and “Ungulate Diets in the South Unit” sections in this chapter).

EXOTIC SPECIES MANAGEMENT

Exotic (non-native) plants are found in a variety of vegetation types and are the dominant species in three of these. At least 90 exotic plants have been identified at Theodore Roosevelt National Park (NPS 2003b, Richardson 2007; see appendix F of this plan/EIS, although not all may occur in the South Unit). Until the 1990s, management of exotic plants at the park was sporadic. In 2002, the Northern Great Plains Exotic Plant Management Team was established to supplement exotic plant control efforts in a network of 14 parks, including Theodore Roosevelt. The park uses an integrated pest management approach to exotic plants, as prescribed by the Northern Great Plains Exotic Plant Management Programmatic Environmental Assessment (NPS 2005), described further in chapter 1. Current management of exotic plants focuses on species identified as problematic or on the North Dakota Noxious Weed List (USDA – NRCS 2007; see appendix F of this plan/EIS). Current management is defined as a “limited integrated approach” because not all potential tools are used. In general, most actions are limited in scope and effect. Each species is treated on a case-by-case basis using chemical, mechanical, manual, or biological control methods. Exotic plant infestations are mapped, and treatment areas are monitored to determine the overall success of exotic plant management treatments.

ELK USE OF VEGETATION IN THE SOUTH UNIT


fringed sage (*Artemisia frigida*)

Several research projects reported habitat selection by elk in the park (Marlow et al. 1984; Westfall 1989; Westfall et al. 1989; and Sullivan et al. 1988). The studies showed that preferred vegetation communities included grassland habitats dominated by wheatgrass, bluegrass, sedge, and needlegrass species, particularly those with both western wheatgrass and green needlegrass, as well as the exotic crested wheatgrass and smooth brome; Rocky Mountain juniper draws; hardwood draws; clinker vegetation; and communities that support browse species, particularly winterfat and western snowberry, but also fringed sage and chokecherry. Unlike historical accounts of elk in North Dakota, the reintroduced population at the park did not extensively use riparian areas.

- Years with high elk numbers had lower coverage of climax gramminoids (Virginia wildrye [*Elymus virginicus*], littleseed ricegrass, and Sprengel’s sedge [*Carex sprengeli*]) in upland grasslands and draws; and

- Green ash, snowberry, and stems of all shrub species were lower in years when the elk numbers were greater than 300 (Irby et al. 2002).

A 2005 report documented the distribution of elk at Theodore Roosevelt National Park compared to the level of use by elk and the availability of that habitat type for a given vegetation community. The results (see table 14) showed disproportionately high rates of use for the Green Ash – American Elm Woodland Alliance (Draws), Rocky Mountain Juniper Woodland Alliance, Prairie Dog Town Complex, and Wolfberry Temporarily-Flooded Shrubland Alliance. However some seasonal variation is still being investigated. For example:

- Overall elk use of the needle-and-thread (38.1% of land area) and crested wheatgrass (2.3% of land area) associations was approximately proportional to availability. However, greater than 50% of locations were recorded in the needle-and-thread association during February, March, and November, and less than 30% were recorded during May to September. The crested wheatgrass association was used relatively heavily for a brief period in April, at the start of the growing season for this and other cool-season grasses, and from July through November.
- Relatively heavy use of the juniper association was observed largely from April through June. In contrast, heaviest use of the green ash association was observed from May through September. Patches of green ash provide excellent cover for young; are often associated with patches of snowberry and forbs (which were important components of summer diets during 2003 and 2004); and likely feature lower canopy temperatures and better air circulation than juniper, which contribute to a more comfortable microclimate for elk (Sargeant et al. 2005).

TABLE 14. ELK GPS LOCATIONS BY PLANT ASSOCIATION, 2003 AND 2004

Plant Community	Mapping Unit[1]	Land area (%)	GPS Locations (%)	
			7-hour	15-minute
Needle-and-thread	Grassland	38.1	40.73	37.89
Broom snakeweed	Badlands Sparse Vegetation	18.0	9.53	7.49
Juniper	Shrubland	11.8	18.82	18.93
Western Snowberry	Shrubland	4.5	5.43	5.71
Western wheatgrass	Grassland	4.5	3.19	3.16
Sumac	Shrubland	4.4	3.56	3.38
Green ash	Woodland	4.1	7.59	9.52
Silver sage	Shrubland	3.1	1.75	1.74
Prairie dog town	Prairie Dog Town Complex	2.5	3.92	3.92
Crested wheatgrass	Exotic Herbaceous Vegetation	2.3	2.08	1.71
Leafy Spurge	Exotic Herbaceous Vegetation	1.7	0.45	0.50

[1] See map 6
Source: Sargeant et al. 2005

SERAL CONDITIONS

The desired conditions for the South Unit (see chapter 2) include a lightly grazed grassland system which is represented by late-stage seral conditions.

The desired conditions for the South Unit (see chapter 2) include a lightly grazed grassland system which is represented by late-stage seral conditions. At present, the park has not collected enough data to determine the extent to which plant communities in the South Unit reflect these conditions; however, to gain insight into the baseline of the seral condition in needle-and-thread grassland communities in the park, data from four plots sampled in 1997 were compared to data collected in 2005. Researchers observed changes in the number of species per plot, which may indicate that the communities in these plots are undergoing a compositional change and that the seral stage may be beginning to shift. In some cases, exotic species observed in these plots in 2005 were not previously observed in 1997. Most exotic species are considered to be early seral species. One characteristic of ecosystem stability is its ability to resist change, including the establishment of exotic species. The presence of these new exotic species within these plots may be another indicator that the community is undergoing a compositional change and a shift in seral stage. Since then, the seral conditions of the needle-and-thread / threadleaf sedge plant community has been monitored to help determine the condition of communities in the South Unit, and will ultimately be used to track changes in species composition to determine trends in grazing effects.

ELK POPULATION

GENERAL ECOLOGY

Elk were once found throughout much of the Northern Hemisphere, from Europe through northern Africa, Asia, and North America. Extensive hunting and habitat destruction have limited elk to a portion of their former range. Today, large populations in North America are found only in the western United States, from Canada through the Eastern Rocky Mountains to New Mexico, and in a small region in the northern parts of the lower peninsula of Michigan (Senseman 2002). Elk also have been reintroduced to some states outside of the western U.S., such as Oklahoma, Wisconsin, Tennessee, and Kentucky.

Elk habitat preferences tend to be very site specific, but some general patterns are evident. Elk prefer open woodlands and avoid dense unbroken forests (Senseman 2002), especially as cover during the summer months. However, elk also use grasslands for foraging and rest in these habitats during winter when temperatures are cooler. Elk feed in the early morning and late evening, but are inactive during the day and the middle of the night, when they spend most of their time chewing their cud. Forage is selected seasonally, primarily based on availability, and typically consists of a variety of grasses and forbs in summer and shrubby species in winter (Senseman 2002).

Female elk may become sexually mature as yearlings, although the proportion that successfully breeds varies, and the prime breeding age for female elk is considered to be 3.5 to 7.5 years of age. Shortly before the fall breeding season or rut, which peaks in late September and early October, male elk begin to compete for mates. Dominant males, usually 4.5 to 8.5 years of age, are polygamous and gather harems that are usually made up of one male and six females with their yearling calves (Senseman 2002; Raedeke et al. 2002). Although yearling males are capable of breeding, they rarely do so because of behavioral interactions with older males. Dominant males are able to maintain larger harems of females and restrict access to them. Younger aged males, 2.5 to 3.5, are rarely able to gather and hold a harem of cows. Fights between dominant males and intruders can be intense and result in injury, exhaustion, or death. During the rut, male elk bugle to attract females to their harem, as well as to identify their status and to warn other males. Males are only territorial during the mating season and are otherwise not aggressive toward other elk (Senseman 2002; Raedeke et al. 2002).

Calves are typically born in late-May to early-June. Female elk separate from the summer herd and may form nursery groups, seeking solitude in forest or shrubland areas. Calves are mobile within days after birth and are often concealed in heavy cover for extended periods of time while the mother feeds or beds. As the calf grows, females and their young gradually return to the herds, and their calves are usually weaned by late summer, within 60 days after birth (Senseman 2002; Raedeke et al. 2002).

ELK POPULATION GROWTH AT THEODORE ROOSEVELT NATIONAL PARK

As described in chapter 1, annual elk population counts from 1985 to 1992 showed an average increase of 22%. Aerial surveys conducted in 2001 and 2004 also indicated a growth rate of approximately 20% annually. For example, in 2001, 304 elk were estimated within Theodore Roosevelt National Park and by 2004, the estimate increased to 528 elk, an average increase of approximately 20% annually. Recently, estimates of vital rates (see discussion in following section) were used in the population reconstruction model describing population growth from 1987 through 2005 (again, see chapter 1); based on this model, the potential rate of growth was 26% annually (Sargeant and Oehler 2007).The growth projections of the population model were very accurate, and it was successfully tested against two other actual case studies involving elk populations with known initial population composition and exceptional rates of increase (Sargeant and Oehler 2007).

Sargeant and Oehler’s research (2007) has shown rates of survival and reproduction that are among the highest reported for an elk population. There were no documented instances of predation or winterkill associated with elk mortality within and surrounding the park. Large predators (wolves and bears) have been extirpated since the late 1800s, and effective natural predation on elk is limited. Although mountain lions also reside within the park, little is known about their population size and their effect on elk.

VITAL STATISTICS (PREGNANCY RATES, SURVIVAL RATES, AGE RATIOS, AND SEX RATIOS) OF ELK IN THE SOUTH UNIT

Elk pregnancy rates were estimated based on blood samples obtained from female elk captured in 1993, 2000, 2001, and 2003 through 2006. Researchers tested 373 elk of known age classes, including 162 elk of known age, and reported pregnancy rates of approximately 54% and 91% for subadults (older than one year old but younger than two years old) and adults (older than two years old), respectively. Using the age class proportions identified during roundups conducted in 1993 and 2000, the estimated population pregnancy rate was approximately 80%. Lastly, it was estimated that approximately 91% to 95% of the pregnancies observed in January produced a juvenile that survived to 8 months of age (Sargeant and Oehler 2007).

Survival rates were estimated based on data collected during studies from 2000 to 2005 for 184 females and 24 males. During this time, eight females were killed outside the park by hunters, three were found dead within the park (cause of death unknown), and radio contact was also lost with two other females that were counted as losses to unknown causes. Eleven male elk were killed outside the park during this period by hunters, while six died outside and two inside the park of unknown causes. One male dispersed approximately 425 miles from the park (the collar was recovered near Handel, Saskatchewan, Canada); one was euthanized by the NPS after becoming trapped in a sinkhole; one died after becoming entangled in the park boundary fence; and radio contact was lost with two others. Based on these observations, annual survival rates for females averaged 96% with hunting, and 99% with hunting excluded from the calculations. Average survival rates for males averaged 52% with hunting, and 68% without hunting. The observed rate of mortality for female elk at the park was consistent with a very high observed rate of population increase, non-selective removals by the NPS, and minimal removals during hunting. For males, losses resulted primarily from emigration and mortality (Sargeant and Oehler 2007).

Estimations of age and sex ratio were based on data collected from 177 antlerless elk during the 1993 and 2000 roundups. Age ratios (juveniles [younger than one year old] to subadult females to adult females) were similar in 1993 and 2000, and indicated that antlerless elk were approximately 35% juveniles, 19% subadult females, and 46% adult females. Pooling the data collected during these roundups, the sex ratio was estimated at 1.2 females for every male (approximately 55% of the herd was female) (Sargeant and Oehler 2007).

ELK MOVEMENT AND DISTRIBUTION IN AND AROUND THE SOUTH UNIT

Early studies concluded that most elk remained in the park since their reintroduction (Sullivan et al. 1988; Westfall 1989; and Westfall et al. 1989). From 1985 to 1988, only seven elk were reported outside the boundary of the South Unit (Sullivan et al. 1988; Westfall 1989). This was attributed to the 7-foot fence surrounding the South Unit, vehicle traffic along an interstate highway that parallels the South Unit's boundary, road construction, cattle grazing, and oil production along the north boundary of the South Unit.

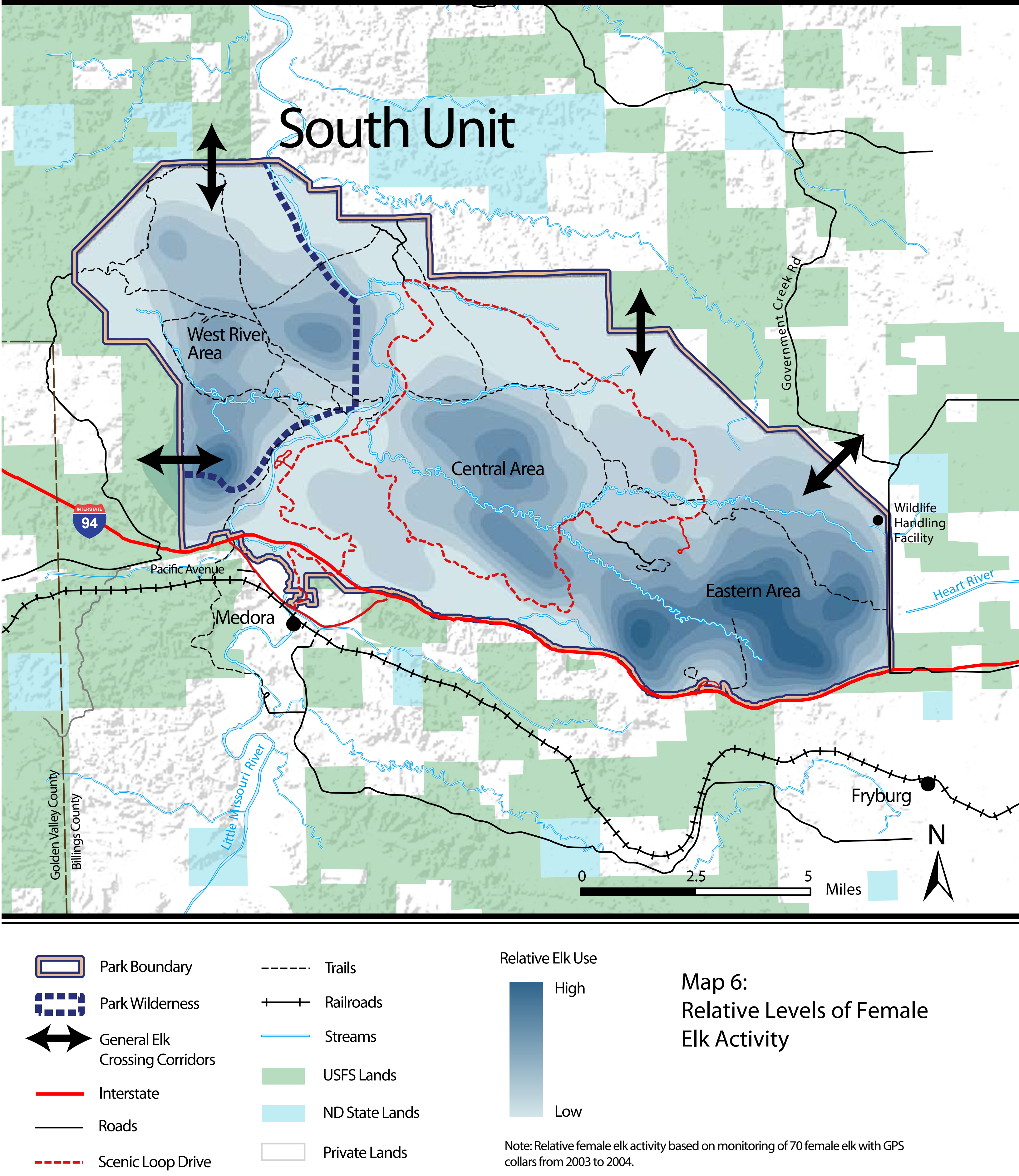
Between 2003 and 2004, 70 female elk older than one year of age were marked with GPS collars (29 in 2003 and 41 in 2004) to record their locations. Results of this study (Sargeant et al. 2005) showed elk were concentrated in three general areas in the park (map 6):

- The West River Area, including areas west of the Little Missouri River (encompasses Petrified Forest Plateau, Big Plateau, and Knutson Creek);
- Central Area, encompassing the area inside the Scenic Loop Road (encompasses Scoria Point, Jones Creek, and the lower reaches of Paddock Creek); and
- Eastern Area, extending from the eastern limits of the Scenic Loop Road to the eastern park boundary (encompasses Buck Hill, Peck Hill, Painted Canyon Overlook, and the upper reaches of the Paddock Creek Drainage).

The research noted that elk avoided areas near roads and, to a lesser extent, trails on a seasonal basis. Avoidance was most pronounced for roads in June, during calving, and was not observed during the September rut. The study also documented random distribution of elk activity near water developments (82% of locations monitored at 15-minute intervals were greater than approximately 0.3 miles [500 meters] from water developments) (Sargeant et al. 2005).

The results of the research also indicated some trends that, contrary to earlier studies, showed elk were moving outside of the park seasonally. Of the 70 collared elk that were tracked in 2003 and 2004, between 59% and 71% left the park annually. Based on this research, elk occasionally used areas outside the park during January and February. Activity outside the park began to increase in April and peaked in June, when calving occurred and elk activity was most concentrated (Sargeant et al. 2005).

The proportion of elk observed outside the park and the number of documented fence crossings both continued to increase and crossings peaked during September (26% of total crossings) and October (20% of total crossings). These results likely reflect the increasing mobility of calves during the summer and early fall. Fence crossings have been documented primarily along the western boundary of the park, south of Knutson Creek; along the northeastern boundary; and where the Little Missouri River exits the northern boundary (see map 6) (Sargeant et al. 2005).



Map 6: Relative Levels of Female Elk Activity

Note: Relative female elk activity based on monitoring of 70 female elk with GPS collars from 2003 to 2004.

Although marked elk ventured up to approximately 25 miles (40 kilometers) from the park during 2003 and 2004, about 90% of activity outside the park was within 12 to 16 miles (20 to 25 kilometers), to the northwest, near Grassy Butte, and south of the park, near Kendley Plateau. The same localized areas were used in 2003 and 2004. Except for an area just west of Grassy Butte, most elk activity outside the park was within the boundary of the Little Missouri National Grassland, which encompasses a patchwork of public and private lands. Elk used public and private land with similar frequency (based on locations collected at 7-hour intervals, 50% of elk were located on USFS or state lands, and 50% on private lands) (Sargeant et al. 2005).

About 90% of elk activity outside the park was within 12 to 16 miles (20 to 25 kilometers), to the northwest, near Grassy Butte, and south of the park, near Kendley Plateau.

The results also documented elk response to hunting outside the park, which lasted from August 8 to 24, 2003 and August 13 to 29, 2004 during the study period. In 2003, locations of elk marked with GPS collars recorded outside the park reduced gradually over a period of several days before the hunting season. In 2004, marked elk abruptly reduced activity outside the park when the hunting season began. Although data from 2005 and 2006 should be analyzed before conclusions are made, the preliminary results indicate that elk activity outside the park decreases in response to hunting (Sargeant et al. 2005).

UNGULATE DIETS IN THE SOUTH UNIT

On a cursory examination of fecal samples collected during other research projects, overlap in forage utilization among elk and other ungulates was generally found to be minimal to moderate (Westfall 1989). A study conducted in 1988 documented the results of fecal analysis to determine potential overlap in diets among elk, mule deer, white-tailed deer, bison, and feral horses in the park (Sullivan et al. 1988). The study reported some overlap of food habits among elk, mule deer, and white-tailed deer in spring, summer, and winter; between elk and feral horses in fall, winter, and spring (in spring both herbivores fed heavily on crested wheatgrass and smooth brome); and among elk and bison in spring and winter. Elk, bison, and feral horses all had high use of browse (shrubby species such as winterfat and western snowberry), and gramminoids (wheatgrass, bluegrass, sedge, and needlegrass species), which accounted for a high percentage of spring and winter diets for all three.

Other studies have weakly correlated elk and feral horse diets, reporting some overlap in utilization of grassland flats and clinker hills (Westfall 1989; Marlow et al. 1992). There were some similarities between elk and bison diets, including the common use of winterfat and some grasses; however, the potential for forage competition between these ungulates was considered low because, during the growing season, bison used more grasses and elk used more forbs. A high correlation was found between total bison and feral horse diets, however, which was attributed to both species feeding primarily on grasses (winterfat was also important for bison and feral horses) (Westfall 1989). This same study concluded elk diets were not correlated greatly with either mule deer or white-tailed deer diets. However, mule deer and white-tailed deer diets were substantially similar, with important forage provided by chokecherry and buffaloberry for both species (Westfall 1989). The relationship between elk and pronghorn diets or habitats has not been studied for Theodore Roosevelt National Park.

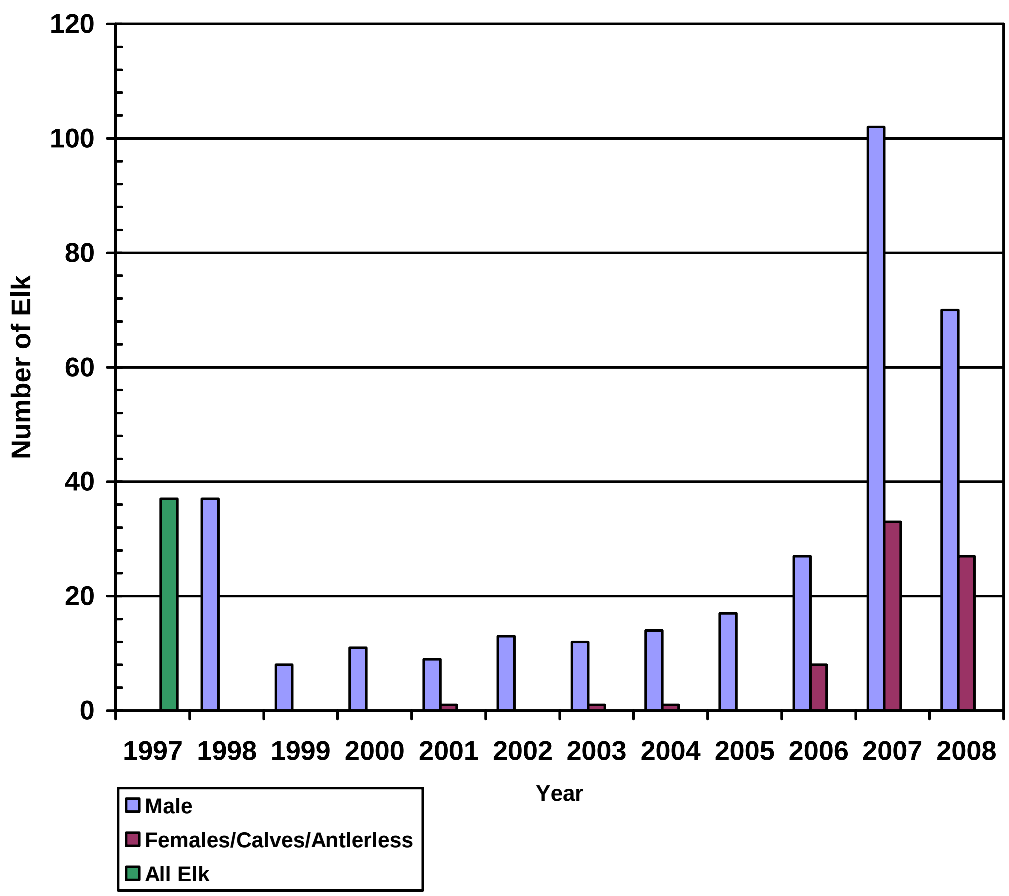
No differences in plant use were detected in juniper draws that elk used versus those they did not use (Sullivan et al. 1988). However, eight browse species and three grasses were identified as likely to be overused by multiple populations of ungulates, including winterfat, chokecherry, western snowberry, buffaloberry, yucca (*Yucca* sp.), golden currant (*Ribes aureum*), water birch (*Betula occidentalis*), green ash, big bluestem, little bluestem, and bluegrass species. Browse species, especially chokecherry, had the highest probability of overuse. The researchers also identified winterfat as a browse species of concern because it was the most common browse species in elk diets. The study noted that this species "constituted a greater percentage of the elk's diet during each season than any browse species and was the most important browse in the diets of horses and bison during later winter" (Sullivan et al. 1988).

A study completed in 1989 (Westfall 1989) identified winterfat as the major constraining forage species for elk, bison, and feral horses. The next most constraining species for elk were reported as chokecherry, sumac, and green needlegrass. All of these species are expected to decrease in numbers and density under moderate to heavy browsing pressure, and these species could be adversely affected in the park if overutilized (Westfall 1989). In addition, communities that include both western wheatgrass and green needlegrass received the highest proportion of elk use in winter, spring, and over the entire study period (Westfall 1989; Westfall et al. 1989).

HUNTING

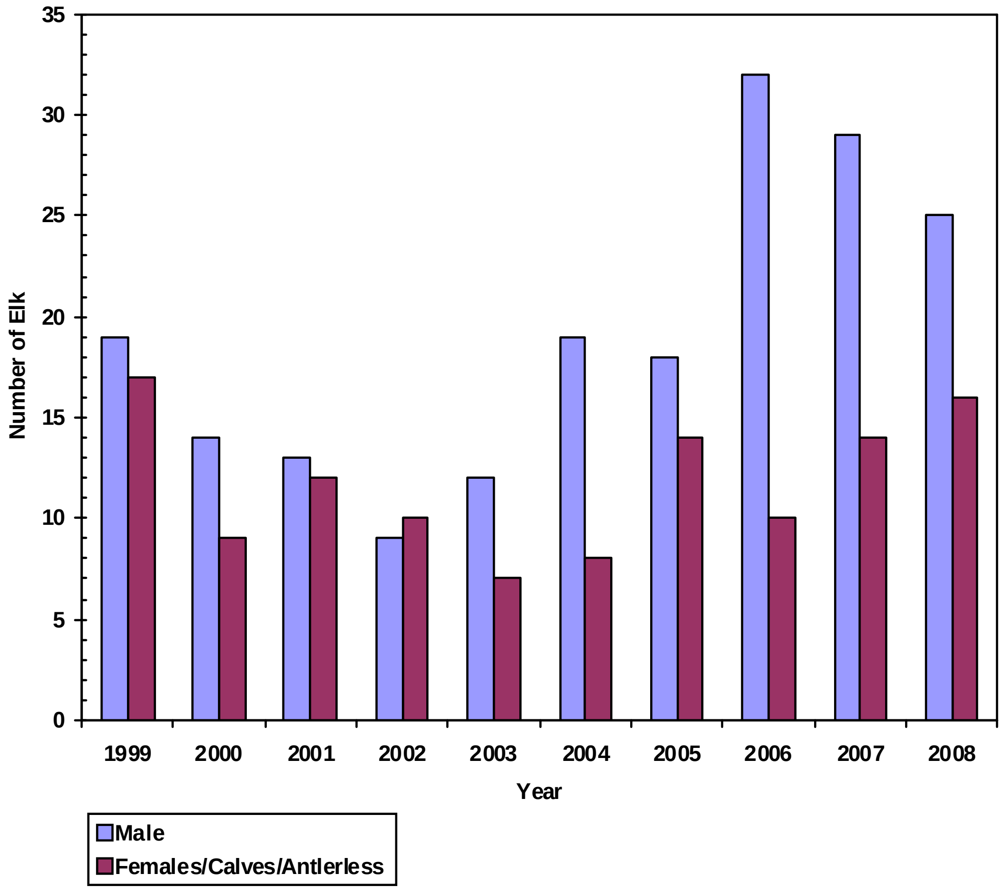
In 1997, NDGF restructured the hunting season for elk outside the park boundaries, to address depredation. Approximately 37 male elk were removed during this year. From 1997 to 2007, 668 removals were documented from elk hunting units established adjacent to the park (NDGF 2007b; Whitney 2007; Gaulke 2007). This includes males and females, calves, and antlerless elk. Figures 5 and 6 provide the annual elk removal data for each unit since they were established.

FIGURE 5. NUMBER OF ELK REMOVED IN HUNTING UNIT E3 – 1998 TO 2008



Sources: NDGF 2007b, 2008b, 2009a; Whitney 2007; Gulke 2007

FIGURE 6. NUMBER OF ELK REMOVED IN HUNTING UNIT E4 – 1999 TO 2008



Sources: NDGF 2007b, 2008b, 2009a; Whitney 2007

ELK HERD HEALTH

Increased elk populations may influence inter- and intra-species transmission of wildlife diseases (parasitic, bacterial, or viral), especially for density-dependent diseases. Roundups and translocation of live elk were necessary in 1993 and 2000 to maintain established population objectives for the elk population in the South Unit. During these roundups, elk were processed for disease testing in a handling facility. In 1993, 272 elk were processed for disease testing (Theodore Roosevelt National Park 1993). The elk were inoculated for a tuberculosis test and blood samples were taken for bluetongue virus, anaplasmosis, and two different brucellosis tests (brucellosis and tuberculosis tests were performed in different phases). At the end of the testing program, all elk tested negative for tuberculosis, bluetongue virus, anaplasmosis, and brucellosis (Theodore Roosevelt National Park 1993). In 2000, 297 elk were taken into the handling facility. Blood samples were taken for disease testing, and all tests were negative (Theodore Roosevelt National Park 2000).

Diseases of Concern

Several diseases have the potential to affect wildlife present in Theodore Roosevelt National Park. A few of the diseases that are currently of concern for ungulates including elk are CWD, brucellosis, tuberculosis, and foot and mouth disease (NPS 2004e).

CWD. CWD is in a family of diseases known as transmissible spongiform encephalopathy (TSE) and is an infectious, self propagating, neurological disease. Free-ranging mule deer, white-tailed deer, elk, and moose are all susceptible to CWD, which impacts the neurological system of the animal and is eventually fatal; there is no treatment or vaccine available to address CWD. CWD is in the same family as other TSEs such as bovine spongiform encephalopathy, also known as “mad cow” (NPS 2006e). To date, Rocky Mountain National Park, Colorado, and Wind Cave National Park, South Dakota, are the only two NPS units where the disease has been identified.

Animals infected with CWD exhibit the disease through changes in behavior and body condition. Some signs of CWD include animals losing their fear of humans, showing repetitive movements, and/or appearing depressed but becoming quickly alert if startled. In addition to these behavioral signs, physical signs include weight loss or poor body condition, despite having an appetite. These signs may start subtly and then over several weeks to several months become more pronounced and increase. Other signs of CWD include lowered head/ears, increased urination, stumbling, “star-gazing,” increased salivation, wide-based stance, increased drinking, loss of coordination, and regurgitation. These behavioral changes could result in physical changes such as pneumonia and staying by water for long periods of time. While any of these may give an observer an indication that an animal might have CWD, the disease can only be diagnosed through laboratory testing.

The exact health risk for humans consuming elk or deer infected with chronic wasting disease is unknown; however the risk is thought to be extremely low. An analysis of existing research studies indicates no established link between the disease and similar human transmissible encephalopathy diseases. Current literature reviews and experts agree that more information is needed and that many questions remain unanswered about the transmissibility of CWD to humans. Appendix C of this plan/EIS provides additional information on CWD diagnosis and management.

Since 2002, 1,233 deer (mule deer and white-tailed deer combined) and 111 elk have been tested for CWD in hunting units adjacent to the park; none have tested positive.

Since February 2003, park staff have submitted 11 samples for CWD testing (nine from elk and two from mule deer), all of which have been negative. As of June 1, 2009, more than 12,300 North Dakota deer, nearly 360 elk and 60 moose have tested negative for CWD (NDGF 2009c). The state of North Dakota currently has no specific regulations regarding CWD in free-ranging deer or elk. However, the state does have several regulations pertaining to testing of captive deer and elk and wildlife and movement of animal parts (CWD Alliance 2004).

Brucellosis. Brucellosis is a highly contagious bacterial disease. Once a domestic or wild animal has been infected with the disease, stillbirths and abortions are common, as well as infertility and decreased milk production (Eborn undated). Brucellosis is most readily transmitted through exposure to an aborted fetus or other birth materials and fluids. Transmission from wild to domestic animals, and vice versa, is not easy to determine, but investigations regarding cattle herds in North Dakota and Wyoming concluded that domestic buffalo were the most probable sources of the disease (Eborn undated). The infestation of five cattle herds near Yellowstone National Park has been attributed to either wild elk or bison in the area. In another case, elk were the most likely source of transmission of the brucellosis bacteria to a herd of Wyoming horses (in horses, the disease is known as fistulous withers) (Eborn undated).

At Yellowstone National Park, where both bison and elk herds are infected with brucellosis, the risk of transmission to cattle is considered much greater with bison than elk (Eborn undated). The disease is most likely to be transmitted during calving season when other animals come into contact with contaminated fluids, placenta, or feed. Bison tend to congregate in large groups at the time of calving, increasing the potential for this contact. Elk tend to calve in isolation, away from the herd, and they usually consume the placenta and any fluids that could contaminate the area after birth. Elk also keep newborn calves separate from the herd for a few days after birth, further reducing the possibility of disease transmission (Eborn undated).

Tuberculosis. Tuberculosis is a chronic, progressive bacterial disease that can cause gradual debilitation, including emaciation and depression. Because infection often involves the lungs, coughing, nasal discharges, and difficulty breathing can occur in severe cases. In some instances, lymph nodes in the neck develop a large blister that may rupture and drain through the skin (State of Michigan 2007a). The primary route of transmission is the exchange of respiratory secretions between infected and uninfected animals. This can be achieved through nose-to-nose contact or by the inhalation of airborne droplets exhaled by an infected animal. Animals may also become infected by ingesting the bacteria, possibly through ingesting contaminated feed. Environmental contamination and the density of the herd also affect the transmission of tuberculosis (State of Michigan 2007b).

OTHER WILDLIFE AND WILDLIFE HABITAT

A variety of species live in the wildlife habitat provided by the vegetation communities within the boundaries of the South Unit. Because impacts to aquatic wildlife and fisheries would be minimal, as described in the "Issues Dismissed from Further Consideration" section of chapter 1, this section focuses on terrestrial species, including mammals, birds, and reptiles and amphibians, in the South Unit of the park that could be affected by elk management.

MAMMALS

Many mammals are found in the South Unit of Theodore Roosevelt National Park, including carnivores, ungulates, small mammals, and bats. Carnivorous mammals, such as coyote (*Canis latrans*), long-tailed weasel (*Mustela frenata*), mink (*Mustela vison*), and badger (*Taxidea taxus*) are common while red fox (*Vulpes vulpes*), bobcat (*Lynx rufus*), and mountain lion (*Puma concolor*) have also been observed (NPS 2002d, 2004d). In addition to elk, ungulates in the South Unit include white-tailed deer, mule deer, pronghorn, bison, feral horses, and occasional bighorn sheep; both bison and feral horse populations are actively managed.

bison (*Bison bison*)

In 1956, 29 bison were reintroduced into the South Unit. Bison numbers are expected to be approximately 310 after young are born in the spring of 2007 (Oehler 2007b). The park has conducted regular bison roundups since 1962, and since 1993, resource managers have used a forage allocation model (Westfall et al. 1993) as a guide when establishing population objectives (200 to 500) for bison in the South Unit. When bison are rounded up, they are tested for selected diseases, and transported to recipients such as Indian Tribes and non-profit organizations. If deemed appropriate, further removals are then implemented to adjust bison populations to within 200 to 300 animals.

As of 2007, the horse population in the South Unit was estimated to be approximately 120 animals (Oehler 2007b). As with bison, park resource managers use the forage allocation model (Westfall et al. 1993) as a guide for setting a population objective of 50 to 90 horses in the South Unit. Activities associated with management of feral horses include vegetation monitoring, population monitoring, disease monitoring, and regular herd reductions. Feral horse roundups have been used to actively manage these herds to satisfy park and herd objectives; as necessary, additional reduction strategies are implemented to reduce the number of horses to approximately 60.

Small mammals in the South Unit include the least chipmunk (*Tamias minimus*), beaver (*Castor canadensis*), western harvest mouse (*Reithrodontomys megalotis*), prairie vole (*Microtus ochrogaster*), desert cottontail (*Sylvilagus audubonii*), Merriam's shrew (*Sorex merriami*), and black-tailed prairie dog. Prairie dogs, which occupied approximately 3% (1,420 acres) of the South Unit, are also herbivorous and alter the plant communities in surrounding towns through their foraging habits. Prairie dogs forage selectively from the plants available in their habitat, and their diet also varies seasonally. In the summer, black-tailed prairie dogs prefer to feed upon wheatgrass, buffalo grass, grama, rabbitbush, and scarlet globmallow (*Sphaeralcea coccinea* ssp. *coccinea*). In the winter, they eat prickly pear cactus (*Opuntia* spp.), thistles, and various roots (Shefferly 1999). Species of bats known in the park include little brown bat (*Myotis lucifugus*), big brown bat (*Eptesicus fuscus*), and hoary bat (*Lasiurus cinereus*) (NPS 2002d).

BIRDS

Approximately 186 species of birds, including raptors (birds of prey), waterfowl, wading birds, shorebirds, upland game birds, and migrants, have been documented in the habitat provided by grasslands, north- and south-facing slopes, hardwood and juniper draws, sagebrush flats, and undisturbed Little Missouri River bottomlands in the park (NPS 2006f). Raptors such as owls and hawks that are known to live in the park depend on other birds and mammals for food. Scavengers like crows (*Corvus corvus*) rely on the remains of other animals for food.


northern harrier (*Circus cyaneus*)

Many of the bird species in the park nest on or near the ground, using grasses and other low-growing vegetation for building nests and concealment (NatureServe 2006). These include the northern harrier (*Circus cyaneus*), mallard (*Anas platyrhynchos*), upland sandpiper (*Bartramia longicauda*), killdeer (*Charadrius vociferous*), sharp-tailed grouse (*Tympanuchus phasianellsus*), wild turkey (*Meleagris gallopavo*), vesper sparrow (*Pooecetes gramineus*), field sparrow (*Spizella pusilla*), western meadowlark (*Sturnella neglecta*), horned lark (*Eremophila alpestris*), and the ovenbird (*Seiurus aurocapilla*) (NPS 2006f).

Some birds in the park nest in shrubs or saplings, generally within plant heights available to elk (up to approximately 6.5 feet [2 meters]) (NatureServe 2006; Sullivan et al. 1989). These include chipping sparrow (*Spizella passerina*), red-eyed vireo (*Vieo olivaceus*), yellow warbler (*Dendroica petechia*), American goldfinch (*Carduelis tristis*), lazuli bunting (*Passerina amoena*), brown thrasher (*Toxostoma rufus*), and yellow-breasted chat (*Icteria virens*) (NPS 2006f).

Birds that nest in the upper parts of the understory or canopy of woodlands include the great horned owl (*Bubo virginianus*), golden eagle (*Aquila chrysaetos*), great blue heron (*Ardea herodias*), and western kingbird (*Tyrannus verticalis*). Woodlands also support cavity-nesting birds such as the kestrel (*Falco sparverius*), woodpeckers, black-capped chickadee (*Poecile atricapillus*), and mountain bluebird (*Sialia currucoides*) (NatureServe 2006; NPS 2006f).

REPTILES AND AMPHIBIANS

North Dakota does not support a diverse array of reptile and amphibian species. The semi-arid climate provides only marginal conditions for amphibian breeding and hibernation, while the low winter temperatures and the short growing season appear to be primary limiting factors for reptiles. Reptiles found in the park include common snapping turtle (*Chelydra serpentina*), painted turtle (*Chrysemys picta*), sagebrush lizard (*Sceloporus graciosus*), short-horned lizard (*Phrynosoma douglassi*), western plains garter snake (*Thamnophis radix*), plains hognose snake, bullsnake (*Pituophis catenifer sayi*), and prairie rattlesnake (*Crotalus viridis*) (NPS 2002d). Amphibians include tiger salamander (*Ambystoma tigrinum*), plains spadefoot toad (*Scaphiopus bombifrons*), Great Plains toad (*Bufo cognatus*), boreal frog (*Pseudacris nigrita*), and leopard frog (*Rana pipiens*). These amphibian species are known at the park, but they are found infrequently (NPS 2002d).


prairie rattlesnake (*Crotalus viridis*)

SPECIES OF SPECIAL CONCERN

WILDLIFE

The state of North Dakota does not have an endangered species act or list any species; however, it does have authority under statutory provisions (N.D. Cent. Code 20.1-02-05) that authorize listing and establishment of management programs. This management consists of identifying and protecting critical nesting areas and habitats, conducting population counts, and managing species in cooperation with South Dakota and Montana (UNM 2007).

North Dakota maintains a comprehensive wildlife conservation strategy for the management of non-game wildlife to promote conservation of all species through habitat and wildlife management. The state focuses on 100 species considered “Species of Conservation Priority.” Information relating to the distribution, abundance, habitat requirements, threats, management goals, and monitoring techniques for each of these species is included in the comprehensive wildlife conservation strategy. All 100 species are categorized into three levels according to the need to conserve them:

- Level I – Species in greatest need of conservation.
- Level II – Species in need of conservation, but have support from other wildlife programs.
- Level III – Species in moderate need of conservation, but on the edge of their range in North Dakota (NDGF 2004).

Only Level I species observed in the park have been addressed. These Level I species and associated habitat are represented in table 15. Some Level 1 species observed in the park were dismissed from further consideration as described in chapter 1.

TABLE 15. LEVEL I WILDLIFE SPECIES OBSERVED AT THEODORE ROOSEVELT NATIONAL PARK

Common Name	Scientific Name	Habitat
Birds		
Upland sandpiper*	*Bartramia longicauda*	Dry, open mixed-grass prairie
Long-billed curlew*	*Numenius americanus*	Short-grass prairie or grazed mixed-grass prairie
Black-billed cuckoo	*Coccyzus erythropthalmus*	Woodlands, thickets, prairie shrubs, shelter-belts, and wooded areas to towns.
Sprague’s pipit*	*Anthus spragueii*	Extensive tracts of ungrazed or lightly grazed prairie
Grasshopper sparrow*	*Ammodramus savannarum*	Idle or lightly grazed mixed-grass prairie, meadows, and hayfields
Baird’s sparrow*	*Ammodramus bairdii*	Native mixed-grass prairie
Lark bunting*	*Calamospiza melanocorys*	Sage brush or sage prairie; mixed-grass prairie interspersed with shrubs
Chestnut-collared longspur*	*Calcarius ornatus*	Grazed or hayed mixed-grass prairie; short-grass prairie

* Indicates ground nesting species

Source: NDGF 2004

WILDERNESS

In 1978 (Public Law 95-625, National Parks and Recreation Act of 1978), the U.S. Congress designated 29, 920 acres of wilderness at the park, including 10,510 acres in the South Unit of the park, west of the Little Missouri River in the North Dakota badlands (see map 6). Wilderness areas eligible for designation must posses at least the following characteristics (as identified in the *Wilderness Act*):

- The earth and its community of life are untrammeled by humans, where humans are visitors and do not remain.
- The area is undeveloped and retains its primeval character and influence without permanent improvements or human habitation.
- The area generally appears to have been affected primarily by the forces of nature, with the imprint of human work substantially unnoticeable.

In 1978 (Public Law 95-625, National Parks and Recreation Act of 1978), the U.S. Congress designated 29, 920 acres of wilderness at the park, including 10,510 acres in the South Unit of the park.

- The area is protected and managed so as to preserve its natural conditions.
- The area offers outstanding opportunities for solitude or a primitive and unconfined type of recreation.

According to the final environmental impact statement for proposed wilderness at the park, the designated area would “preserve a segment of primitive America unaltered by the hand of man.” It specifically mentions the opportunity to see native wildlife; the challenge of traveling a roadless area; and the sense of solitude and quiet in the area (NPS 1973).

Section 4(c) of the *Wilderness Act* prohibits certain activities, including commercial enterprises and permanent roads, within any designated wilderness area, except as necessary to meet minimum requirements for the administration of the area. In addition, the act states that there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such wilderness area.

SOCIOECONOMICS

Theodore Roosevelt National Park is the most popular visitor attraction in North Dakota and provides significant economic and employment benefits for the state and region (NPS 2002d). From October 1 2004 to September 30, 2005, the park contributed approximately $24.9 million to the local area (50 miles from the park), and supported 605 jobs (a combination of park employees and full/part-time jobs created by visitors and park employees spending money or wages in the local area) (NPS 2006g). Although elk management actions would only be taken in the South Unit, located in Billings County, the actions could also affect the socioeconomic environment of McKenzie County, where the North Unit is located; therefore, this section discusses the socioeconomic environment of both Billings and McKenzie Counties.

Billings County encompasses approximately 1,139 square miles with an estimated population of 798 in 2007. The county population experienced a 19.9% decrease from 1990 to 2000 and a 10% decrease from 2000 to 2007. Medora, the Billings County seat, has a population of 100 individuals (U.S. Census 2007a). McKenzie County encompasses about 2,735 square miles, with a population of 5,617 in 2007 (U.S. Census 2007b). McKenzie County’s population decreased by 10.1% between 1990 and 2000 and decreased an additional 2.0% from 2000 through 2007. However, population trends for the county have been trending upward since 2005. Watford City is the county seat and home to approximately 25% of county residents (U.S. Census 2007b).

Full- and part-time employment totaled 823 and 4,164 jobs in Billings and McKenzie counties, respectively, in 2006 (U.S. BEA 2008). Unemployment in the region in 2007 was 2.5% and 3.1% in Billings and McKenzie counties, respectively. These figures compare with the statewide figure of 3.2% for North Dakota, and were both below the national average of 4.6% in 2007 (U.S. BLS 2008). Between 1990 and 2006, total real (in 2007 dollars) annual personal income growth was well below the national and state averages: 29% in Billings County and 32% in McKenzie County. This compares with 43% for the state and 57% for the U.S. (U.S. BEA 2008)

Real per capita income in the region lags behind state and national averages. Real per capita income (2007 dollars) averaged $28,956 in McKenzie County and $31,892 in Billings County in 2006. This compared with a state average of $33,641 and a national average of $39,646 (U.S. BEA 2008). According to the U.S. Census Bureau, 12.5% of the nation’s population lived in poverty in 2003. During that same year, North Dakota’s poverty level was below the national average at 10.5%. However, the poverty level in Billings and McKenzie counties were slightly above the state average at 11% and 13.7%, respectively (U.S. Census 2000a, 2000b).

Employment growth in the study area lagged behind growth throughout the state. Employment increased by 8 percent (36,000) in North Dakota between 2000 and 2006 (U.S. BEA 2008). Billings County reported an increase in employment of 2 percent (20) while McKenzie County increased employment by 6 percent (270) during this same time period. Agriculture, forestry, fishing, hunting, and mining industries accounted for approximately 37.1% of employment in Billings County in 2000. Arts, entertainment, recreation, accommodation, and food services account for an additional 13.4% and construction employs 9.2%. The government employed 98 individuals, or 21.9%, in 2000 (U.S. Census 2000a, 2000b). In McKenzie County, agriculture, forestry, fishing, hunting, and mining were the main employment sectors within the county, accounting for 24.4% of employment in 2000. Education, health, and social services were second, accounting for 22.7% of total employment, while the government employed 12.1% of the county work force in 2000 (U.S. Census 2000a, 2000b).

Billings County supports several game species, including elk, deer, pronghorn, bighorn sheep, and numerous other small game species. Residents of North Dakota, including residents of Billings County, pursue the wild game species for both meat and sport. Sportsmen engage in hunting and fishing activities that contribute substantial amounts to the economy from expenditures on food, lodging, fuel, guides and outfitters, among other things. Today, the outfitting industry supplements the ranching businesses of a number of county residents (Billings County 2007).

The livestock industry is an important component of agricultural activity in Billings and McKenzie counties. According to the Northern Great Plains Management Plan produced by the U.S. Forest Service (USFS 2001), cattle are by far the most prevalent type of livestock grazed on National Forest System lands on the Northern Great Plains. Rangeland forage is a major food source for cattle and sheep. Livestock production from U.S. Forest Service lands in the Northern Great Plains is very important to the people who hold grazing permits. The Medora Grazing Association has a comprehensive grazing permit with the U.S. Forest Service for the area surrounding the park. The grazing association, in turn, issues permits to various individual ranchers for specific parcels. Fees are charged per Animal Unit Month (AUM). The costs are passed from the Medora Grazing Association to the individual permittees. In 2001, the federal government charged $1.37 per AUM and the grazing association added 90 cents. Therefore, a rancher paid $2.27 per AUM (Medora Grazing Association 2007). After the grazing association collected its fees, 67.5 cents of the total fee went to the federal treasury. The 20-year permitted levels (average) in the entire Little Missouri National Grassland are 315,900 AUM.

Oil and gas production in North Dakota ranks ninth in the nation. In 2006, Bowman, Billings, McKenzie, and Williams Counties led in production, with the majority of the production from Bowman County (North Dakota Department of Mineral Resources 2007). During the early 2000s, Billings and McKenzie Counties averaged approximately 400,000 barrels of oil production per month (North Dakota Industrial Commission 2008a). The trend changed in McKenzie County in 2004 which reported an increase in production to over 600,000 barrels per month according to the latest data available. Production in Billings County has remained steady at approximately 400,000 barrels per month to date. By comparison, Bowman County has reported production in excess of 1 million barrels a month since July of 2005. These trends are also reflected by the changes in the total number of wells completed in each of these counties since 2000, when compared to more recent data (2006 and 2007), as shown in table 16.

TABLE 16. TOTAL WELLS COMPLETED IN BILLINGS, BOWMAN, AND MCKENZIE COUNTIES

	2000	2006	2007
Billings	22	32	26
Bowman	7	51	43
McKenzie	10	120	59

Source: North Dakota Industrial Commission 2008; Heilman 2008

The vitality of the oil and gas industry in western North Dakota is evident in the fact that the region accounts for a substantial percentage of North Dakota's oil production and employs nearly 1,000 individuals. Billings and McKenzie counties continue to experience an increase in oil and gas exploration and development. As of September 2008, Billings County reported one active drill rig operating in the county while McKenzie County reported 16 active rigs (North Dakota Industrial Commission 2008b). The industry also contributed an estimated $237 million to North Dakota's Treasury in severance taxes in 2007, up from $165 million in 2006 (North Dakota Office of State Tax Commission). Oil and gas management within the Williston Basin has a direct and immediate effect on the regional oil and gas industry (NPS 2002d).

LAND MANAGEMENT ADJACENT TO THE PARK

ELK MANAGEMENT UNITS

The NDGF manages two units designated for elk hunting outside the South Unit of the park. Unit E3 was established in 1998 and E4 was established in 1999 (see map 3 in chapter 1). As described in chapter 1, each year, the elk hunting season and the number of once-in-a-lifetime licenses available are established by the state through proclamations issued by the governor. A raffle is also held for one such license (as per North Dakota Century Code 20.1-08-04.6).

NDGF has taken several actions to increase elk hunting opportunities outside the park.

Once-in-a-lifetime landowner preference licenses are also issued to residents that lease at least 160 acres of land for agricultural purposes or that own at least 160 acres of land within an elk hunting unit. The number of these licenses issued in units E3 and E4 are subject to certain requirements as outlined in North Dakota Century Code 20.1-03-11.7, including provisions limiting the number of landowner preference licenses to less than 15% of the total for that unit (NDGF 2007a). In addition, North Dakota Century Code 20.1-03-11-7 indicates that the NDGF director may issue special elk depredation management licenses to landowners in designated areas around Theodore Roosevelt National Park. These designated areas are identified during the hunting proclamation issued each year. The provisions of this section governing the number of licenses issued for each designated district or unit for hunting elk (e.g., the 15% limitation) do not apply to special elk depredation management licenses, and a person who receives such a license under this subsection is still eligible to apply for a license to hunt elk in future years, as well as participate in the raffle described previously.

In 2008, NDGF proposed changes to help reduce the elk population near the park. These include increasing licenses available via lottery; eliminating the traditional August hunting season; and providing a season from September through December; allowing E3 and E4 license holders to hunt either unit after the first three days of the season; enlarging the E3 landowner preference area; establishing a new hunting unit, E5, that encompasses all of the state area not currently open to elk hunting and is open to all lottery license holders from September 5 through December 31; and requiring that hunters report information so that informed decisions are made for the next year's elk seasons (the penalty for not complying with this new requirement would be forfeiting license eligibility for the following year) (NDGF 2008b).

Table 17 summarizes information about the hunting seasons in the state-managed elk units since 1998, including season dates, number of licenses (not including landowner preference or depredation licenses), and success rate. As the table shows, NDGF has taken several actions to increase hunting opportunities outside the park, such as increasing licenses and altering season dates.

TABLE 17. ELK HUNTING SEASON DATA

Year	Hunting Unit	Hunting Season Dates	Number of Licenses Issued	Elk Removed	Success Rate (percent of successful licenses)
1997	E3	Oct 24 – Nov 16	47	37	79%
	E4	N/A	N/A	N/A	N/A
		1997 Totals	**47**	**37**	**79%**
1998	E3	August 14-20 August 21-30	60	37	62%
	E4	N/A	N/A	N/A	N/A
		1998 Totals	**60**	**37**	**62%**
1999	E3	August 13–29	14	8	57%
	E4	August 13–19 (early season) August 20–29 (late season)	59	36	61%
		1999 Totals	**73**	**44**	**60%**
2000	E3	August 11–27	14	11	79%
	E4	May 15 – July 25[a] August 11–17 (early season) August 18–27 (late season)	57	23	40%
		2000 Totals	**71**	**33**	**47%**
2001	E3	August 10–26	16	9	56%
	E4	May 15 – July 24[a] August 10–16 (early season) August 17–26 (late season)	66[b]	25	38%
		2001 Totals	**82**	**34**	**41%**
2002	E3	August 9–25	20[c]	13	65%
	E4	August 9–15 (early season) August 16–25 (late season)	65[d]	19	29%
		2002 Totals	**85**	**31**	**37%**
2003	E3	August 8–24	20	13	65%
	E4	August 8–14 (early season) August 15–24 (late season)	65	19	29%
		2003 Totals	**85**	**32**	**38%**

TABLE 17. ELK HUNTING SEASON DATA

Year	Hunting Unit	Hunting Season Dates	Number of Licenses Issued	Elk Removed	Success Rate (percent of successful licenses)
2004	E3	August 13–29	20	15	75%
	E4	August 13–19 (early season) August 20–29 (late season)	66	27	41%
2004 Totals			**86**	**42**	**49%**
2005	E3	August 12–28	20	17	85%
	E4	August 12–18 (early season) August 19-28 (late season)	65	32	49%
2005 Totals			**85**	**49**	**58%**
2006	E3	August 11–27 October 6–29[e]	50[f]	4	70%
	E4	August 11–17 (early season) August 18–27 (late season) October 6–29[e]	68	42	62%
2006 Totals			**118**	**77**	**65%**
2007	E3	August 10-26 (regular season) August 31-September 30 (second season)[g] October 5-28 (regular season)[e] November 2-December 30 (extended season)[g]	200[h]	136	68%
	E4	May 4-July 15[a] August 10-16 (early season) August 17-26 (late season) August 31-September 30 (second season)[g] October 5-28 (regular season)[e] November 2-December 30 (extended season)[g]	**97**[i]	43	44%
2007 Totals			**297**	**178**	**60%**
2008	E3/E4	September 5-30 (September Season)[j] October 3-31 (October Season)[j] November 7-December 31 (extended season)[k]	415	138	33%
2008 Totals			**415**	**138**	**33%**
2009	E3/E4	September 4-30 (Any Elk September Season)[j] October 2-31 (Any Elk October Season)[j] November 6-December 31 (Any Elk Extended Season)[k] September 4-December 31 (Antlerless Elk Season)[l]	Not Available	Not Available	Not Available
2009 Totals			Not Available	Not Available	Not Available

TABLE 17. ELK HUNTING SEASON DATA

Year	Hunting Unit	Hunting Season Dates	Number of Licenses Issued	Elk Removed	Success Rate (percent of successful licenses)

[a] Season for landowner preference license to remove elk causing damage to private property; no landowners participated in 2000, and one participated in 2001.Number of participants in 2007 is currently unknown.

[b] The number of licenses available in this hunting unit was increased over the previous year by offering 10 antlerless-elk-only licenses.

[c] The number of licenses available in this hunting unit was increased over the previous year by offering six “any-elk” licenses.

[d] The 10 anterless-elk-only licenses added in 2001 were changed to “any-elk” licenses due to low hunter success rates.

[e] These seasons were added in an attempt to increase elk removals around Theodore Roosevelt National Park during times when more elk were outside the park. They were open to hunters who were unsuccessful during the August seasons.

[f] This is an increase in 30 licenses over 2005, including 20 additional anterless-elk-only licenses.

[g] These seasons were added in response to the growing elk population and landowner concerns over the increasing number of elk coming onto private lands. The extended season was open to all regular and second season hunters.

[h] The number of licenses available in this hunting unit was increased over the previous year by offering 110 more any-elk and 40 more antlerless-elk-only licenses.

[I] The number of licenses available in this hunting unit was increased over the previous year by offering 15 more any-elk and 15 more antlerless-elk-only licenses.

[j] After 3 days, hunters could hunt in either unit.

[k] Open for both September and October license holders

[l] E3 andE4 lottery license holders may hunt in either unit

Source: NDGF 2007b, 2008b, 2009a, 2009b; Whitney 2007; Gulke 2007

U.S. FOREST SERVICE – LITTLE MISSOURI NATIONAL GRASSLAND

The Little Missouri National Grassland encompasses approximately 1,000,000 acres in the western region of North Dakota. It is divided into two ranger districts, the McKenzie District in the north and the Medora District in the south, and includes two geographic areas described by the USFS: the Badlands Geographic Area (found along the Little Missouri River) and the Rolling Prairie Geographic Area (generally encompasses the eastern and western edges of the Little Missouri National Grassland). These geographic areas are fairly distinct: the Badlands Geographic Area is characterized by intricately dissected drainages and draws typical of a badlands landscape with small inclusions of rolling prairie. The Rolling Prairie Geographic Area is characterized by nearly level to rolling hills with scattered buttes and badlands landscapes. The dominant vegetation is similar to that found in the South Unit and includes riparian cottonwood forests along the Little Missouri River (Badlands Geographic Area), hardwood draws of green ash and chokecherry; uplands of western wheatgrass and needle-and-thread grass; uplands of blue grama (*Bouteloua gracilis*) and little bluestem; rolling grasslands of western wheatgrass and prairie junegrass; outcrops and river breaks with juniper (*Juniperus* spp.) and silver sage; terraces of wolfberry (*Symphoricarpos occidentalis*) and silver sage; and ponderosa pine (*Pinus ponderosa*) savannas (USFS 2002).

The USFS identified desired conditions for vegetation in these areas including a diversity of mixed grass and short grass communities; hardwood draws with a multi-layer and multi-age class of herbaceous plants, shrubs, and trees; streams and riparian areas with adequate soil moisture to perpetuate riparian plant communities with strong root masses; juniper stands with a multi-layer of Rocky Mountain juniper interspersed with green ash and a lower layer consisting of herbaceous plants, moss, and shrubs; and savannah-like ponderosa pine communities with an upper layer of trees and a lower layer of herbaceous plants, shrubs, and trees (USFS 2002). The majority of the USFS lands in the Badlands Geographic Area and the Rolling Prairie Geographic Area (approximately 86% to 87%) are currently in early to mid-seral stages (likely the result of livestock grazing), with comparatively little in late seral stages (USFS 2001; Oehler et al. 2007). To better conserve biological diversity, the USFS has recently established the following seral stage goals for these geographic areas (USFS 2002):

- Early – 10-15%
- Mid – 65-75%
- Late – 15-20%

Management Areas

The USFS designated seven types of management areas around the South Unit of the park (see map 7):

- Non-motorized Backcountry Recreation;
- Bighorn Sheep Habitat (including habitat with non-federal mineral ownership);
- Rangelands with Diverse Natural-Appearing Landscapes;
- River and Travel Corridors;
- Dispersed Recreation: High Use; and
- Rangeland with Broad Resource Emphasis.

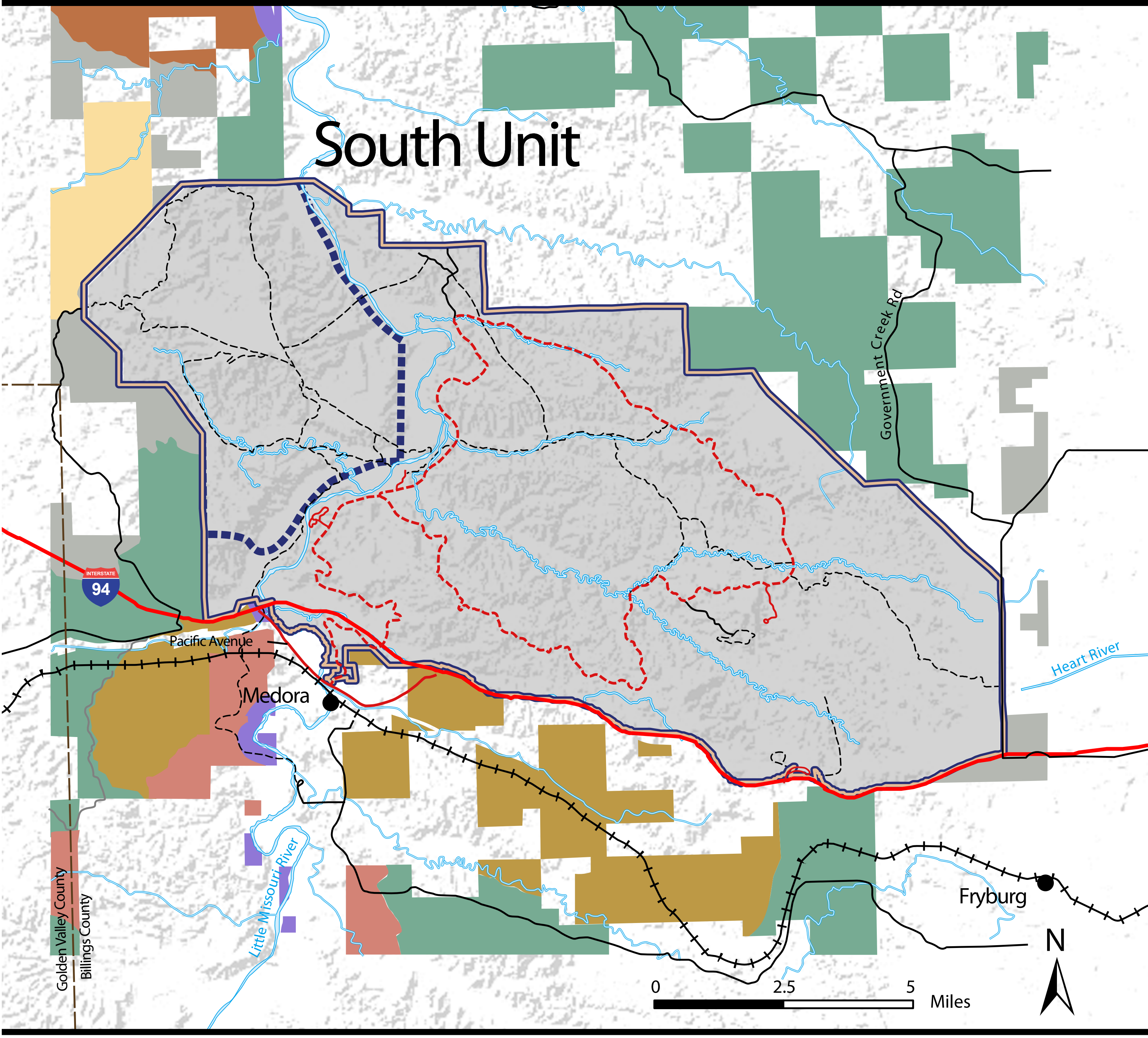
The management of these areas is briefly described below, with an emphasis on those activities and desired conditions that could influence or be affected by elk management in the area. Complete descriptions of the management areas, including associated general and resource-specific standards and guidelines, are included in the Land and Resource Management Plan for the Dakota Prairie Grasslands Northern Region (USFS 2002).

Non-motorized Backcountry Recreation. These areas are managed to provide non-motorized, semi-primitive recreational opportunities in a natural-appearing landscape. Valid existing rights are honored when development is proposed. A variety of uncrowded, non-motorized, recreational opportunities are provided in a natural or natural-appearing setting. These areas may offer unique hunting opportunities away from motorized vehicles. Vegetation is moving toward the range of desired conditions (as described previously in this chapter under the “U.S. Forest Service – Little Missouri National Grassland” section), and natural processes, such as fire, insects, diseases, rest, and grazing, control vegetative composition and structure (USFS 2002).

Bighorn Sheep Habitat. These areas are managed to provide quality forage, cover, escape terrain, and solitude for bighorn sheep. To achieve population objectives, the integrity of lambing, breeding, and other important habitat features (e.g., escape cover) in occupied and unoccupied habitat are protected (USFS 2002). Some of these areas overlap with lands that have non-federal subsurface mineral rights and are mapped separately in map 7.

Theodore Roosevelt National Park
North Dakota

National Park Service
U.S. Department of the Interior



- Park Boundary
- Park Wilderness
- Interstate
- Roads
- Scenic Loop Drive
- Trails
- Railroads
- Streams
- Bighorn Sheep
- Bighorn Sheep Habitat with Non-Federal Mineral Ownership
- Dispense Recreation: High Use
- Non-motorized Backcountry Recreation
- Rangeland with Broad Resource Emphasis
- Rangeland with Diverse Natural-Appearing Landscapes
- River and Travel Corridors

Map 7: U.S. Forest Service Management Areas in the Vicinity of the South Unit

Rangelands with Diverse Natural-Appearing Landscapes. This management area emphasizes maintaining or restoring a diversity of desired plants, animals, and ecological processes and functions. It provides a mix of other rangeland values and uses with limits on facilities to maintain a natural-appearing landscape. These areas have relatively few livestock grazing developments, such as fences and water tanks, resulting in a mosaic of livestock grazing patterns and diverse vegetation composition and structure. Prescribed fire is used as a management tool, but wildfires are aggressively controlled. Natural outbreaks of native insects and diseases are allowed to proceed without intervention unless there is a substantial threat to high-value resources (USFS 2002).

River and Travel Corridors. This area is managed to protect or preserve the scenic values and recreational uses of the Little Missouri River Corridor and the Grand River Scenic Travel Route. The Little Missouri River Corridor is defined as national grasslands contained within a ¼-mile zone on each side of the river.

Dispersed Recreation: High Use. These areas are managed for recreational opportunities and scenic qualities and are usually adjacent to high-use developed recreation sites and bodies of water. Visitors recreate in a relatively natural environment while pursuing a variety of activities such as camping, picnicking, hiking, fishing, and motorized vehicle use where allowed. Because of the amount and types of use, these areas offer a more social type of recreational experience, and biological communities complement the recreational values (USFS 2002).

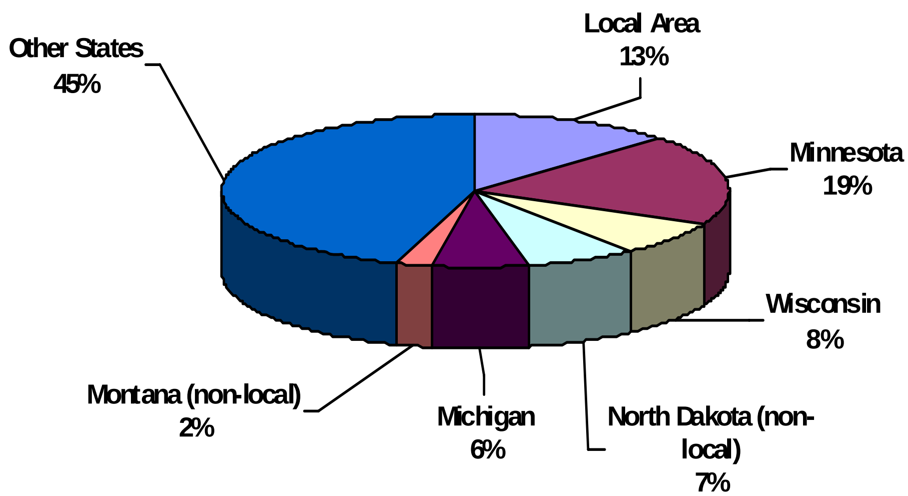
Rangeland with Broad Resource Emphasis. This area is primarily a rangeland ecosystem managed to meet a variety of ecological conditions and human needs. Ecological conditions are maintained while emphasizing selected biological (grasses and other vegetation) structure and composition that consider the range of natural variability. These lands often display high levels of development, commodity uses, and activity; density of facilities; and evidence of vegetative manipulation. Users expect to see other people and evidence of human activities. Facilities supporting the various resource uses are common. Motorized transportation is common on designated roads and two-track trails. Livestock graze most areas annually, but a spectrum of vegetation structure and a high degree of biodiversity is present. Livestock grazing intensity varies; however, moderate use prevails over most of the management area. Natural disturbance processes, including grazing and fire, are used to emulate the natural range of variability of vegetation structure and composition (USFS 2002).

VISITOR USE AND EXPERIENCE

VISITATION

Visitors to Theodore Roosevelt National Park have the opportunity to experience the badlands environment and to understand and enjoy it as Roosevelt once did. Based on a survey of visitors from the summer of 2001, 13% of visitors to the park were from western North Dakota communities surrounding Bismarck, Minot, Williston, and Dickinson, and those living in the eastern Montana towns of Sidney, Glendive, or Wibaux (NPS 2002c). As shown in figure 7, the largest number of visitors from a single state came from Minnesota.

FIGURE 7. BREAKDOWN OF VISITORS TO THEODORE ROOSEVELT NATIONAL PARK, SUMMER 2001



Source: NPS 2002b

Visitation to the South Unit (including both the Medora and Painted Canyon areas) represents an average of 87.5% of the total number of visitors to the park from 1998 to 2009 (table 18). During this time, visitation to the South Unit increased an average of 3.5%, with the highest being an 13% increase from 2008 to 2009. There was also a 5% decrease in visitation in 2004 when compared to 2003, and the largest decline was experienced from 2005 to 2006 when visitation decreased by 11.3% (NPS 2007b; Whitworth 2007). As shown in figure 8, June, July, and August are the busiest months in the South Unit.

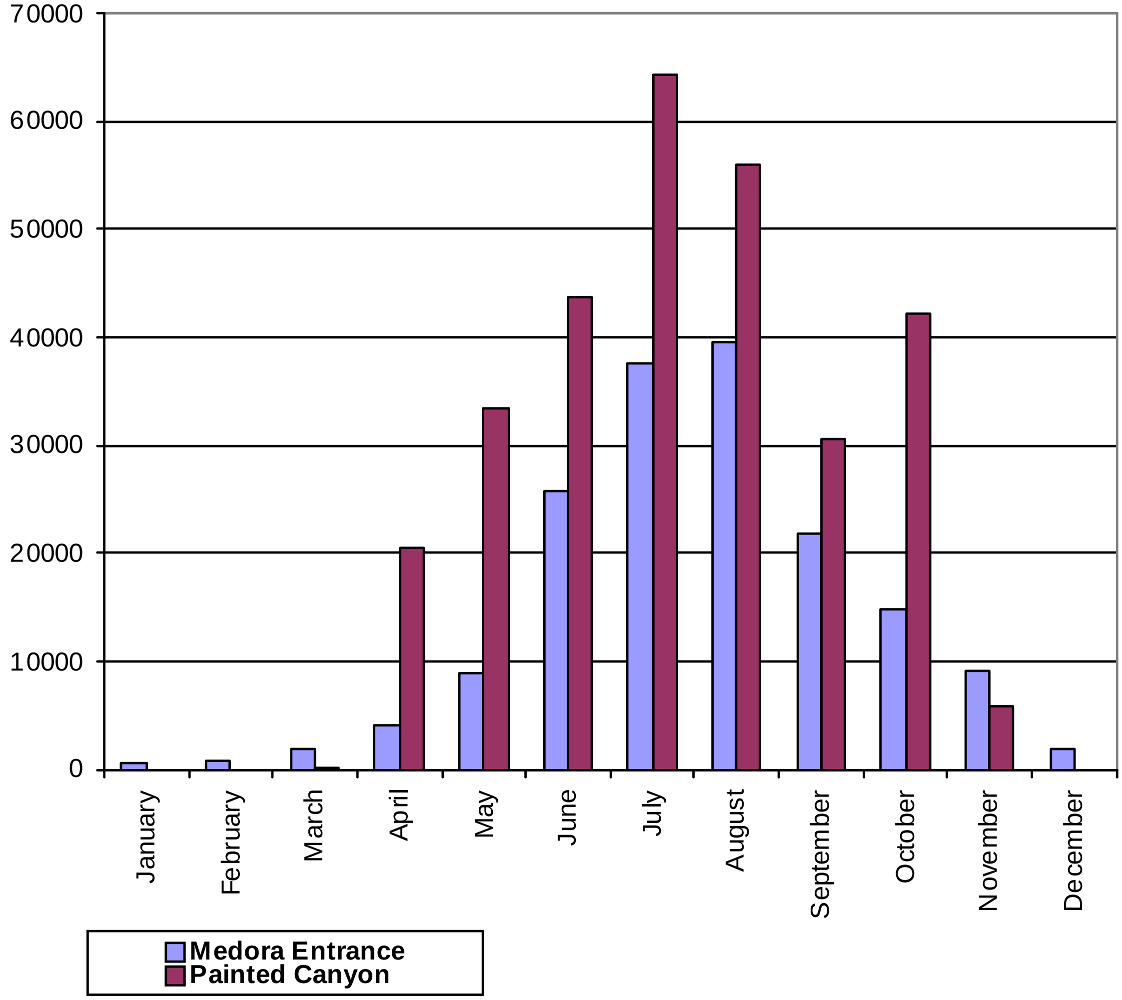
TABLE 18. VISITOR USE STATISTICS FOR THE SOUTH UNIT, 1998 TO 2009

Year	South Unit Visitation[1]	Percent Change from Previous Year	Percent of Total Park Visitation
1998	359,498	—	79.1
1999	361,212	0.5	82.5
2000	380,883	5.4	86.9
2001	411,509	8.0	90.8
2002	423,424	2.9	88.6
2003	443,873	4.8	89.3
2004	421,727	-5.0	87.8
2005	437,580	3.8	87.6
2006	387,928	-11.3	89.1
2007	402,247	3.6	88.1
2008	459,189	12.4	89.6
2009	528,075	13.0	90.6
Average	404,963	3.5	87.5

[1] These numbers include counts from visitors who stopped at Painted Canyon.

Source: NPS 2007b, 2009; Whitworth 2007

FIGURE 8. AVERAGE MONTHLY VISITATION FOR THE SOUTH UNIT, 1998-2009



Sources: NPS 2007b, 2009; Whitworth 2007

VISITOR ACTIVITIES

Viewing wildlife and taking pictures are the most common visitor activities in the park (NPS 2002c), and the South Unit provides ample opportunity for such activities. Other popular uses include visiting the museum, horseback riding, camping, and participating in interpretive programs. These activities are all are available in the South Unit in addition to hiking, fishing, boating, and scenic drives (NPS 2004d). Winter activities within the South Unit are limited, but include cross-country skiing, snowshoeing, and occasional snowmobiling on the river corridor. An important park experience is created by the interplay of natural forces including weather, vegetation, wildlife, vistas, smells, color and shape of landform, air quality, varied light, and seasons. Geological forces continue to create spectacular examples of badlands and provide opportunities for visual interpretation of the erosion processes (NPS 2005). The most important recreation experiences documented in a 2001 survey included enjoying scenery, seeing wildlife in natural habitats, getting away from life's demands, and being close to nature (NPS 2002c).

While visitor activities are generally available at all times of the year, the park Superintendent may restrict use of any area or trail in order to protect visitors and the park's resources. Weather conditions may also warrant closing an area, and extreme fire conditions may restrict the use of fires and grills within the park.

Wildlife Viewing

As described previously, numerous species of mammals and birds, as well as reptiles and amphibians, are found in the South Unit, and the NPS encourages visitors to view these animals in the natural setting provided by the park. The park provides species lists, including a bird checklist and wildlife viewing tips, to help educate visitors on the types of wildlife they may encounter. Wildlife viewing is one of the most common visitor activities in the park – approximately 88% of visitors surveyed in the summer of 2001 indicated they spent their time viewing wildlife, and approximately 26% saw elk (NPS 2002c).

Visitor Centers

Approximately 72% of visitors surveyed in the summer of 2001 indicated they spent some of their time in the park viewing museum collections in the park's visitor centers (NPS 2002c). In the South Unit, the Medora Visitor Center is located at the entrance to the park and has a museum, theater, and information desk. The visitor center is open daily except during Thanksgiving, Christmas, and New Year's Day. The staff provides information about road and trail conditions, park activities, park operations, and management programs. The museum has personal items of Theodore Roosevelt, ranching artifacts, and natural history displays (NPS 2004d).

Painted Canyon, located approximately 7 miles east of Medora, provides another opportunity for visitors to get oriented to the South Unit of the park. When traveling west on I-94, this is the first introduction to the South Unit and includes the Painted Canyon Overlook that provides views of the badlands from the canyon rim. In addition to the overlook, a visitor center, restrooms, picnic shelters, tables, and water are available April 1st through November 11th (a short walk provides access during winter when facilities are closed) (NPS 2007c).

Horseback Riding

Theodore Roosevelt National Park is open to horse use, and in the summer of 2001, 8.2% of visitors went horseback riding in the park (NPS 2002c). Visitors may bring their own horses or take rides with the park concessioner. The current trail ride operator in the park is Peaceful Valley Ranch / Shadow Country Outfitters. The park trail system, except for developed nature trails, is open to horse use. Crosscountry horseback travel is also allowed. Horses are not allowed on park roadways, in developed campgrounds, picnic areas, or on developed nature trails (NPS 2007d). Horse parties wishing to camp in the park must camp in the backcountry or board horses either with the South Unit trail ride concessioner or outside the park. Like all other users, horse parties must obtain a free backcountry use permit for overnight backcountry camping and are subject to general backcountry regulations, including limitations on the length of stay (14 days). Overnight parties in the backcountry are limited to a maximum of eight horses and eight riders per group (NPS 2007d). Horses are not permitted to graze in the park, and visitors are required to bring weed-free feed as part of a strategy to control noxious weeds (NPS 2007e).

Camping

Two campgrounds are available in the South Unit of the park: the Cottonwood Campground and the Roundup Group Horse Campground. Cottonwood is a first-come, first-serve campground (no reservations accepted) with 76 sites. Pull-through sites are available, as is a group site (which can be reserved beginning March 1). There are no hook-ups for water, sewer, or electrical, and no showers. Each site includes a picnic table and grill. Flush toilets with running cold water and water faucets spaced throughout the campground are available from May through September (NPS 2007e).

The Roundup Group Horse Campground can accommodate 20 people and 20 horses, or 30 people without horses. This campground accepts reservations, and provides a firepit, cooking grills, picnic tables, drinking water, a loading ramp, a hitch rail for horses, designated campsites, a pavilion, corrals, and water tanks for horses. At the discretion of the Superintendent, use of the area may be restricted to protect visitors and the park resources. Weather conditions may warrant closing the area (NPS 2007e).

There are no established campgrounds in the backcountry of the South Unit. People wishing to camp overnight in the backcountry of the South Unit must register and obtain a free backcountry use permit from the visitor center in Medora (NPS 2007g).

Interpretive Programs

Ranger talks, movies, hikes, campfire programs, and other interpretive programs take place at the visitor center and out in the park. The significance statements discussed in chapter 1 reflect the primary interpretive themes for the park. Roosevelt's Maltese Cross Cabin is located behind the visitor center in Medora and is open for self-guided tours from September through May, while tours and ranger talks are provided during summer. Rangers at the Medora Visitor Center conduct two 20-minute talks on different topics every day from early June to Labor Day (beginning of September) at the Medora Visitor Center in the South Unit. Guided evening walks to view wildlife or educate visitors about the cultural history of the park, as well as evening campfire programs in the Cottonwood Campground are offered from mid-June to Labor Day. In addition, rangers lead half-day hikes to more remote areas of the park for visitors that would like to explore the badlands (NPS 2007f). Limited ranger-led programs are available in May and September. Approximately one quarter of visitors surveyed in the summer of 2001 indicated that they participated in ranger-led activities (NPS 2002c).

Hiking

Many trailheads and trails are accessible from the park road in the South Unit, including self-guided nature trails (Ridgeline and Coal Vein), short trails to specific features or overlooks (Buck Hill, Wind Canyon, and Painted Canyon), and longer trails (up to approximately 8 miles) that provide access to the backcountry of the park as well as opportunities for longer loop hikes. There are also more than 20 miles of hiking trails west of the Little Missouri River in the Theodore Roosevelt National Park Wilderness Area (NPS 2007g). Almost 58% of visitors surveyed in the summer of 2001 indicated that they hiked on trails during their time in the park (NPS 2002c).

The Maah Daah Hey Trail is a 96-mile hiking, horseback, and mountain bicycle trail that traverses through the scenic and rugged North Dakota badlands. The trail begins at Sully Creek State Park, located south of Medora in Billings County, and winds its way to its northern terminus at the U.S. Forest Service CCC Campground in McKenzie County (located 20 miles south of Watford City off Highway 85). The trail passes through the Little Missouri National Grassland, state land, and private land, as it connects the North and South Units of Theodore Roosevelt National Park. It is open for use all year, but at various times, the trail may be impassable due to mud, snow, ice, and high water (NPS 2007g). Within Theodore Roosevelt National Park, bicycles are not allowed on the trail.

The trail name, "Maah Daah Hey," comes from the Mandan Indians and means "an area that has been or will be around for a long time" (NPS 2007g). The Maah Daah Hey Trail traverses an area of highly dissected badlands surrounded by large expanses of gently rolling prairie. Mule deer and coyotes are often seen, while an occasional golden eagle or prairie falcon may also be seen. Bighorn sheep, elk, bison, and feral horses are also found on the landscapes traversed by the trail (NPS 2007g).

Fishing and Boating

Visitors can fish in the Little Missouri River, however, the water contains a lot of silt, is usually cloudy, and the quantity and quality of fishes is unpredictable. Fish found in the river include chubs (*Couesius plumbeus*), minnows, redhorses (*Moxostoma* spp.), carpsuckers (*Carpiodes carpio*), and catfish, and on rare occasions, walleye (*Sander vitreus*), and fingerling pike (*Esox lucius*). Sport fishing is limited to channel catfish (*Ictalurus punctatus*), goldeyes (*Hiodon alosoides*), and sauger (*Sander canadensis*). North Dakota state laws and license requirements apply (NPS 2007i).

The river ice on the Little Missouri River generally breaks up and is flushed downstream by early March. Thereafter, moderating temperatures and spring rains may combine to produce satisfactory conditions for float trips on the Little Missouri River. Water levels are best for canoeing in early spring, although river levels are sometimes high enough for canoe travel as late as early July. For much of the year, low water levels and restrictive channels require frequent portages. Summer thunderstorms may cause the water level to suddenly increase with little or no warning. The use of outboard motors is permitted but not recommended because the channel is frequently too shallow for their use, and the river's heavy silt load may destroy the engine's water pumps after a very brief running time (NPS 2007j).

Scenic Drive

A major feature of the South Unit is a paved, 36-mile, scenic loop road with interpretive signs that explain some of the park's historical and natural features. The park offers a "Road Log Guide" for sale at the bookstore or online. The book helps interpret the resources along the drive (NPS 2007c). There are many formal overlooks along the road, in addition to trailheads and other opportunities to enjoy the scenery of the park.

Winter Activities

The badlands of North Dakota receive about 30 inches of snow per year between October and April. This provides limited opportunities (i.e., once every decade) for winter activities including cross-country skiing, snowshoeing, and snowmobiling. The park does not groom any trails for cross-country skiing. Skiers blaze their own trails through the snow, and the best places to cross-country ski are usually on the frozen Little Missouri River or on closed park roads. Skiing on park trails can be somewhat difficult because the trails are narrow and many cross creek bottoms. These creek bottoms may be too steep for safe skiing and may also fill up with blowing snow hiding their true depth (NPS 2007k).

Snowmobiling is prohibited in national parks unless the Superintendent permits it in designated areas. An environmental assessment (NPS 1975) resulted in restricting snowmobiles to the Little Missouri River. There was no challenge to the assessment's conclusions, so in 1975 the river remained open to limited snowmobile use (NPS 2004f). In August 1984, a special regulation specific to Theodore Roosevelt National Park was published in the Code of Federal Regulations (36 CFR). Regulation 7.54 states that "designated routes open to snowmobile use are the portions of the Little Missouri River which contain the main river channel as it passes through both units of the park. Ingress and egress to and from the designated route must be made from outside the boundaries of the park. There are no designated access points to the route within the park." According to this regulation, the Superintendent determines the opening and closing dates for the use of designated snowmobile routes each year and notifies the public by posting appropriate signs at the main entrance to both units of the park. The park can also require a snowmobile permit, if the park deems it necessary. Nevertheless, snowmobiles must be operated in accordance with NPS regulations and state laws.

SOUNDSCAPES

A soundscape refers to the total acoustic environment of an area. Park natural soundscape resources encompass the natural sounds present in parks, absent human-caused sound, including the physical capacity for transmitting those natural sounds and the interrelationships among natural sounds of different frequencies and volumes. Natural sound and the opportunity to experience solitude are valued experiences in Theodore Roosevelt National Park. The wilderness qualities of a backcountry experience within the South Unit of the park include the ability of visitors to enjoy uninterrupted solitude and natural sounds. This is reflected in the fact that nearly 45% of visitors surveyed in the summer of 2001 indicated that experiencing the natural quiet of the area and solitude were very important experiences during their trip to the park (NPS 2002c).

Natural sounds are within and beyond the range of sounds that humans can perceive, and can be transmitted through air, water, or solid materials. Some natural sounds in the natural soundscape are also part of the biological or other physical resource components of the park. Natural sounds are an important park resource and a critical component of the ecological communities parks seek to preserve. Primary sources of human-caused noise in national parks are cars, buses, and other motorized vehicles, including recreational vehicles and their generators; airplanes and helicopters; and park operations, such as use of maintenance equipment.

To date, noise monitoring has not been conducted at Theodore Roosevelt National Park. Interstate 94 and the railroad that run near the boundary of the South Unit introduce noise (motor vehicles and trains) that could be carried into the park, as have diesel engines associated with oil and gas well pumpjacks. Park activities occasionally generate noise, including intermittent use of mechanical or motorized equipment, such as chainsaws, during maintenance activities; small-scale construction activities; overflights conducted as part of elk population surveys; and visitor use activities (use of motor vehicles, recreational vehicles, people in campgrounds, snowmobiling, etc.).

Noise standards and sound measurement equipment have been designed to account for the sensitivity of human hearing to different frequencies. Applying “A-Weighted” correction factors accommodates this varying sensitivity. This correction de-emphasizes the very low and very high frequencies of sound in a manner similar to the response of the human ear. The primary assumption is that the A-weighted decibel (dBA) is a good correlation to a human’s subjective reaction to noise. In general, noise generated in a residential area during the day is 50 dBA and in an urban residential area at night is 40 dBA. Noise generated in the park would be expected to fall within this range, with the activities described above possibly exceeding these levels occasionally.

EMPLOYEE AND VISITOR HEALTH AND SAFETY

EQUIPMENT USE

The NPS advocates a safe work environment for employees and a safe experience for park visitors. Currently, park staff are exposed to a variety of health and safety concerns, including use of equipment such as chainsaws, portable sprayers, all-terrain vehicles, and helicopters. These types of equipment are all standard devices with established safety protocols. The park provides employees training on the proper use of equipment.

Health and safety concerns related to the use of a contract helicopter range across a number of unique issues, including: (1) mechanical failure resulting in a crash; (2) contact or entanglement with the main and/or tail rotor; (3) rotor wash dislodging stones, sticks, dust, snow (may cause white-out conditions if snow is not compacted), or other debris on the ground; (4) rotor contact with trees, tall shrubs, power lines, etc. at capture/landing sites or during operation; and (5) air sickness of the pilot or passengers.

HAZARDOUS MATERIALS

The NPS recognizes the far-reaching impacts of waste products, contaminants, and wasteful practices, not only on national park resources but also on resources elsewhere. The types and quantities of hazardous materials used at Theodore Roosevelt National Park are limited. The park uses small quantities of gasoline and diesel fuel to power some motor-driven devices such as chainsaws and all-terrain vehicles. Small quantities of oil and antifreeze are also stored at the park, as are small amounts of pesticides, which may also be transported to treatment areas.

RESEARCH

Wildlife biologists, mammalogists, and field researchers that presently work in the park may come in contact with a variety of physical and biological hazards during the normal conduct of wildlife management activities for bison, feral horses, and elk research, including capture, immobilization, transport, data collection procedures, and monitoring of radio-collared animals. During capture, collaring, and data collection procedures, researchers can be kicked or bitten by the animals, causing physical harm to researchers. In addition, researchers immobilizing an animal may be exposed to drugs that are latently dangerous to humans.

The relocation and monitoring of radio-collared animals present health and safety risks to NPS staff and researchers. Physical environmental hazards affecting field personnel include sunburn, exposure to weather, uneven terrain for walking, driving vehicles, etc. Biological hazards include insect bites, plants, animals, parasites (including fleas and ticks), fungi, bacteria, or viruses that may physically harm or cause disease in humans. Plant species of concern to field personnel include woody plants with sharp branches and plants with thorns or spines that can inflict physical injury, and those causing allergic reactions. Diseases may be transmitted from animals to humans, including bacteria and viruses that may enter humans through contact with the skin, eyes, mouth, and/or through inhalation. Researchers may be exposed to bacteria and virus vectors that include mosquitoes, deer flies, fleas, ticks, and chiggers, among others.

ACCIDENTS

Employee accidents typically involve minor motor vehicle incidents. There were no employee injuries that resulted in lost time in either 2005 or 2006 (Cox 2007). In 2007, there was an accident involving a helicopter during a feral horse roundup. The accident occurred as the horses were being herded in the vicinity of the handling facility.

In 2005 and 2006, park staff dealt with a variety of accidents and incidents, including more than 30 incidents that required responses from emergency medical services within and outside the park. None of these involved interactions (human or vehicle) with elk. Five incidents required searches for lost or overdue hikers. During this time, there were more than 500 other law enforcement offenses/violations, including vandalism, traffic-related offenses, wildlife poaching, and natural resource violations. In 2005, two elk were shot within the South Unit boundary in one of the wildlife poaching incidents; one mule deer was shot in 2005 and one was shot in 2006. There was also an incident in 2007 where one mule deer and two elk were shot within the South Unit.

PARK OPERATIONS AND MANAGEMENT

The park budget for Fiscal Year 2007 was $2,332,365 (net). The park had 38 full-time equivalent employees. This included permanent full-time, part-time, seasonal, and intermittent staff. The park also has a volunteer staff, including interns, to assist with operations and visitor services. Personnel resources are distributed among park management, administration, resource and visitor protection, facility management, interpretation, and resource management (NPS 2006i).

PARK MANAGEMENT

Park management is comprised of a Park Manager (Superintendent) as well as a team of Division Chiefs and program managers. The Superintendent has overall responsibility for the management of all park programs. With authority delegated from the regions, they work independently and in conjunction with the park's team of program managers to plan, organize, direct, evaluate, preserve, and develop park operations within applicable federal laws and NPS policies. The Superintendent serves as the primary contact and liaison for state and local governments, communities near park areas, regional contacts, and other partners (NPS 2006i).

ADMINISTRATION

The Administration Division consists of six full-time employees that provide support functions to all divisions and operations of the park, including coordination and guidance on procedural, policy, and regulatory matters. They are responsible for a variety of functions, including office management, personnel, payroll, travel, training, contracting, purchasing, property management, budget, finance, housing, computers, phone systems, mail, keys and uniforms (NPS 2006i).

RESOURCE AND VISITOR PROTECTION

The Resource and Visitor Protection Division provides resource protection, resource education, and public use management services through law enforcement patrols; search and rescue; emergency medical assistance; visitor and employee safety; physical security; entrance and camping fee collection; special park use programs; and concession operations (the trail ride business at Peaceful Valley). They also provide oversight and assistance to the fire programs. Although law enforcement activities are limited to those specifically authorized to perform law enforcement duties, each employee has the responsibility of resource protection and visitor and employee safety (NPS 2006i). There are six permanent employees and nine to eleven seasonal employees in the resource and visitor protection division.

FACILITY MANAGEMENT

The Facility Management Division is responsible for operating and maintaining the park's facilities, trails, roads, and vehicle fleet. The division engages in design and construction of new visitor use and support facilities such as picnic areas, comfort stations, parking lots, and trail systems. Routine daily activities include vehicle and equipment repairs; grounds work; general maintenance of buildings; housing maintenance; carpentry; plumbing; electrical work; installation of new equipment or fixtures; repairing vandalism damage; maintaining historic structures; repairing roads; sign maintenance; litter pick up; correcting safety hazards; and implementing accessibility compliance for park facilities (NPS 2006i). Facility management staff also maintain the park fence and the handling facility in the South Unit, and conduct repairs when damage is identified. There are 10 permanent employees supplemented by seasonal employees in the Facility Management Division.

INTERPRETATION

The principal responsibility of the Interpretation Division is resource education and visitor services. The goal for this division is to foster an understanding and appreciation of the significance of the park. The division helps minimize user-caused resource damage; enhance visitor enjoyment of the park; reduce accidents and injuries; and develop public support for park programs. Goals are achieved through contact with park visitors via three visitor centers; a variety of talks and walks throughout the park; nature trails; wayside exhibits; site bulletins and publications; and off-site programs to a variety of organizations. Additional activities of the division include working with the Theodore Roosevelt Nature and History Association; the Volunteers in Parks Program; public affairs; media development; editorial assistance; environmental education; Student Conservation Association liaison; and assistance with cultural resource management. The staff consists of three permanent employees that are supported by seasonal and volunteer staff (NPS 2006i).

RESOURCE MANAGEMENT

The Resource Management Division consists of four permanent employees (including the chief), one intermittent (air quality) employee, and one term employee. Other seasonal employees may be hired, depending upon annual project funding. Resource management personnel monitor air and water quality; manage wildlife, including bison and feral horses, and vegetation; identify and control exotic species; oversee research permits; and use a variety of techniques to safeguard; and restore park ecosystems. This division is responsible for monitoring of the elk population, including related vegetation research. The division also works closely with the Interpretation Division and manages the park’s historic structures, museum collections, and numerous other cultural resources. Resource management operates a sophisticated Geographic Information System to analyze, store, and display large volumes of resource information and mapping data, including data gathered as part of elk research in the South Unit. This division also oversees environmental planning to minimize the effects of human activities on park resources and meet the requirements of the National Environmental Policy Act, Endangered Species Act, and other laws (NPS 2006i). The division is responsible for fire management, including prescribed burns and fire suppression.

ENVIRONMENTAL CONSEQUENCES

THEODORE ROOSEVELT NATIONAL PARK

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

This “Environmental Consequences” chapter analyzes both beneficial and adverse impacts that would result from implementing any of the alternatives considered in this plan/EIS. This chapter also includes a summary of laws and policies relevant to each impact topic, definitions of impact thresholds (for example, negligible, minor, moderate, and major), methods used to analyze impacts, and the analysis methods used for determining cumulative impacts. As required by the Council on Environmental Quality (CEQ) regulations implementing the NEPA, a summary of the environmental consequences for each alternative is provided in table 13 which can be found in “Chapter 2: Alternatives.” The resource topics presented in this chapter, and the organization of the topics, correspond to the resource discussions contained in “Chapter 3: Affected Environment.”

INTRODUCTION

SUMMARY OF LAWS AND POLICIES

Three overarching environmental protection laws and their implementing policies guide the actions of the National Park Service in the management of the parks and their resources — the *Organic Act of 1916*, NEPA and its implementing regulations, and the *Omnibus Management Act*. For a complete discussion of these and other guiding authorities, refer to the section titled “Related Laws, Policies, Plans, and Constraints” in “Chapter 1: Purpose of and Need for Action.” These guiding authorities are briefly described below.

The *Organic Act of 1916* (16 United States Code (USC) 1), as amended or supplemented, commits the NPS to making informed decisions that perpetuate the conservation and protection of park resources unimpaired for the benefit and enjoyment of future generations.

NEPA is implemented through CEQ regulations (40 CFR Parts 1500–1508). The NPS has, in turn, adopted procedures to comply with these requirements, as found in Director’s Order 12 (NPS 2001a) and its accompanying handbook.

The *National Park Service Omnibus Management Act of 1996* (16 USC 5901 et seq.) underscores the NEPA provisions in that both acts are fundamental to park management decisions. Both acts provide direction for connecting resource management decisions to the analysis of impacts and communicating the impacts of those decisions to the public, using appropriate technical and scientific information. Both acts also recognize that such data may not be readily available, and they provide options for resource impact analysis should this be the case. Section 4.5 of Director’s Order 12 adds to this guidance by stating, “when it is not possible to modify alternatives to eliminate an activity with unknown or uncertain potential impacts, and such information is essential to making a well-reasoned decision, the National Park Service will follow the provisions of the CEQ regulations (40 CFR 1502.22).” In summary, the NPS must state in an environmental assessment or impact statement (1) whether such information is incomplete or unavailable; (2) the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment; (3) a summary of existing credible scientific adverse impacts that is relevant to evaluating the reasonably foreseeable significant adverse impacts; and (4) an evaluation of such impacts based on theoretical approaches or research methods generally accepted in the scientific community. Collectively, these guiding regulations provide a framework and process for evaluating the impacts of the alternatives considered in this environmental impact statement.

GENERAL METHODOLOGY FOR ESTABLISHING IMPACT THRESHOLDS AND MEASURING EFFECTS BY RESOURCE

The following elements are used in the general approach for establishing impact thresholds and measuring the effects of the alternatives on each resource category:

- General analysis methods as described in guiding regulations, including the context and duration of environmental effects
- Basic assumptions used to formulate the specific methods used in this analysis
- Thresholds used to define the level of impact resulting from each alternative
- Methods used to evaluate the cumulative impacts of each alternative in combination with unrelated factors or actions affecting park resources
- Methods and thresholds used to determine if impairment of specific resources would occur under any alternative

These elements are described in the following sections.

General Analysis Methods

The analysis of impacts follows CEQ guidelines and Director’s Order 12 procedures (NPS 2001a) and is based on the underlying goal of supporting a lightly grazed, northern plains mixed-grass prairie system in elk use areas of Theodore Roosevelt National Park, specifically the South Unit. This analysis incorporates the best available scientific literature applicable to the region and setting, the species being evaluated, and the actions being considered in the alternatives.

Assumptions

Several guiding assumptions were made to provide context for this analysis. These assumptions are described below.

Analysis Period. Goals, objectives, and specific implementation actions needed to manage elk at Theodore Roosevelt National Park would be established for the next 15 years or until conditions necessitate the plan be revised. For the purposes of the analysis, the life of the plan and period used for assessing impacts is 15 years. The impact analysis for each alternative is based on the principles of adaptive management, which would allow the NPS to change management actions as new information emerges from monitoring the results of management actions and ongoing research throughout the life of this plan.

Geographic Area Evaluated for Impacts (Area of Analysis). The geographic study area (or area of analysis) for this plan includes the South Unit of Theodore Roosevelt National Park and immediately adjacent lands. The area of analysis may extend beyond this boundary for some cumulative impact assessments, as shown in table 19. The specific area of analysis for each impact topic is defined at the beginning of each topic discussion.

TABLE 19. CUMULATIVE IMPACT SCENARIO

Resource Area	Spatial Boundary	Temporal Boundary	Past Actions	Current Actions	Reasonably Foreseeable Future Actions
Soil and Water Resources	Park and Surrounding Watershed	1985 (reintroduction of elk) – Life of the Plan	• Road construction and repairs • Building construction • Small disturbances associated with maintenance of existing facilities, utilities, and roads (both inside and outside of park) • Oil and gas developments • The Medora Golf Course • Visitor use (NPS and USFS) • Land and Resource Management Plan for the Dakota Prairie Grasslands – Northern Region (USFS 2002) • Bison/elk/horse roundups • Fire suppression • Prescribed burns • Wildland fire • Herbivory/grazing (ungulates, prairie dogs, cattle) • Agricultural activities	Same as past except no building construction, elk roundups, or fire suppression, plus: • Roadbed failures • The Little Missouri River rural community development • Pesticide and fertilizer contamination • Bison/horse roundups	Same as past except no building construction, development of springs, elk roundups, or fire suppression, plus: • Conversion of large ranches to small ranchettes or home sites
Vegetation	South Unit and Adjacent Lands	1985 (reintroduction of elk) – Life of the Plan	Same as soils and water resources, plus: • Exotic plant control • Vegetation exclosures	Same as soils and water resources except roadbed failures, plus: • Exotic plant control • Vegetation exclosures • Park weed-free hay policy	Same as soils and water resources plus: • Exotic plant control • Vegetation exclosures • Park weed-free hay policy • Increasing use of stock animals
Elk Population	South Unit and Adjacent Lands	1985 (reintroduction of elk) – Life of the Plan	• Road construction and repairs • Building construction • Small disturbances associated with maintenance of existing facilities, utilities, and roads (both inside and outside of park) • Oil and gas developments • The Medora Golf Course • Visitor use (NPS and USFS) • Land and Resource Management Plan for the Dakota Prairie Grasslands – Northern Region (USFS 2002) • Bison/elk/horse roundups • Fire suppression • Prescribed burns • Wildland fire • Herbivory/grazing (ungulates, prairie dogs, cattle) • Agricultural activities • Habitat fragmentation from roads and other developments, including oil and gas • Vegetation exclosures • Exotic plant management • Elk research • Predator reduction efforts • Adjacent elk hunting units and state of North Dakota hunting regulations	Same as past except for the Medora Golf Course, building construction, fire suppression, or elk management.	Same as current, plus: • Conversion of large ranches to small ranchettes or home sites • Vegetation exclosures
Other Wildlife and Wildlife Habitat	South Unit and Adjacent Lands	1985 (reintroduction of elk) – Life of the Plan	Same as elk population.	Same as elk population.	Same as elk population.
Special Status Species	South Unit and Adjacent Lands	1985 (reintroduction of elk) – Life of the Plan	Same as elk population.	Same as elk population except for elk research.	Same as elk population except for elk research.

TABLE 19. CUMULATIVE IMPACT SCENARIO

Resource Area	Spatial Boundary	Temporal Boundary	Past Actions	Current Actions	Reasonably Foreseeable Future Actions
Wilderness	Designated Wilderness and Adjacent Lands	1978 (Designation of Wilderness) – Life of the Plan	• Reintroduction of elk • Small disturbances associated with maintenance of trails • Oil and gas developments • Bison/elk/horse roundups • Fire suppression • Prescribed burns • Wildland fire • Exotic plant management • Herbivory/grazing (ungulates, prairie dogs, cattle) • Park operations that include the use of aircraft, off-road vehicles, and/or large work crews, including ungulate management	Same as past, except elk roundups.	Same as current
Socioeconomic Environment/Land Management Adjacent to the Park	South Unit and Adjacent Communities	1985 (reintroduction of elk) – Life of the Plan	• Oil and gas developments • Hunting outfitters • Grazing organizations • State of North Dakota Policies (hunting) • Visitation to Theodore Roosevelt • Agriculture and Crop Damage	Same as past.	Same as past plus: • Conversion of large ranches to small ranchettes or home sites
Visitor Use and Experience (including soundscapes and visibility)	Park Boundary and Surrounding Lands	1985 (reintroduction of elk) – Life of the Plan	• Reintroduction of elk • Oil and gas development • The Medora cell tower • Rural development • Lights near park boundaries • Noise from oil wells • Noise from road traffic from the interstate and other roads • Train whistles and railroad noise • Noise from firearms associated with hunting • Maintenance of existing facilities, utilities, and roads (both inside and outside of park) • Exotic plant management • Park operations that include the use of aircraft, off-road vehicles, and/or large work crews, including ungulate management • Elk/bison/horse management • Visitor activities and traffic noise (inside the park) • Road/area/facility closures • Predator reduction efforts • Adjacent elk hunting units and state of North Dakota hunting regulations • Land and Resource Management Plan for the Dakota Prairie Grasslands – Northern Region (USFS 2002) • Fire suppression • Prescribed burns • Wildland fire • Herbivory/grazing (ungulates, prairie dogs, cattle)	Same as past except for predator reduction, and fire suppression.	Same as current, plus: • Stack and plume from a proposed coal gasification plant near South Heart • Hunting firearms noise • Conversion of large ranches to small ranchettes or home sites
Human Health and Safety	South Unit Boundary and Adjacent lands	1985 (reintroduction of elk) – Life of the Plan	• Elk/bison/horse management, including disease testing • Oil and gas development • Falling, tripping, slipping • Hunting outside the park	Same as past except elk management.	Same as current.
Park Operations and Management	South Unit Boundary	1985 (reintroduction of elk) – Life of the Plan	• Wildland firefighting • Elk/bison/horse management • Fence maintenance • Update and improve handling facility (increase size and capacity) • Loss Control Management Safety and Environmental Health Program (NPS 2002b)	Same as past except elk management, update and improve handling facility, plus: • Implementation of an exotic plant management plan • Vegetation monitoring • Public involvement, educational and interpretative measures	Same as current, plus: • Increase public involvement, educational and interpretative measures

Duration and Type of Impacts

Duration has been defined for each resource topic. However, the following assumptions are used for all impact topics (the terms "impact" and "effect" are used interchangeably throughout this document):

- Direct impacts — Impacts are a direct result of elk management actions.
- Indirect impacts — Impacts are from elk management actions and would occur later in time or farther in distance from the action.

Impact Thresholds

Determining impact thresholds is a key component in applying NPS *Management Policies 2006* (NPS 2006a) and Director's Order 12 (NPS 2001a). These thresholds provide the reader with an idea of the intensity of a given impact on a specific topic. The impact threshold is determined primarily by comparing the effect to a relevant standard based on regulations, scientific literature and research, or best professional judgment. Because definitions of intensity vary by impact topic, intensity definitions are provided separately for each impact topic analyzed in this document. Intensity definitions are provided throughout the analysis for negligible, minor, moderate, and major impacts. In all cases the impact thresholds are defined for adverse impacts. Beneficial effects are addressed qualitatively.

As described in the "Desired Conditions" section of chapter 1, and the "Elements Common to All Action Alternatives" section of chapter 4, based on past management and recommendations of the science team, the NPS would manage the elk population between 100 and 400 elk. Although the hypothetical scenarios for most alternatives assume a target population of 200 elk after initial reduction, the intensity of impacts described throughout this chapter would not change if the NPS reduces the elk population to 100 animals.

CUMULATIVE IMPACTS ANALYSIS METHOD

The CEQ regulations to implement NEPA require the assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts need to be analyzed in terms of the specific resource, ecosystem, and human community being affected and should focus on effects that are truly meaningful. Cumulative impacts are considered for all alternatives, including alternative A.

Cumulative impacts were determined by combining the impacts of the alternative being considered with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects and plans at Theodore Roosevelt National Park and, if applicable, the surrounding area. Table 19 summarizes these actions that could affect the various resources at the park that might also be affected by elk management, and those requiring additional explanation are discussed in the following narrative or in chapter 1.

The analysis of cumulative impacts was accomplished using four steps:

Step 1—Identify Resources Affected: fully identify resources affected by any of the alternatives.

Step 2—Set Boundaries: identify an appropriate spatial and temporal boundary for each resource.

Step 3—Identify Cumulative Action Scenario: determine which past, present, and reasonably foreseeable future actions to include with each resource.

Step 4—Cumulative Impact Analysis: summarize impacts of these other actions (x) plus impacts of the proposed action (y), to arrive at the total cumulative impact (z).

CUMULATIVE IMPACT SCENARIO

PAST ACTIONS WITHIN AND AROUND THEODORE ROOSEVELT NATIONAL PARK

Development Inside the Park

The developed areas inside the South Unit of the park include the Medora visitor center area, the Painted Canyon visitor center area, the Peaceful Valley Ranch (listed on the National Register of Historic Places), one campground, one picnic area, parking lots, a horse camp, hiking trails, and paved and unpaved roads. Developed areas, such as these have vehicular access and utilities, and require varying levels of maintenance.

Development Outside the Park

Development in the vicinity of the South Unit has included construction and maintenance of transportation corridors (roads, railroads, and bridges), as well as rural community developments. This includes development in the town of Medora, as well as the conversion of large ranches to small ranches or home sites. Parts of the South Unit are near the freeway, county and local roads, and the railroad line, and can be affected by associated noises and lights. Recent development includes the 18-hole Bully Pulpit Golf Course, located approximately 3 miles south (upstream) of the Medora visitor center, which opened in June 2004 (Theodore Roosevelt Medora Foundation 2007).

Oil and Gas Development

The first viable commercial drilling in the Williston Basin, the oil producing basin where the park is located, began in 1950. By 1953 seismic surveys were being conducted around the South Unit and production remained steady during the oil boom of the 1950s. However, there was a decline of new wells in the 1960s. In 1972, fewer than 100 new wells were drilled and four new reservoirs were discovered; net oil and gas revenue to the state was $3.2 million. A second boom began after the oil embargo of 1973 and by 1981, a year in which 848 new wells were drilled and 83 new reservoirs were discovered, net oil and gas revenue to the state was $163.3 million. Drilling slackened in 1983, but the Williston Basin has remained productive, and there have been approximately 2,500 wells drilled in or near the Little Missouri National Grassland since drilling began in North Dakota. From 1996 to 2000, production averaged 4.3 million barrels of oil and 4.4 billion cubic feet of gas per fiscal year (USFS 2002).

Elk Hunting Outside the Park

NDGF restructured the elk hunting season outside the park in August 1997. Elk hunting units E3 and E4 were established in 1998 and 1999, respectively. Since elk hunting was restructured in the vicinity of the South Unit through the 2007 season, approximately 631 elk have been removed. Over the years, the state has added additional hunting seasons or expanded the number of licenses issued to increase success rates. The people that engage in hunting contribute to the local economy from expenditures on food, lodging, fuel, guides and outfitters, among other things. Today, the outfitting industry supplements the ranching businesses of a number of county residents (Billings County n.d.). Additional details on elk hunting are provided in the “Land Management Adjacent to the Park” and “Elk Population” sections of chapter 3.

NPS Elk Management

After reintroduction in 1985, the elk population in the South Unit was actively managed on two occasions based on population objectives (approximately 360 elk) established by park staff using a forage allocation model (Westfall et al. 2003). The size of the elk population in the park was reduced through roundups and translocation in 1993 and in 2000. Approximately 221 elk were translocated in 1993 and 203 elk were translocated in 2000 (Sargeant and Oehler 2007). A third translocation was scheduled in 2003, but did not occur due to the 2002 Director’s Guidance Memorandum on CWD (NPS 2002a). See “History of Elk Management at Theodore Roosevelt National Park” in chapter 1 for more details on past elk management activities.

Elk Research

Since elk were reintroduced in 1985, park staff and other researchers have conducted numerous studies for monitoring characteristics of the elk population within the park, including associated vegetation research. Some of these studies have included radio-collaring and monitoring elk movements. Elk have also been rounded up for studies on population dynamics and vital statistics. Data was collected on demographics and herd health during roundups in 1993 and 2000 and aerial surveys were conducted in 2001 and from 2004 to 2006 to estimate population size. See the “Summary of Existing Research/Modeling” section of chapter 1 and the “Elk Population” section in chapter 3 for more details on this research.

CURRENT ACTIONS WITHIN AND AROUND THEODORE ROOSEVELT NATIONAL PARK

Existing Park Plans and Management Actions

Ungulate Management at Theodore Roosevelt National Park. As described in the “Other Wildlife and Wildlife Habitat” section in chapter 3, park staff have managed bison and feral horses in the South Unit since 1993 using a forage allocation model (Westfall et al. 1993) to inform decisions about population objectives (200 to 500 bison; 50 to 90 feral horses). Elk numbers have not been reduced through translocation since 2000 due to the 2002 Director’s Guidance Memorandum on CWD (NPS 2002a).

The park does have the ability to conduct targeted and opportunistic surveillance for CWD in elk, but has not sampled any elk to date in accordance with the guidance memorandum. Targeted surveillance, as defined by the NPS, includes lethal removal of deer or elk that exhibit clinical signs consistent with CWD for testing. Park staff look for animals with clinical signs of the disease, but none of the signs have been observed to date, and no elk have been removed for testing. Opportunistic surveillance involves taking diagnostic samples for CWD testing from deer or elk found dead, such as road kill, or animals lethally removed from the park for other purposes (e.g., research).

Fire Management. It is well established that the plains ecosystem historically experienced frequent, fast running, short duration fires. From the recorded accounts of early European explorers and settlers, fires were a common occurrence on the plains (Higgins 1986). Fires were often ignited by lightning activity during the late spring to early autumn season or by Native Americans for the purposes of signaling others, herding game, adjusting the vegetative mix and to clear campsites. Following the influx of European settlers in the mid-to-late 1800s, most human-caused prairie fires resulted from the carelessness of cowboys and cooks, rather than Indians (Wright and Bailey 1980 as cited in NPS 1999b).

From the establishment of the park in 1947, fire management involved full and immediate suppression of all observed fires. Approximately 90 such fires burned on park lands from 1949 to 1993. The park implemented a revised fire management plan in 2008, recognizing the importance of both wildland and prescribed fire in ecosystem management, both of which are now used to reduce fuel loads and restore plant community structure and composition to ranges of natural variability comparable to pre-European settlement. Prescribed fires are also used to minimize unnaturally intense fires by reducing hazard fuels. Details of the fire management plan for the park are discussed in the “Relationship to Planning Documents for Theodore Roosevelt National Park” section of chapter 1.

Exotic Plant Management. Exotic plant management at Theodore Roosevelt National Park is defined as a “limited integrated approach” because not all potential tools are used. In general, most actions are limited in scope and effect. Each species is treated on a case-by-case basis using chemical, mechanical, manual, or biological control methods. The park is currently transitioning to an integrated pest management approach to exotic plants, as prescribed by the Northern Great Plains Exotic Plant Management Plan (NPS 2005). Details of exotic plant management are described in the “Relationship to Planning Documents for Theodore Roosevelt National Park” section of chapter 1 and the “Exotic Species Management” section of chapter 3.

Theodore Roosevelt National Park prohibits grazing from domestic livestock within the park. For this reason and as part of the strategy to control noxious weeds, visitors who use horses or other pack animals within the park are required to bring only certified weed-free feed for these animals. In addition to this regulation, visitors are required to feed their horses or other pack animals only certified weed-free feed within 96 hours before entering backcountry areas within the park.

Current Actions Around the Park

Hunting. The state recently increased licenses and/or added hunting seasons, increasing the opportunities available to hunters near the South Unit, as well as the number of animals removed in recent years. For example, in 1999 a total of 44 elk were removed by hunters, compared to the 178 in 2007.

State CWD Testing. Nearly 8,500 deer and 147 elk have been tested for CWD statewide since 2002. Of these, 111 were elk removed by hunters in the hunting units adjacent to the South Unit. The disease has not been diagnosed in any wild or captive animal during these testing efforts (NDGF 2007b; Oehler 2007a).

Agricultural Activities. Agricultural activities in the vicinity of the South Unit include some crop production, but largely consist of cattle grazing. Within Billings County, 54% of the estimated grazing forage output is produced from federal lands, nearly 100% of which are contained within the Little Missouri National Grassland. Much of the private grazing land is located within these tracts of federal lands. Within the Little Missouri National Grassland, grazing is cooperatively managed by the USFS and Medora Grazing Association.

Of the 1,026,900 acres of land in the grassland, 86% (884,730 acres) is considered to have physical characteristics conducive to livestock grazing, including areas with slopes less than 40% and accessible to livestock, areas producing at least 200 pounds of forage per acre, areas with stable soils, and areas with natural or developed water available or capable of being developed. The grassland produces an average of 803,335,000 pounds of forage, and has a 20-year average authorized animal unit month (AUM) of 315,900. An AUM is the amount of forage required by one mature cow (approximately 1,000 pounds) and a calf (usually 6 months of age), or their equivalent, for a period of one month (USFS 2002).

The majority of grazing leases in the Little Missouri National Grassland are rotated, and the maximum percent of capable acreage that is grazed simultaneously is 62%. There is approximately one water development (e.g., stock pond) for livestock use in every 320 acres of the grassland, which supports pastures ranging between 560 and 1,140 acres in size (USFS 2002).

Wildlife causes some agricultural damage to rangelands and crops in the vicinity of the South Unit because deer, pronghorn, and elk all forage on agricultural lands and crops in the area. The Billings County Land Use Plan (Billings County n.d.) notes that elk have damaged crops and hay on surrounding property, but identifies prairie dogs as the biggest concern. The "Plant and Animal Damage Control" section of the Land and Resource Management Plan for the Dakota Prairie Grasslands – Northern Region notes that the USFS is frequently contacted by adjacent landowners regarding prairie dog control and the damage they cause to agricultural lands (USFS 2002). This section does not address damage from ungulates, suggesting elk play less of a role than prairie dogs.

Oil and Gas Developments. A third oil and gas boom has hit the Williston Basin. The latest increase in oil and gas activity is related to improvements in technology associated with horizontal drilling and fractionation that have made the vast reserves in the Bakken Formation in western North Dakota, Montana and Saskatchewan accessible (Markman 2008). Reserve estimates recently published by the USGS indicate that the Bakken Formation has a mean resource of 3.6 billion barrels of oil (USGS 2008). The Nesson-Little Knife Structural Assessment Unit, which lies near Theodore Roosevelt National Park has an estimated resource of nearly a billion barrels of oil. Details on current oil and gas developments are provided in the "Socioeconomics" section of chapter 3.

Land and Resource Management Plan for the Dakota Prairie Grasslands – Northern Region (USFS 2002). The Land and Resource Management Plan for the Dakota Prairie Grasslands includes several guidelines and objectives pertaining to managing resources to complement native species and their habitat needs while balancing management of other resources and uses, including livestock grazing and recreation. This plan does not include any policies or management actions specific to elk, and big game is only mentioned as a resource present within the grasslands; however, general objectives and guidelines that would apply to elk management are described. In addition, to better conserve biological diversity, the USFS has recently established the following seral stage goals for the Dakota Prairie Grasslands, including lands near Theodore Roosevelt National Park (USFS 2002):

- Early – 10-15%
- Mid – 65-75%
- Late – 15-20%

This plan is discussed further in the "Other Federal Agency Plans, Policies, and Actions" section of chapter 1.

REASONABLY FORESEEABLE FUTURE ACTIONS

The following actions discussed under past and current actions are expected to continue and contribute to cumulative effects:

- NPS ungulate management
- Hunting
- Agricultural activities

- Oil and gas development
- Implementation of the Land and Resource Management Plan for the Dakota Prairie Grasslands – Northern Region (USFS 2002)

In addition, the following are considered reasonably foreseeable future actions likely to contribute to cumulative effects on the resources discussed in this plan:

Coalbed Methane Development

A reasonably foreseeable development scenario, which projects oil and gas development for a planning area, was developed for the Dakota Prairie Grasslands in 1997 and revised in 1999. The results are summarized in the land and resource management plan for the (USFS 2002) for this grassland, and indicates the area has moderate to high potential for coalbed methane production (USFS 2002).

South Heart Coal LLC

Great Northern Power Development LLP has proposed to construct the South Heart Coal LLC coal gasification plant and lignite mine near South Heart, North Dakota, located less than 20 miles from the South Unit.

IMPAIRMENT ANALYSIS METHOD

The NPS *Management Policies 2006* (NPS 2006a) require an analysis of potential effects to determine whether actions would have the potential to impair park resources. The fundamental purpose of the national park system, as established by the *Organic Act* and reaffirmed by the *Redwood National Park Act*, as amended, begins with a mandate to conserve park resources and values. NPS managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adversely impacting park resources and values. However, the laws do give the NPS the management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park. Although Congress has given the NPS the management discretion to allow certain impacts within a park system unit, that discretion is limited by the statutory requirement that the agency must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values.

An impact would be more likely to constitute impairment, a subset of a major impact, to the extent that it has a major or severe adverse effect upon a resource or value whose conservation is:

- Necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- Key to the natural or cultural integrity of the park; or
- Identified as a goal in the park’s general management plan or other relevant NPS planning documents.

Impairment may result from NPS activities in managing the park, visitor activities, or activities undertaken by concessioners, contractors, and others operating in the park.

The following process was used to determine whether the alternatives had the potential to impair park resources and values:

1. The park's enabling legislation, the general management plan, the strategic plan, and other relevant background were reviewed with regard to the unit's purpose and significance, resource values, and resource management goals or desired future conditions.

2. Management objectives specific to resource protection goals at the park were identified.

3. Thresholds were established for each resource of concern to determine the context, intensity and duration of impacts, as defined above.

4. An analysis was conducted to determine if the magnitude of impact reached the level of "impairment," as defined by NPS *Management Policies 2006*.

The impact analysis includes any findings of impairment to park resources and values for each of the alternatives.

SOILS, EROSION, AND WATER RESOURCES

GUIDING REGULATIONS AND POLICIES

The Clean Water Act (33 USC 1251 et seq.) provides the mechanisms to protect and restore the quality of natural waters through the establishment of nationally recommended water quality standards. Under the oversight of the U.S. EPA states are given the responsibility of administering the provisions of the Clean Water Act by establishing water quality standards and managing water quality. According to EPA regulations, water quality standards must (1) designate uses to be made of the water; (2) set minimum narrative or numeric criteria sufficient to protect the uses, and; (3) prevent degradation of water quality through antidegradation provisions.

In administering the Clean Water Act, the state of North Dakota identifies the Little Missouri River as Class II, indicating that beneficial uses include aquatic wildlife, warm water fishing, and recreation (NPS 1998b). All the creeks and tributaries to the Little Missouri River within the park are classified as Class III. Beneficial uses for these streams include aquatic life, recreation, agriculture, and industry.

NPS *Management Policies 2006* (NPS 2006a, Section 4.6.3) states the NPS will "take all necessary actions to maintain or restore the quality of surface waters and ground waters within the parks consistent with the Clean Water Act and all other applicable federal, state, and local laws and regulations." NPS *Management Policies 2006* also instruct park units to prevent, to the extent possible, the unnatural erosion, physical removal, or contamination of the soil, or its contamination of other resources (NPS 2006a, Section 4.8.2.4).

ASSUMPTIONS, METHODOLOGY, AND INTENSITY THRESHOLDS

Ninety-two percent of the South Unit is covered by soils with either a moderate or high erosion classification that would be primarily affected by erosion from the loss of vegetative ground cover due to elk use. It is assumed that removal of vegetation would cause greater stormwater flows during storm events that would result in increased soil erosion. Vegetative cover is just one of several factors determining how much and how quickly rainfall or snowmelt reaches surface waters in a grassland habitat. Other factors include soil type, climate, topography, and the amount of time between precipitation events.

Impacts to soils and water resources were assessed by determining the types and current condition of the soils and surface waters in the South Unit likely to be affected by management actions implemented under each alternative.

Impact intensities for soils and water quality were derived from the available soils information and from water quality data available for the Little Missouri River in and near the park. The thresholds for the intensity of an impact are defined as follows.

Negligible: Chemical or physical properties of soils or water quality would not be affected, or the effects would be below or at the levels of detection. Water quality would be well within water quality standards or criteria and historical or desired water quality conditions. There would be no discernable effect on the rate of soil erosion, or the ability of the soil to support native vegetation.

Minor: Changes in chemical or physical properties of soil and water quality would be detectable. Water quality would be well within historic or desired water quality conditions. There would be measurable effects on the rate of soil erosion, the ability of soil to support native vegetation, or suspended sediment concentrations in water resources.

Moderate: Changes in the chemical or physical properties of soils or water quality would be readily apparent. Water quality may temporarily vary from historical baseline or desired water quality conditions. There would be observable or clear changes in the rate of soil erosion, the ability of soil to support native vegetation, and/or in suspended sediment concentrations in water resources.

Major: The chemical or physical properties of soils or water quality would be substantially changed or frequently altered. Water quality could often vary from the historic baseline or desired condition. There would be highly noticeable changes in the rate of soil erosion, the ability of soil to support native vegetation, and/or suspended sediment concentrations in water resources.

Duration: **Short-term**: Occurs only through the duration of initial management actions.

Long-term: Continues beyond the duration of initial management actions throughout the life of the plan.

Area of Analysis

The area of analysis for assessment of impacts of the various alternatives is the South Unit and for cumulative impacts it is the park and the surrounding watershed.

IMPACTS OF THE ALTERNATIVES

Alternative A: No Action (Continue Existing Elk Management Program)

Dense grassland vegetation promotes the production of soil organic material and increases infiltration rates, helping prevent soil erosion. Although trailing (i.e., the loss of vegetative ground cover from elk foraging and movement), and impacts to surface waters have not been documented as problems relating to soils and water quality since elk reintroduction, it is expected that continued growth of the elk population increases the potential for heavy sustained grazing that weakens or kills vegetation, reduces soil cover, and thereby contributes to and accelerates surface erosion (USDA 2000). This is especially true in areas with steep slopes, along water flow paths, and areas exposed to wind. With increased erosion, soil fertility decreases and sediment yields to surface waters increase. In stream areas, heavy elk use could cause bank destabilization through trampling, compaction, and vegetation removal. When vegetation is lost, stream banks are more susceptible to breakdown from animal movements and erosional forces of the stream flow leading to greater erosion and sedimentation.

Increased sediment in streams increases turbidity and can reduce the oxygen carrying capacity of a stream, potentially affecting aquatic biota (USDA 2000); however, turbidity levels in the Little Missouri River have historically exceeded water quality criteria set by the NPS in the park. For example, water quality monitoring from 1971 to 1994 showed 116 exceedances in a total of 182 tests (NPS 1998b). Water quality in the Little Missouri River is also variable and related to flow (NPS 1998b). During low flow periods, most of the water in the Little Missouri River is derived from ground water and turbidity is low due to a lack of surface runoff. During periods of intense rainfall and/or high flow, streams may be unusually turbid with high sediment loads from the erosive soils and deposits associated with the surficial geology of the Little Missouri River basin (NPS 1998b).

Considering the susceptibility of the highly and moderately erosive soils in the South Unit and the loss of vegetative ground cover, as well as the naturally high turbidity in the park's surface waters, the sedimentation created by sustained heavy elk use would be detectable, but would also be within historic levels. As a result, there would be long term, minor to moderate, adverse impacts on soils and water quality under alternative A. Routine research and monitoring would contribute minimally to these impacts as a result of the impacts of limited foot traffic (e.g., trampling and vegetation loss)

Cumulative Impacts. A large portion of the Little Missouri River watershed lies outside of the park's boundary, so cumulative impacts on soil and water quality arise not only from activities within the park, but are also heavily influenced by past, present and reasonably foreseeable future actions in the areas adjacent to the park.

Approximately 42 percent of the Little Missouri River watershed is pasture or rangeland and a significant portion of that is associated with soils of high wind erosion potential or with fragile soils (NPS 1998b). Long-term, minor, impacts on the soils and water quality are expected from livestock grazing in areas outside the park boundaries which could increase soil erosion due to greater vegetative ground cover loss, soil compaction, and destabilization of river/stream banks. Wildlife grazing, including that associated with elk since their reintroduction, contributes to such impacts. U.S. Forest Service implementation of the Land and Resource Management Plan for the Dakota Prairie Grasslands, as well as the seral stage goals described previously, would help offset some of these impacts by maintaining healthy plant communities that decrease erosion potential.

Oil and gas operations surrounding the park have the potential to affect soils and water quality. Although seismic operations are not likely to contribute to such impacts, the development of the wells requires pipelines, reserve pits, storage tanks, as well as an extensive network of roads. During the development and operation of the wells there is the potential for short- and long-term, minor to moderate, adverse impacts from increased erosion and sedimentation of as well as potential contamination from spills.

The Medora Golf Course, agricultural lands surrounding the park, and other upstream developments have contributed to pesticide and fertilizer contamination that could have long-term, negligible to minor, adverse impacts on water quality. The use of pesticides within the park to control exotic plant species such as leafy spurge could also contribute to adverse effects on water quality. Although past fire suppression minimized impacts on soils and water quality temporarily associated with fires (e.g., the loss of vegetative cover, loss of organic soil layers, exposed soil, and greater runoff), the more recent use of prescribed burns do cause such impacts. However, the temporary adverse effects are ultimately offset by the long-term benefits (e.g., increased vegetative cover, enrichment of soil layers) of a more natural fire regime.

Small disturbances associated with visitor use and maintenance of existing facilities, utilities, and roads, both inside and outside the park, could change soils structure and composition in affected areas; however, this would likely be mitigated through the use of best management practices. Infrastructure projects such as road improvements and building construction could also affect soils and water quality through increased erosion from disturbed areas and sedimentation of the surrounding surface waters, as well as increases in stormwater flows. These would contribute short- and long-term, negligible to minor impacts on soils and water quality.

Several management actions that have been undertaken at the park, and that would continue into the foreseeable future, could have short- and long-term minor impacts to soil and water quality. Road developments in and around the park, roadbed failures and erosion could increase sedimentation in surface waters adjacent to roads. Rural community development, including the conversion of ranches to ranchettes, may increase sedimentation generated from recently developed areas. Bison and feral horse roundups, similar to the potential elk roundups described in this plan, could also affect park soils and water quality. Trailing (i.e., the loss of vegetative ground cover from foraging and movement) from wildlife in the park, including other ungulates, would continue and would contribute to soil impacts as well as erosion and potential impacts to water quality.

All of these activities, when combined with the long-term, moderate impacts from continued elk browsing and grazing pressure under the no action alternative, would result in short- and long-term, minor to moderate, adverse impacts on soil and water quality.

Conclusion. Long-term, moderate, adverse impacts on soils and water quality could result from soil erosion and sedimentation due to trailing, loss of vegetation, and trampling from sustained heavy elk use associated with a larger elk population. Past, present, and reasonably foreseeable future activities both inside and outside the park, when combined with the long-term, moderate, adverse impacts from continued elk browsing and grazing pressure under the no action alternative, would result in short- and long-term, minor to moderate, adverse cumulative impacts on soil and water quality. There would be no impairment of park soils or water resources under alternative A.

Alternative B: Direct Reduction with Firearms

The gradual reduction (over 5 years based on the assumptions in chapter 2) and maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) would decrease the potential for sustained heavy use, vegetative cover loss, and erosion in elk use areas. This would reduce the potential for sedimentation to surface waters associated with a larger elk population, as well as the potential for trailing (i.e., the loss of vegetative ground cover from foraging and movement), and would have long-term beneficial effects on soils and water resources.

Activities associated with an annual direct reduction program, including use of firearms, field dressing, removing carcasses/salvageable meat, and routine research and monitoring, would have long-term, local, negligible impacts associated with routine field activities (e.g., temporary impacts such as localized soil compaction and vegetation loss). Given the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (removal of a maximum of 275 elk over several months each year for the first 5 years, versus 20 to 24 elk removed in a relatively short period of time each year thereafter). Routine research and monitoring would contribute minimally to these impacts as described for alternative A. The use of non-lead bullets would eliminate potential concerns associated with lead contamination from ammunition. In addition, leaving carcasses in place would not have any effects on soils or water quality.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and B. The cumulative impacts from alternative B would be similar to those from the no action alternative because the beneficial long-term impacts on soil and water quality of alternative B would only slightly offset some of the adverse cumulative impacts. The majority of impacts to the water quality of the Little Missouri River watershed lie outside the park where impacts may or may not be mitigated. Therefore actions of alternative B would offset only a very small part of the overall cumulative effects, which would continue to be short- and long-term, minor to moderate, and adverse.

Conclusion. The reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to soils and water quality by reducing vegetative cover loss, erosion, and sedimentation. Activities associated with lethal sharpshooting would have long-term, local, negligible impacts associated with routine field activities (e.g., temporary soil compaction). The beneficial long-term impacts of alternative B would only slightly offset the adverse, short- and long-term, minor to moderate cumulative impacts due to the large portion of the impacts outside of the park boundary. No impairment to park soils or water resources would occur under alternative B.

Alternative C: Roundup and Euthanasia

The amount of vegetative cover loss and erosion in elk use areas, as well as the potential sedimentation to surface waters, would quickly decrease by reducing the elk population in the South Unit in 1 year and maintaining it between 100 and 400 animals (based on the assumptions in chapter 2). Coupled with the reduction in trailing (i.e., the loss of vegetative ground cover from foraging and movement), this would have long-term, beneficial effects on soils and water resources.

Roundups for initial reduction and periodic maintenance of the elk population would result in temporary impacts normally associated with such operations (e.g., temporary increases in the potential for soil compaction, erosion, and sedimentation as elk are driven across the landscape, including surface waters). Under the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 800 elk the first year to approximately 200 elk once every 3 to 4 years thereafter). The associated impacts would be intermittent over the life of this plan; would last only a matter of days when management actions are implemented; and soils and water quality would recover to previous conditions once management actions are complete. Given the scope and frequency of these operations, and based on past experience with elk roundups, and periodic bison and feral horse roundups, these impacts would be long-term, minor, and localized. Routine research and monitoring would contribute minimally to these impacts as described for alternative A.

Cumulative Impacts. The cumulative impacts from alternative C would be similar to those under the no action alternative and alternative B, but with a slightly greater short-term beneficial effect from the faster reduction of elk numbers. However, as with alternative B, the beneficial effects of this alternative would only slightly offset some of the cumulative adverse impacts, since the majority of the impacts to soils and the water quality of the Little Missouri River watershed lie outside the park where impacts may or may not be mitigated. Therefore the combined actions of alternative C with other past, present and reasonably foreseeable future activities would result in short- and long-term, minor to moderate, adverse impacts.

Conclusion. The reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to soils and water quality by reducing vegetative cover loss, erosion, and sedimentation. Long-term, local, minor, adverse impacts associated with normal roundup operations conducted over the life of this plan would occur under alternative C (e.g., temporary increases in the potential for soil compaction, erosion, and sedimentation as elk are driven across the landscape). The beneficial long-term impacts of alternative C would only slightly offset the adverse, short- and long-term, minor to moderate cumulative impacts due to the large portion of the impacts that are outside of the park boundary. No impairment to park soils or water resources would occur under alternative C.

Alternative D: Testing and Translocation

As with alternative B, the amount of vegetative cover loss and erosion in elk use areas, as well as the potential sedimentation to surface waters, would be gradually decreased (over at least 3 years as described in chapter 2) by reducing and maintaining the elk population in the South Unit between 100 and 400 animals. Coupled with the reduction in trailing (i.e., the loss of vegetative ground cover from foraging and movement), this would have long-term, beneficial effects on soils and water resources.

Normal operations associated with roundups for CWD testing and translocations during initial reduction and periodic maintenance would have similar impacts to the roundups described under alternative C (e.g., temporary increases in the potential for soil compaction, erosion, and sedimentation as elk are driven across the landscape). Considering the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 1,036 elk over the first 3 years to approximately 375 elk in year 10). Each management action would last a matter of days, and soils and water quality would recover to previous conditions once management actions are complete. Given the scope and frequency of the proposed operations, as well as past experience with elk roundups, and periodic bison and feral horse roundups, these impacts would be long-term, negligible to minor, and localized. Routine research and monitoring would contribute minimally to these impacts as described for alternative A.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities expected under alternatives A, B, and C would also apply under alternative D. As under alternatives B and C, the beneficial long-term impacts of alternative D to soils and water quality would only slightly offset some of the cumulative adverse impacts because the majority of the impacts to soils and the water quality of the Little Missouri River watershed lie outside the park where impacts may or may not be mitigated. Overall, the cumulative impacts would be short-term and long-term, minor to moderate, and adverse.

Conclusion. Long-term, beneficial effects on soil and water quality would result from the reduced vegetative cover loss, erosion, and sedimentation associated with reducing and maintaining an elk population consistent with a lightly grazed system. There would be long-term, negligible to minor, adverse impacts associated with normal roundup operations conducted over the life of this plan under alternative D. The beneficial long-term impacts of alternative D would only slightly offset the adverse, short-term and long-term, minor to moderate cumulative impacts of all other actions due to the fact that the majority of the impacts to the water quality of the Little Missouri River watershed lie outside the park where impacts may or may not be mitigated. No impairment of park soils or water resources would occur under alternative D.

Alternative E: Hunting Outside the Park

As with alternative B, the amount of vegetative cover loss and erosion in elk use areas, as well as the potential sedimentation to surface waters, would be gradually decreased (over at least 5 years given the assumptions in chapter 2) by reducing and maintaining the elk population in the South Unit between 100 and 400 animals. Coupled with the reduction in trailing (i.e., the loss of vegetative ground cover from foraging and movement), this would have long-term, beneficial effects on soils and water resources.

Dispersing elk out of the park to increase hunting opportunities would have similar impacts to those associated with normal roundup operations described for alternatives C and D (e.g., temporary increases in the potential for soil compaction, erosion, and sedimentation as elk are driven across the landscape). Considering the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 1,358 elk over the first 5 years to approximately 200 elk every 3 to 4 years thereafter). These impacts would be intermittent after initial reduction is complete; should be finished in a matter of days when implemented; and soils and water quality would recover to previous conditions once management actions are complete. In addition, the NPS would attempt to minimize the distance elk would be driven, reducing the overall area impacted.

Potential adverse impacts associated with increased elk hunting opportunities outside the park are expected to be similar to those described for routine field activities under alternative B (direct reduction with firearms), but slightly less intense because management actions would be conducted in winter when the ground would likely be frozen.

Given the scope and frequency of these operations; the fact the ground would likely be frozen; and past experience with elk, bison, and feral horse roundups, the adverse impacts to soils and water resources would be long-term and negligible, with possibly some minor adverse effects where the elk are forced to cross water features that are not frozen. Routine research and monitoring would contribute minimally to these impacts.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities expected under the no action alternative would also apply under alternative E. As described for the other action alternatives, the beneficial long-term impacts of implementing alternative E would only slightly offset some of the cumulative adverse impacts, since the majority of the impacts to soils and the water quality of the Little Missouri River watershed lie outside the park where impacts may or may not be mitigated. Overall the cumulative impacts would be adverse, short- and long-term, and minor to moderate.

Conclusion. Long-term, beneficial effects on soil and water quality would result from the reduced vegetative cover loss, erosion, and sedimentation associated with reducing and maintaining an elk population consistent with a lightly grazed system. Long-term, negligible to minor, adverse impacts from dispersals and increased hunting opportunities outside the park under alternative E would be similar to those experienced during normal roundup operations and routine field work. The beneficial long-term impacts of the alternative E actions would only slightly offset the short- and long-term, minor to moderate, adverse cumulative impacts of all other actions because the majority of the impacts to the water quality of the Little Missouri River watershed lie outside the park where impacts may or may not be mitigated. There would be no impairment of park soils or water resources under alternative E.

Alternative F: Fertility Control (Maintenance Only)

Fertility control in free-ranging elk is currently experimental, but if a fertility control agent could be developed that meets NPS criteria and proves effective at maintaining elk population levels (i.e., 100 to 400) consistent with a lightly grazed system in the park, it could decrease the amount of vegetative cover loss and erosion in elk use areas, as well as the potential sedimentation to surface waters. Coupled with the reduction in trailing (i.e., the loss of vegetative ground cover from foraging and movement), this would have long-term, beneficial effects on soils and water resources.

Roundups for administering fertility control during maintenance would have similar impacts to those associated with normal roundup operations described for alternatives C and D (e.g., temporary increases in the potential for soil compaction, erosion, and sedimentation as elk are driven across the landscape). Considering the assumptions described in chapter 2, this would require rounding up at least 70 elk per year after initial reduction is complete, which could be completed in a matter of days at the most. Given the scope and frequency of the proposed operations, and based on past experience with elk roundups, and periodic bison and feral horse roundups, these impacts would be long-term, adverse, and negligible. Routine research and monitoring would contribute minimally to these impacts.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities expected under the no action alternative would also apply under alternative F. As described for the other action alternatives, the beneficial long-term impacts of implementing alternative F would only slightly offset some of the cumulative adverse impacts, since the majority of the impacts to soils and the water quality of the Little Missouri River watershed lie outside the park where impacts may or may not be mitigated. Overall the cumulative impacts would be adverse, short- and long-term, and minor to moderate.

Conclusion. Long-term, beneficial effects on soil and water quality would result from the reduced vegetative cover loss, erosion, and sedimentation associated with reducing and maintaining an elk population consistent with a lightly grazed system. Long-term, negligible adverse impacts during roundups for fertility control treatment under alternative F would be similar to those experienced during normal roundup operations. The beneficial long-term impacts of the alternative F actions would only slightly offset the short- and long-term, minor to moderate, adverse cumulative impacts of all other actions because the majority of the impacts to the water quality of the Little Missouri River watershed lie outside the park where impacts may or may not be mitigated. There would be no impairment of park soils or water resources under alternative F.

Preferred Alternative: Combined Techniques

The gradual reduction (over 3 to 5 years based on the assumptions in chapter 2) and maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) would decrease the potential for sustained heavy use, loss of vegetative cover, and erosion in elk use areas. This would reduce the potential for sedimentation to surface waters associated with a larger elk population, as well as the potential for trailing (i.e., the loss of vegetative ground cover from foraging and movement), and would have long-term beneficial effects on soils and water resources.

Activities associated with an annual direct reduction program using firearms, including field dressing, removing carcasses/salvageable meat, and routine research and monitoring, would have long-term, local, negligible impacts associated with routine field activities (e.g., temporary impacts such as localized soil compaction and vegetation loss). Given the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (removal of a maximum of 275 elk over several months each year for the first 2 to 5 years, versus 20 to 24 elk removed in a relatively short period of time each year thereafter). The use of non-lead bullets would eliminate potential concerns associated with lead contamination of the landscape and food sources (e.g., salvageable meat) from ammunition.

If it is necessary to supplement initial reduction actions with roundup and euthanasia/translocation in year 3 there would be additional but minimal temporary impacts (e.g., temporary increases in potential for soil compaction, erosion, and sedimentation as elk are driven across the landscape, including surface waters). In addition, based on the assumptions in chapter 2, the associated impacts would occur only in year 3; would last only a matter of days when management actions are implemented; and soils and water quality would recover to previous conditions once management actions are complete. Considering the scope and frequency of these operations, and based on past experience with elk roundups, and periodic bison and feral horse roundups, these impacts would be short-term, minor, and localized. Although unlikely, if these management actions are used for maintenance, they would have impacts similar to those described for initial reduction, but would involve much smaller numbers of elk, reducing the intensity of the effect.

In addition, leaving a small number of carcasses in place (due to the difficulty of retrieval) would not have any effects on soils or water quality. Routine research and monitoring would contribute minimally to these impacts as described for alternative A.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities expected under alternatives A would be expected under the preferred alternative. As under alternatives B, C, D, and E the beneficial long-term impacts of the preferred alternative to soils and water quality would only slightly offset some of the adverse cumulative impacts. The majority of impacts to the water quality of the Little Missouri River watershed lie outside the park where impacts may or may not be mitigated. Therefore actions of the preferred alternative would offset only a very small part of the overall cumulative effects, which would continue to be short- and long-term, minor to moderate, and adverse.

Conclusion. The reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to soils and water quality by reducing vegetative cover loss, erosion, and sedimentation. Activities associated with direct reduction with firearms would have long-term, local, negligible impacts associated with routine field activities (e.g., temporary soil compaction). Additional short-term, local, minor, adverse impacts associated with normal roundup operations would occur under the preferred alternative (e.g., temporary increases in the potential for soil compaction, erosion, and sedimentation as elk are driven across the landscape) only if roundup and euthanasia/translocation are used in year 3 to supplement direct reduction with firearms. Routine research and monitoring would contribute minimally to these impacts. The beneficial long-term impacts of the preferred alternative would only slightly offset the adverse, short- and long-term, minor to moderate cumulative impacts due to the large portion of the impacts outside of the park boundary. No impairment to park soils or water resources would occur under the preferred alternative.

VEGETATION

GUIDING REGULATIONS AND POLICIES

The NPS *Organic Act of 1916* and the NPS *Management Policies 2006* (NPS 2006a) direct parks to provide for the protection of park resources. The *Management Policies 2006* state that the NPS "will try to maintain all the components and processes of naturally evolving park ecosystems, including the natural abundance, diversity, and genetic and ecological integrity of the plant and animal species native to those ecosystems" (NPS 2006a, Section 4.1). NPS *Management Policies 2006,* Section 4.4.2 also states that "[w]henever possible, natural processes will be relied upon to maintain native plant and animal species and influence natural fluctuations in populations of these species. The Service may intervene to manage populations or individuals of native species only when such intervention will not cause unacceptable impacts to the populations of the species or to other components and processes of the ecosystems that support them."

The park's GMP and resource management plan outline goals related to wildlife include restoring and/or maintaining endemic plants and animals and the associated biological and ecological processes of the Little Missouri badlands. See chapter 1 for more details on these plans and their management goals.

ASSUMPTIONS, METHODOLOGY, AND INTENSITY THRESHOLDS

Maps showing vegetation cover within South Unit, communications with NPS staff, and past vegetation classification data were used to identify baseline conditions within the study area, including information on the condition and composition of the vegetation in the park. Past studies on habitat and vegetation use were used to identify which plant communities could be affected by management actions as well as by elk themselves. Thresholds identified for taking management actions (described in the "Potential Adaptive Management Approaches and Action Thresholds" section) are based in part on the effectiveness of an alternative to maintain a lightly grazed system as currently found in the South Unit. Monitoring would determine if vegetation in elk use areas are trending towards lightly grazed conditions (or later seral stage), and would include observing changes in cover and frequency of diagnostic native species, as well the amount of bare ground and litter present; evidence of over-utilization of key plant species (plant vigor, hedging, browse lines, substantial use of low-preference plants, etc.); and the contribution of exotic plants, especially invasive species. Therefore, the impact intensity levels are based on the potential for changes to such characteristics. The thresholds are qualitative because monitoring of vegetation related to current grazing conditions (and seral stage) has been limited.

Negligible: Individual plants may be affected, but measurable or perceptible changes in the natural function and character of the plant community in terms of growth, abundance, reproduction, distribution, structure, or diversity of native species would not occur.

Minor: Effects on multiple plants would be measurable or perceptible. However, the natural function and character of plant communities in terms of growth, abundance, reproduction, distribution, structure, or diversity of native species would only be perceptible in small localized areas.

Moderate: A change would occur in the natural function and character of the plant communities in terms of growth, abundance, reproduction, distribution, structure, or diversity of native species, but not to the extent that plant community properties (i.e., size, integrity, or continuity) change.

Major: Effects on plant community properties would be readily apparent and would substantially change the natural function and character of the vegetation community.

Duration: **Short-term**: Apparent over two or three growing seasons or less corresponding to initial management actions.

Long-term: Changes would be detectable over multiple seasons and could persist over the lifetime of the plan and beyond.

Area of Analysis

The area of analysis for vegetation, including cumulative impacts, is the South Unit and adjacent lands.

IMPACTS OF THE ALTERNATIVES

Alternative A: No Action (Continue Existing Elk Management Program)

Under alternative A, vegetation research and annual population surveys would continue to be conducted as funding is available. The continued growth of the population increases the potential for sustained, heavy browsing, grazing, and trampling of vegetation communities in elk use areas. Overuse and trampling of vegetation can decrease the stability of plant communities and cause shifts in or reduce the diversity of native species composition. This can also lead to an increase in exotic species and the amount of bare ground, indictors of a plant community in transition. These changes can cause shifts in plant communities from late seral stages to early stages.

Although the park has collected limited data to date (beginning in 2005 to establish baseline conditions in needle-and-thread/threadleaf sedge grasslands of elk use areas in the South Unit), impacts to vegetation have not been apparent since elk management activities were last conducted (2000). However, a comparison of 1997 and 2005 monitoring data indicates that the communities in the plots are undergoing a compositional change and the seral stage may be beginning to shift (see "Seral Stage discussion in chapter 3). Before accurate conclusions can be drawn from these comparisons, more research is needed to first establish the baseline conditions in elk use areas and secondly to determine trends towards heavy or lightly grazed systems, taking into consideration factors such as drought.

Based on data collected regarding elk use of vegetation as habitat and forage (Marlow et al. 1984; Westfall 1989; Westfall et al. 1989; and Sullivan et al. 1988; Irby et al. 2002; Sargeant et al. 2005; see "Elk Population" section of chapter 3 for details), the herbaceous plant communities within the South Unit, with the exception of the Prairie Sandreed Herbaceous Alliance, could be affected by sustained, heavy use as they support many forage species for elk (see "Vegetation" section of chapter 3). Elk also forage in communities that support winterfat and other shrubby browse such as chokecherry, as well as green ash. These include the badlands sparse vegetation, the Green Ash – American Elm Woodland Alliance (found in draws), and the Rocky Mountain Juniper Woodland Alliance (also found in draws) described in chapter 3. Elk also use habitat provided by the Green Ash – American Elm Woodland Alliance and the Rocky Mountain Juniper Woodland Alliance for cover, especially during hot summer months.

As the elk population continues to grow, it is expected elk use areas would expand and more would leave the park on a more frequent basis. This would increase the potential for heavier, sustained browsing and grazing on these plant communities within and outside the park and could cause a shift away from the lightly grazed conditions (late seral stage) towards a heavily grazed (early seral stage) system, as evidenced by changes in species abundance and diversity, as well as increases in non-native species and bare ground. Therefore, alternative A would have long-term, moderate to major, adverse impacts on vegetation. Routine research and monitoring would contribute minimally to these impacts as a result of trampling associated with limited foot traffic.

Cumulative Impacts. Approximately 42 percent of the Little Missouri River watershed is pasture or rangeland. Livestock grazing in areas outside the park boundaries could increase loss of vegetative ground cover, which would have long-term, negligible to minor, adverse impacts. Wildlife grazing, including that associated with elk since their reintroduction, contributes to such impacts. U.S. Forest Service implementation of the Land and Resource Management Plan for the Dakota Prairie Grasslands, as well as the seral stage goals described previously, would help offset some of these impacts by managing grazing at appropriate levels to maintain healthy plant communities.

Development of oil and gas wells requires pipelines, reserve pits, storage tanks, as well as an extensive network of roads, which result in the loss of vegetation. The Medora Golf Course, agricultural lands surrounding the park, and other developments (roads, rail roads, buildings, etc.) have contributed to vegetation loss, and have had short- and long-term, minor to moderate adverse impacts on vegetation.

Past fire suppression in the South Unit has altered natural structure and composition of vegetation; however, more recently, prescribed burns have been used and wildland fires have not been fully suppressed. There would be short-term, minor adverse impacts from the loss of vegetative cover initially associated with fires, but long-term benefits as a result of restoring growth promoted by fires. Exotic plant management; the use of vegetation exclosures for research and monitoring; and the implementation of a weed-free hay policy also have long-term beneficial effects on plant communities. Bison and feral horse roundups, similar to the potential elk roundups described in this plan, could also affect vegetation as a result of trampling. Grazing by other herbivores in the park (e.g., other ungulates and prairie dogs) also contributes to vegetation impacts, although at appropriate levels, these have beneficial effects by encouraging vegetation growth.

Small disturbances associated with visitor use (including an increased use of stock animals), as well as maintenance of existing facilities, utilities, and roads, both inside and outside the park, may temporarily affect vegetation. Infrastructure projects such as road improvements and building construction also contribute to these effects. Rural community development, including the conversion of ranches to ranchettes, results in vegetation loss, all of which would have short- and long-term, negligible to minor, adverse impacts on vegetation.

All of these activities, when combined with the long-term, negligible to major adverse impacts from continued elk population growth in the South Unit under the no action alternative, would result in short- and long-term, major, adverse cumulative impacts on vegetation.

Conclusion. There would be long-term, moderate to major, adverse impacts on vegetation from overuse and trampling of vegetation in the South Unit as the elk population continues to double every 3 to 4 years. Vegetation research would have long-term, negligible impacts from trampling. Past, present, and reasonably foreseeable future activities both inside and outside the park, when combined with the long-term, moderate to major, adverse impacts from sustained, heavy use of vegetation under the no action alternative, would result in short- and long-term, major, adverse cumulative impacts on vegetation. Continued growth of the elk population unchecked could lead to impairment of vegetation in elk use areas of the South Unit, specifically grassland communities, from the long-term effects of sustained heavy use by elk.

Alternative B: Direct Reduction with Firearms

The gradual reduction (over 5 years) and maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) would decrease browsing and grazing pressure and reduce the potential for trampling from elk. Elk impacts on vegetation outside the South Unit would also be reduced because pressure for available resources would decrease, and more elk would likely stay within the park unit. For example, research conducted in 2003 and 2004, when the population had grown to more than 500 elk, showed approximately 59% to 71% of collared females left the South Unit seasonally. Research conducted shortly after the reintroduction of elk showed very little movement outside the park at relatively small population numbers: only seven elk were reported outside the boundary of the South Unit from 1985 to 1988 when the elk population grew to approximately 111 animals (Sullivan et al. 1998; Westfall 1989). Although there would be less movement outside the park, maintaining the elk population at 100 to 400 animals would result in lightly grazed conditions that would have long-term, beneficial effects to vegetation.

Activities associated with an annual direct reduction program, including use of firearms, field dressing, and removing carcasses/ salvageable meat, would have impacts similar to those associated with routine field activities (e.g., trampling from foot traffic). However, annual management actions would be carried out in fall or winter, outside the growing season, and vegetation would recover to previous conditions once management actions are complete. Given the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (removal of a maximum of 275 elk over several months each year for the first 5 years, versus 20 to 24 elk removed in a minimal period of time each year thereafter). As a result, there would be long-term, local, and negligible adverse impacts to vegetation. Routine research and monitoring would contribute minimally to these impacts as described for alternative A.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and B. The cumulative impacts from alternative B would be similar to those from the no action alternative because the beneficial long-term impacts on vegetation under alternative B would only slightly offset some of the adverse cumulative impacts, which would continue to be short- and long-term, moderate, and adverse.

Conclusion. The reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to vegetation by decreasing browsing and grazing pressure and reducing the potential for trampling. Activities associated with lethal sharpshooting would have long-term, local, negligible impacts associated with routine field activities. Routine research and monitoring would contribute minimally to these impacts. The beneficial long-term impacts on vegetation under alternative B would only slightly offset some of the adverse cumulative impacts, which would continue to be short- and long-term, moderate, and adverse. There would be no impairment of vegetation from implementing alternative B.

Alternative C: Roundup and Euthanasia

Browsing and grazing pressure, and the potential for trampling from elk, would quickly decrease over a short period of time by reducing the elk population in the South Unit in 1 year and maintaining it between 100 and 400 animals. This would also limit elk impacts on vegetation outside the South Unit as described for alternative B, but long-term, beneficial effects to vegetation would be realized sooner.

Roundups for initial reduction and periodic maintenance of the elk population would result in intermittent impacts normally associated with such operations (e.g., trampling of vegetation as elk are herded to the handling facility). Management actions would be carried out in fall or winter, outside the growing season, which would reduce the potential for such impacts. Considering the assumptions described in chapter 2, the potential for such impacts would be greatest in the first year, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 800 elk the first year to approximately 200 elk once every 3 to 4 years thereafter). The associated impacts would be intermittent over the life of this plan; would last only a matter of days when management actions are implemented; and vegetation would recover to previous conditions once management actions are complete. Given the scope and frequency of these operations, and based on past experience with elk roundups, and periodic bison and feral horse roundups, these impacts would be long-term, minor, and localized. Routine research and monitoring would contribute minimally to these impacts as described for alternative A.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and C. The cumulative impacts from alternative C would be similar to those from the no action alternative because the beneficial long-term impacts on vegetation under alternative C would only slightly offset some of the adverse cumulative impacts, which would continue to be short- and long-term, moderate, and adverse.

Conclusion. The reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to vegetation by reducing browsing and grazing pressure and the potential for trampling. Long-term, local, minor, adverse impacts associated with normal roundup operations conducted over the life of this plan would occur under alternative C. Routine research and monitoring would contribute minimally to these impacts. The beneficial long-term impacts on vegetation under alternative C would only slightly offset some of the adverse cumulative impacts, which would continue to be short- and long-term, moderate, and adverse. There would be no impairment of vegetation from implementing alternative C.

Alternative D: Testing and Translocation

As with alternative B, browsing and grazing pressure, as well as the potential for trampling from elk, would be gradually decreased (over at least 3 years) by reducing and maintaining the elk population in the South Unit between 100 and 400 animals. This would limit elk impacts on vegetation inside and outside the South Unit as described for alternative B and would have long-term, beneficial effects on vegetation.

Normal operations associated with roundups for CWD testing and translocations during initial reduction and periodic maintenance would have similar impacts to the roundups described under alternative C (e.g., trampling of vegetation as elk are herded to the handling facility). Considering the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 1,036 elk over the first 3 years to approximately 375 elk in year 10). Each management action would last a matter of days, and vegetation would recover to previous conditions once management actions are complete. Given the scope and frequency of the proposed operations, as well as past experience with roundups, these impacts would be long-term, minor, and localized. Routine research and monitoring would contribute minimally to these impacts as described for alternative A.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and D. The cumulative impacts from alternative D would be similar to those from the no action alternative because the beneficial long-term impacts on vegetation under alternative D would only slightly offset some of the adverse cumulative impacts, which would continue to be short-term and long-term, moderate, and adverse.

Conclusion. The reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to vegetation by reducing browsing and grazing pressure and the potential for trampling. There would be long-term, negligible to minor, adverse impacts associated with normal roundup operations conducted over the life of this plan under alternative D. Routine research and monitoring would contribute minimally to these impacts. The beneficial long-term impacts on vegetation under alternative D would only slightly offset some of the adverse cumulative impacts, which would continue to be short-term and long-term, moderate, and adverse. No impairment of vegetation would occur from implementing alternative D.

Alternative E: Hunting Outside the Park

The gradual reduction (over 5 years) and maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) would decrease browsing and grazing pressure and the potential for trampling. This would also limit elk impacts on vegetation outside the South Unit as described for alternative B, and would have long-term, beneficial effects on vegetation.

Dispersing elk out of the park to increase hunting opportunities would have similar impacts to those associated with normal roundup operations described for alternatives C and D (e.g., trampling of vegetation as elk are dispersed). Considering the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 1,358 elk over the first 5 years to approximately 200 elk every 3 to 4 years thereafter). However, the increased elk numbers outside the park would temporarily increase vegetation impacts from grazing, browsing, and trampling, until the elk are removed. These impacts would be intermittent after initial reduction is complete, and vegetation would recover to previous conditions once management actions are complete. In addition, the NPS would attempt to minimize the distance elk would be driven, reducing the overall area impacted.

Potential adverse impacts associated with increased hunting opportunities outside the park are expected to be similar to those described for routine field activities under alternative B (direct reduction with firearms), but slightly less intense because the ground would likely be frozen.

Given the scope and frequency of these operations and past experience with elk, bison, and feral horse roundups, the adverse impacts to vegetation would be long-term and negligible. Routine research and monitoring would contribute minimally to these impacts.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and E. The cumulative impacts from alternative E would be similar to those from the no action alternative because the beneficial long-term impacts on vegetation under alternative E would only slightly offset some of the adverse cumulative impacts, which would continue to be short- and long-term, moderate, and adverse.

Conclusion. Long-term, beneficial effects on vegetation would result from the decreased vegetative cover loss associated with reducing and maintaining an elk population consistent with a lightly grazed system. Long-term, negligible to minor, adverse impacts from dispersals and increased hunting opportunities outside the park under alternative E would be similar to those experienced during normal roundup operations and routine field work. Routine research and monitoring would contribute minimally to these impacts. The beneficial long-term impacts on vegetation under alternative E would only slightly offset some of the adverse cumulative impacts, which would continue to be short- and long-term, moderate, and adverse. There would be no impairment of vegetation from implementing alternative E.

Alternative F: Fertility Control (Maintenance Only)

Fertility control in free-ranging elk is currently experimental. If a fertility control agent could be developed that meets NPS criteria and proves effective at maintaining elk population levels consistent with a lightly grazed system in the park after initial reduction, it would decrease browsing and grazing pressure and the potential for trampling. This would limit elk impacts on vegetation inside and outside the South Unit as described for alternative B, and would have long-term, beneficial effects on vegetation.

Roundups for administering fertility control during maintenance would have similar impacts to those associated with normal roundup operations described for alternatives C and D (e.g., trampling of vegetation as elk are herded to the handling facility in the South Unit). Considering the assumptions described in chapter 2, this would required rounding up at least 70 elk per year after initial reduction is complete, which could be completed in a matter of days at the most, and vegetation would recover to previous conditions once management actions end. Given the scope and frequency of the proposed operations, and based on past experience with elk roundups, and periodic bison and feral horse roundups, these impacts would be long-term, adverse, and negligible. As described for alternative A, routine research and monitoring activities described would contribute minimally to these impacts.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and F. The cumulative impacts from alternative F would be similar to those from the no action alternative because the beneficial long-term impacts on vegetation would only slightly offset some of the adverse cumulative effects. As a result, cumulative impacts would continue to be short- and long-term, moderate, and adverse.

Conclusion. Long-term, beneficial effects on vegetation would result from the decreased vegetative cover loss associated with maintaining an elk population consistent with a lightly grazed system. Long-term, negligible to minor, adverse impacts during roundups for fertility control would be similar to those experienced during normal roundup operations and routine field work. Routine research and monitoring would contribute minimally to these impacts. The beneficial long-term impacts on vegetation under alternative F would only slightly offset some of the adverse cumulative impacts, which would continue to be short- and long-term, moderate, and adverse. There would be no impairment of vegetation from implementing alternative F.

Preferred Alternative: Combined Techniques

The gradual reduction (over 3 to 5 years) and maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) would decrease browsing and grazing pressure and reduce the potential for trampling from elk. Elk impacts on vegetation outside the South Unit would also be reduced because pressure for available resources would decrease, and more elk would likely stay within the park unit. For example, research conducted in 2003 and 2004, when the population had grown to more than 500 elk, showed approximately 59% to 71% of collared females left the South Unit seasonally. Research conducted shortly after the reintroduction of elk showed very little movement outside the park at relatively small population numbers: only 7 elk were reported outside the boundary of the South Unit from 1985 to 1988 when the elk population grew to approximately 111 animals (Sullivan et al. 1998; Westfall 1989). Although there would be less movement outside the park, maintaining the elk population at 100 to 400 animals would result in lightly grazed conditions that would have long-term, beneficial effects to vegetation.

Activities associated with an annual direct reduction program using firearms, including field dressing, and removing salvageable meat, would have impacts similar to those associated with routine field activities (e.g., trampling from foot traffic). However, annual management actions would be carried out in fall or winter, outside the growing season, and vegetation would recover to previous conditions once management actions are complete. Given the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (removal of a maximum of 275 elk over several months each year for the first 2 to 5 years, versus 20 to 24 elk removed in a minimal period of time each year thereafter). As a result, activities associated with direct reduction with firearms for population reduction would result in long-term, local, and negligible adverse impacts to vegetation.

If it is necessary to supplement initial reduction and maintenance actions with roundup and euthanasia/translocation in year 3 there would be additional but minimal impacts similar to those normally associated with such operations (e.g., trampling of vegetation as elk are herded to the handling facility). However, based on the assumptions in chapter 2, the associated impacts would occur only in year 3; would last only a matter of days when management actions are implemented; and vegetation would recover to previous conditions once management actions are complete. Considering the scope and frequency of these operations, and based on past experience with elk roundups, and periodic bison and feral horse roundups, these methods would have short-term, local, negligible to minor adverse impacts to vegetation. Although unlikely, if these management actions are used for maintenance, they would have impacts similar to those described for initial reduction, but would involve much smaller numbers of elk, reducing the intensity of the effect.

Routine research and monitoring would contribute minimally to these impacts as described for alternative A.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternative A and the preferred alternative. The cumulative impacts from the preferred alternative would be similar to those from the no action alternative because the beneficial long-term impacts on vegetation under the preferred alternative would only slightly offset some of the adverse cumulative impacts, which would continue to be short-term and long-term, moderate, and adverse.

Conclusion. The reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to vegetation by decreasing browsing and grazing pressure and reducing the potential for trampling.

Direct reduction with firearms would have long-term, local, negligible impacts similar to those associated with routine field activities. If it is necessary to supplement initial reduction actions with roundup and euthanasia/translocation in year 3, there would be minimal short-term, negligible to minor, adverse impacts associated with normal roundup operations. Routine research and monitoring would contribute minimally to these impacts. The beneficial long-term impacts on vegetation under the preferred alternative would only slightly offset some of the adverse cumulative impacts, which would continue to be short- and long-term, moderate, and adverse. There would be no impairment of vegetation from implementing the preferred alternative.

ELK POPULATION

GUIDING REGULATIONS AND POLICIES

The NPS Organic Act, which directs parks to conserve wildlife unimpaired for future generations, is interpreted by the agency to mean that native animal life should be protected and perpetuated as part of the park’s natural ecosystem. Natural processes are relied on to control populations of native species to the greatest extent possible; otherwise they are protected from removal, harassment, or harm by human activities. According to the NPS *Management Policies 2006*, the restoration of native species is a high priority (NPS 2006a, Section 4.1). Management goals for wildlife include maintaining components and processes of naturally evolving park ecosystems, including natural abundance, diversity, and the ecological integrity of plants and animals.

ASSUMPTIONS, METHODOLOGY, AND INTENSITY THRESHOLDS

There would be impacts to elk from the uncontrolled growth of the population under alternative A and the reduction and maintenance of the population under the action alternatives. In addition to impacts on individual elk and the population (including impacts on behavior of individuals and the susceptibility of the population to diseases of concern), the effects on elk habitat in the South Unit were also considered. The associated impacts to other wildlife species and their habitat conditions are addressed in the “Other Wildlife and Wildlife Habitat” section of this chapter.

Past and ongoing research, discussions with park staff, and scientific literature were reviewed to assess the potential effects. For the purposes of analyzing impacts of the no action alternative, it was assumed that the elk population would continue to grow at current rates until density dependent competition results in a substantial decrease in the number of elk at the park (as described in chapter 1). It was assumed that aerial surveys and hunting data would be considered when establishing the extent of management actions. It was also assumed that a live test for CWD in elk would not be available during the life of this plan and, therefore, all samples would come from elk removed lethally. Considering the above, the intensity thresholds for elk were defined as follows:

Negligible: There would be no observable or measurable impacts to the elk population, their habitat, or the natural processes sustaining them. Elk behavior changes would not be detectable.

Minor: Effects on the elk population, its habitat, and the natural processes sustaining both would be detectable. Foraging choices, distribution, or other behavioral aspects may change for individual or small groups of elk. Population level changes, including age and sex ratios, genetic variability, reproductive and recruitment rate, etc. would not be detectable.

Moderate: Effects on the elk population, its habitat, or the natural processes sustaining both would be detectable. Changes in foraging choices, distribution, or other behavioral aspects for individual or small groups of elk would be apparent. Population level changes, including age and sex ratios, genetic variability, reproductive and recruitment rate, etc. may be detectable. Elk may be disturbed during particularly vulnerable life-stages, such as breeding, late stages of pregnancy or juvenile stages, or severe winter; occasional mortality or interference with activities necessary for survival could be expected, but is not expected to threaten the continued existence of elk in the park.

Major: Effects on the elk population, its habitat, or the natural processes sustaining both would be obvious. Distinct shifts in foraging choices, distribution, or other behavioral aspects for large groups of elk could occur. Population level changes, including age and sex ratios, genetic variability, reproductive and recruitment rate, etc. would occur. Elk may be disturbed during particularly vulnerable life-stages, such as breeding, late stages of pregnancy or juvenile stages or severe winter; mortality or interference with activities necessary for survival could be expected.

Duration: **Short-term**: Impacts occurring from initial management actions.

Long-term: Impacts occurring from actions beyond initial management actions through the lifetime of the plan or beyond.

Area of Analysis

The area of analysis for elk, including cumulative impacts, is the South Unit and adjacent lands.

IMPACTS OF THE ALTERNATIVES

Alternative A: No Action (Continue Existing Elk Management Program)

Under alternative A, there would be no measures taken to actively reduce the number of elk in the South Unit. As stated in the "Vegetation" section of this chapter, the continued growth of the elk population would result in a herd size that increases the potential for habitat degradation from sustained, heavy use, including decreased native plant diversity and increased nonnative plants, in elk use areas of the South Unit. This could affect foraging choices of elk as well as cause changes to structural diversity in woodlands that provide hiding, resting, and thermal cover for elk. As a result, there would be long-term, moderate to major adverse impacts to elk habitat provided in these plant communities.

At present, the elk population growth does not appear to be slowed by density-dependent competition for resources among elk. Given the limited effects of natural predation and hunting on mortality rates (survival rates are 96% for female elk with hunting, 99% without hunting; and 52% for males with hunting, 68% without hunting), continued population growth is expected and would increase competition.

Increased competition would result in increased energy expenditures by elk, which cause responses including elevated heart rate and metabolism; elevated levels of stress hormones, diminished health (NPS 2006d); and reductions in fecundity (reproductive capability), body condition, and other population characteristics (such as recruitment and juvenile survival). This would ultimately result in a large decline in the elk population consistent with the irruptive sequence (Caughley 1970) described in chapter 1. As a result, increased competition would have long-term, moderate to major adverse impacts on the elk population under the no action alternative. The sex ratio is not expected to change unless the state adjusts the number of hunting licenses for female elk, or changes current management strategies.

Continued growth of the elk population could also affect elk movement in and around the South Unit. Although research in 2003 and 2004 (Sargeant et al. 2005) showed elk primarily concentrate in three areas (see map 6 in chapter 3), it is expected these and other elk use areas would expand as competition for resources, such as forage and cover, increases. The research indicated approximately 59% to 71% of collared female elk leave the South Unit seasonally. This activity primarily started in April, with the peak in June (occasional movements outside the park were also observed in January and February). The number of elk that leave the park, as well as the time of year they leave, the locations where they cross the boundary fence, and the distance traveled, could change as the population grows and competition for resources increases in and around the South Unit.

In the absence of NPS management, there would be more elk that would increase hunting opportunities. The potential for increased hunting opportunities outside the park could also influence elk movement and distribution. The 2003 and 2004 elk movement data indicated activity outside the South Unit showed a marked drop just prior to hunting season. Presently, other factors influencing elk movement and distribution in the South Unit include roads and trails (avoided on a seasonal basis, although not during the rut). In addition, elk are not habituated to the presence of humans in the South Unit. This could change as the population grows, resulting in more human-elk and vehicle-elk interactions, which would also influence movement and distribution. These changes in elk movement and distribution would have long-term, moderate to major, adverse impacts to the elk population under the no action alternative. Population surveys and routine elk research would also contribute to these impacts as a result of temporary changes in movement, as well as increased energy expenditures and stress in winter.

Increased elk populations may also influence inter- and intra-species transmission of wildlife diseases (parasitic, bacterial, or viral), especially for density-dependent diseases. Although none of the diseases of concern described in the “Elk Population” section of chapter 3 (CWD, brucellosis, tuberculosis, and foot and mouth disease) have been found in the elk population of the South Unit (last tested in 2000), the larger elk population could increase the risk of spreading the diseases should they be introduced. As a result, there would be long-term, moderate adverse impacts on the elk population under the no action alternative.

Cumulative Impacts. Past translocations of elk in 1993 and 2000 temporarily reduced the number of elk in the South Unit, and were followed by rapid growth of the population. These activities had short-term, negligible to minor adverse impacts on elk habitat (as a result of impacts from trampling), and long-term, moderate to major, impacts on elk population movement and distribution, although both have recovered since management actions were taken. Hunting outside the park also contributed to adverse impacts on individual elk, but ultimately, these activities have long-term benefits for elk because they help maintain the elk population and ensure adequate forage. Bison and feral horse roundups, similar to the potential elk roundups described in this plan, could also affect elk movements in the short- and long-term, but also result in beneficial impacts from ensuring adequate forage is available.

A lack of predators in and outside the park has reduced a source of mortality, which benefits individual elk, but ultimately has long-term, moderate adverse impacts on the population from contributions to unregulated population growth.

Approximately 42 % of the Little Missouri River watershed is pasture or rangeland that provide modified foraging habitat for elk. Long-term, minor, adverse impacts on elk habitat are expected from livestock grazing in areas outside the park boundaries which could increase loss of vegetative ground cover. Wildlife grazing, including that associated with elk since their reintroduction, contributes to such impacts. U.S. Forest Service implementation of the Land and Resource Management Plan for the Dakota Prairie Grasslands, as well as the seral stage goals described previously, would help offset some of these impacts by managing livestock grazing at appropriate levels to maintain healthy plant communities.

Oil and gas operations surrounding the park have the potential to affect elk population. Although seismic operations are not likely to contribute to such impacts, development of wells requires pipelines, reserve pits, storage tanks, and an extensive network of roads that result in the further fragmentation and loss of habitat. The Medora Golf Course, agricultural lands surrounding the park, and other developments (roads, rail roads, buildings, rural residential development, including the conversion of ranches to ranchettes, etc.) contribute to habitat loss and fragmentation as well, causing displacement and mortality (wildlife-vehicle collisions). These developments have short- and long-term, minor to moderate adverse impacts on the elk population.

Past fire suppression in the South Unit has altered natural structure and composition of elk habitat; however, more recently, prescribed burns have been conducted. There are short-term, minor adverse impacts from the loss of vegetative cover and forage initially associated with fires, but there are long-term benefits as a result of restoring habitat. Exotic plant management; the use of vegetation exclosures for research and monitoring; and the implementation of a weed-free hay policy also have long-term beneficial effects on elk habitat.

Small disturbances associated with visitor use, maintenance of existing facilities, utilities, and roads, both inside and outside the park, as well as infrastructure projects (such as road improvements and building construction) are not likely to affect the elk population, as they are not habituated to humans, and tend to avoid these areas (at least seasonally). Any temporary displacement would have no discernable effects.

All of these activities, when combined with the impacts of the no action alternative, would result in short- and long-term, moderate to major, adverse impacts on the elk population.

Conclusion. Under alternative A, there would be long-term, moderate to major adverse impacts to elk habitat from potential overuse related to the large population as a result of changes in forage availability in grasslands and a reduction in hiding, resting, and thermal cover in some woodlands. The continued population growth is expected to increase density-dependent competition among elk, which could contribute to impacts on overall population health. As the competition for resources increases in and around the South Unit, changes in movements, distribution, and energy expenditures of elk, including the number of elk that leave the park, the time of year they leave, the locations where they cross the boundary fence, and the distance traveled, would have long-term, moderate to major adverse impacts on the elk population. Increased hunting opportunities, as well as the potential for increased human-elk interactions and population surveys, would contribute to impacts on movement and distribution. Although no diseases of concern are currently known in the elk population, the rapid growth would increase the risk of spreading diseases should they be introduced, which would have long-term, moderate adverse impacts on the elk population.

Past, present, and reasonably foreseeable future actions, when combined with the impacts of the no action alternative, would result in short- and long-term, moderate to major adverse, impacts on the elk population.

If elk population growth continues unchecked, it could lead to impairment of elk habitat, specifically grassland communities, in the South Unit due to degradation from the long-term effects of sustained heavy use by elk. Potentially major impacts to the overall health of the elk population, their movement, and distribution would not cause impairment as the population would ultimately stabilize at some point, given available resources, and elk would remain on the landscape.

Alternative B: Direct Reduction with Firearms

The gradual reduction (over 5 years per the assumptions in chapter 2) and maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) would eliminate the potential for sustained, heavy use and trampling of vegetation by elk. This would have long-term beneficial effects on elk habitat, including availability of forage and cover. Elk impacts on habitat outside the South Unit would also be reduced because the decreased pressure for available resources would likely cause more elk to stay within the park unit (see alternative B discussion under “Vegetation”).

Maintaining the elk population at this level would eliminate the potential for density-dependent competition for resources between elk by increasing available forage and cover, as evidenced by the rapid rate of population growth that has occurred since reintroduction. As a result there would be long-term, beneficial effects on overall population health, including fecundity (reproductive capability), body condition, and other population characteristics. The sex ratio would also be maintained through the removal process.

The decreased competition would have a beneficial effect by reducing energy expenditures and the potential for human-elk and vehicle-elk interactions. Maintaining the population at this level would decrease the hunting opportunities outside the South Unit and it is assumed the state would alter management options outside the park in response. The 2003 and 2004 elk movement data indicated activity outside the South Unit showed a marked drop just prior to hunting season. Decreasing the population could reduce these temporary human-influenced movements if these changes include a reduction in hunting seasons or licenses, which would have a long-term benefit. The decreased elk population would reduce the risk of diseases of concern spreading, should they be introduced (none are documented in the elk at the park). This would also have a long-term, beneficial effect on the elk population.

Although concentrations of elk could be similar to current distributions after the population is reduced (see map 6 in chapter 3), elk use areas in the park would decrease in size as the population and competition for resources, especially forage, decreases. This could cause the elk population to become more sedentary as less movement is required to find these resources within or outside the South Unit. The number of elk that leave the park, as well as the time of year they leave, the locations where they cross the boundary fence, and the distance traveled, could all change as the population is reduced and maintained. It is expected elk would continue to avoid roads and trails, as well as human activity, given the available habitat throughout the South Unit. Ultimately, long-term, moderate changes would be expected in the movement and distribution of the elk population due to the smaller size.

Activities associated with an annual direct reduction program, would cause intermittent disturbances from noise associated with the use of firearms, the presence of people, and the removal of carcasses/salvageable meat. With the exception of the use of firearms, these activities would have similar impacts to other routine management actions (such as bison and feral horse roundups), and could make elk more wary of people and areas of the South Unit where management actions are taken. Although elk may be accustomed to some noise associated with firearms outside the park during hunting, the annual use of firearms within the park would cause substantial impacts on elk movements during management actions. If used, firearm noise suppressors could offset some of these impacts. Annual activities associated with direct reduction with firearms, which could be implemented during the rut (fall), could affect breeding behavior, and would also temporarily increase energy expenditures and stress in winter, a time of year when wildlife are more susceptible to mortality due to weather or reduced forage availability.

As a result, there would be long-term, minor to major adverse impacts on the elk population that would intermittently offset some of the benefits described previously. Impacts would be major at first, but would decrease to minor after year 5 as the number of elk to be removed would drop (removal of a maximum of 275 elk over several months each year for the first 5 years, versus 20 to 24 elk removed in a minimal period of time each year thereafter). Potential impacts to elk habitat from trampling would contribute minimally to these impacts, especially because management actions would be carried out in fall and winter, outside the growing season, and would recover once they are complete. Routine research and monitoring would also contribute minimally to these impacts as described for alternative A.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and B. The cumulative impacts from alternative B would be similar to those from the no action alternative because the beneficial long-term impacts on the elk population (primarily from the reduced potential for overuse, the effect of reduced competition on population health, and reduced potential for spreading diseases) would only slightly offset some of the adverse impacts from alternative B and the cumulative actions. Therefore, cumulative effects would continue to be short- and long-term, moderate, and adverse.

Conclusion. The reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to the elk population and their habitat by reducing the potential for sustained, heavy use; decreasing competition; increasing available forage and cover; and reducing human-influenced impacts on movement from hunting. Ultimately, long-term, moderate changes would be expected in the movement and distribution of the elk population due to the smaller size. Activities associated with lethal sharpshooting would have long-term, local, minor to major adverse impacts associated with disturbances from noise and the presence of people. Past, present, and reasonably foreseeable future activities, when combined with the impacts of alternative B, would be long-term, moderate to major, and adverse. Although temporary major impacts to elk would occur during annual management actions, there would be no impairment of elk as a viable population would be maintained within the South Unit.

Alternative C: Roundup and Euthanasia

The rapid decrease of the elk population over 1 year (per the assumptions in chapter 2) and maintenance between 100 and 400 animals would result in long-term beneficial effects for elk and their habitat, including habitat outside the park, as described for alternative B. However, these benefits would be realized sooner under alternative C as initial reduction would last one year versus five years under alternative B.

The potential for density-dependent competition for resources between elk would be eliminated by increasing available forage and cover. This would benefit overall population health, including fecundity (reproductive capability), body condition, and other population characteristics; reduce energy expenditures and the potential for human-elk and vehicle-elk interactions; and reduce human-influenced impacts on movement from hunting. The decreased elk population would reduce the risk of diseases of concern spreading, should they be introduced (none are documented in the elk at the park). This would also have a long-term, beneficial effect on the elk population.

The smaller numbers of elk could cause the animals to become more sedentary as less movement is required to find these resources within or outside the South Unit. Ultimately, this would cause long-term, moderate changes in the number of elk that leave the park, as well as the time of year they leave, the locations where they cross the boundary fence, and the distance traveled. It is expected elk would continue to avoid roads and trails, as well as human activity, given the available habitat throughout the South Unit.

Roundups for initial reduction and periodic maintenance (expected three or four times during the life of this plan) of the elk population would result in intermittent impacts normally associated with such operations, including some trampling of vegetation. Management actions would be carried out in fall or winter, outside the growing season, which would reduce the effects. Considering the assumptions described in chapter 2, the potential for such impacts would be greatest in the first year, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 800 elk the first year to approximately 200 elk once every 3 to 4 years thereafter). The associated impacts would be intermittent over the life of this plan; would last only a matter of days when management actions are implemented; and impacts to elk habitat would recover once complete. Given the scope and frequency of these operations, and based on past experience with elk roundups, and periodic bison and feral horse roundups, these impacts on elk habitat would be long-term, negligible, and localized. Routine research and monitoring would contribute minimally to these impacts.

The noise and disturbances associated with using a helicopter and driving elk to the handling facility would have intermittent but long-term major impacts on elk population movements during periodic management actions. Increased energy expenditures and increased stress during roundups, including while elk are held in the park handling facilities before euthanasia, would contribute to these impacts. These activities could be implemented during the rut (fall), resulting in changes in breeding behavior, or during winter, a time of year when wildlife is more susceptible to mortality due to weather or reduced forage availability. These impacts would not last as long once maintenance is implemented (as a result of removing approximately 200 elk during periodic maintenance versus 800 elk during the first year), and elk would be expected to recover once management actions are complete. Routine research and monitoring would contribute minimally to these impacts as described for alternative A.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and C. The cumulative impacts from alternative C would be similar to those from the no action alternative because the beneficial long-term impacts on the elk population (primarily from reduced potential for overuse, the effect of reduced competition on population health, and the reduced potential for spreading diseases) would only slightly offset some of the adverse impacts from alternative C and the cumulative actions. Therefore, cumulative effects would continue to be short- and long-term, moderate, and adverse.

Conclusion. Under alternative C, the reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to the elk population by decreasing competition and reducing the risk of spreading diseases of concern should they be introduced (none are documented in the elk at the park). Ultimately, the smaller numbers of elk could cause the animals to become more sedentary, which would cause long-term, moderate changes in the movement and distribution of the elk population.

Roundups for initial reduction and periodic maintenance (expected three or four times during the life of this plan) of the elk population would result in intermittent, long-term, negligible adverse impacts on elk habitat from trampling of vegetation normally associated with such operations. The disturbances associated with roundups would have intermittent but long-term major adverse impacts on elk population movements during periodic management actions. Increased energy expenditures and increased stress during roundups, including while elk are held in the park handling facilities before euthanasia, would contribute to these impacts. Routine research and monitoring would contribute minimally to these impacts.

Past, present, and reasonably foreseeable future activities, when combined with the impacts of alternative C, would be long-term, moderate, and adverse. Although temporary major impacts to the elk population would occur during periodic management actions, there would be no impairment of elk as a viable population would be maintained within the South Unit.

Alternative D: Testing and Translocation

As described for alternative B, the gradual reduction (over at least 3 years per the assumptions in chapter 2) and maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) would result in long-term beneficial effects for the elk population and their habitat, including habitat outside the park.

The potential for density-dependent competition for resources among elk would be eliminated by increasing available forage and cover. This would benefit overall population health, including fecundity (reproductive capability), body condition, and other population characteristics; reduce energy expenditures and the potential for human-elk and vehicle-elk interactions; and reduce human-influenced impacts on movement from hunting. The decreased elk population would reduce the risk of diseases of concern spreading, should they be introduced (none are documented in the elk at the park). This would also have a long-term, beneficial effect on the elk population.

The smaller numbers of elk could cause the animals to become more sedentary as less movement is required to find these resources within or outside the South Unit. Ultimately, this would cause long-term, moderate changes in the number of elk that leave the park, as well as the time of year they leave, the locations where they cross the boundary fence, and the distance traveled. It is expected elk would continue to avoid roads and trails, as well as human activity, given the available habitat throughout the South Unit.

Normal operations associated with roundups for CWD testing and translocations during initial reduction or maintenance would have similar impacts to the roundups conducted under alternative C. These impacts would be intermittent and would last a matter of days. They would include long-term, negligible, and localized impacts on elk habitat as a result of trampling vegetation; and long-term major impacts on elk population movements, energy expenditures, and stress during periodic management actions. These activities could be implemented during the rut (fall), resulting in changes in breeding behavior, or during winter, a time of year when wildlife is more susceptible to mortality due to weather or reduced forage availability. Considering the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 1,036 elk over the first 3 years to approximately 375 elk in year 10). In addition, elk and their habitat would be expected to recover once management actions are complete. Routine research and monitoring would contribute minimally to these impacts as described for alternative A.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and D. The cumulative impacts from alternative D would be similar to those from the no action alternative because the beneficial long-term impacts on the elk population (primarily from reduced potential for overuse, the effect of reduced competition on population health, and the reduced potential for spreading diseases) would only slightly offset some of the adverse impacts from this alternative and the other cumulative actions. Therefore, cumulative effects would continue to be short-term and long-term, moderate, and adverse.

Conclusion. Under alternative D, the reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to the elk population by decreasing competition and reducing the risk of spreading diseases of concern should they be introduced (none are documented in the elk at the park). Ultimately, the smaller numbers of elk could cause the animals to become more sedentary, which would cause long-term, moderate changes in the movement and distribution of the elk population.

Roundups for initial reduction and periodic maintenance (expected three or four times during the life of this plan) of the elk population would result in intermittent, long-term, negligible impacts on elk habitat from trampling of vegetation normally associated with such operations. The disturbances associated with roundups would have intermittent but long-term major adverse impacts on elk population movements during periodic management actions. Increased energy expenditures and increased stress during roundups, including while elk are held in the park, would contribute to these impacts. Routine research and monitoring would contribute minimally to these impacts. Routine research and monitoring would contribute minimally to these impacts.

Past, present, and reasonably foreseeable future activities, when combined with the impacts of alternative D, would be long-term, moderate, and adverse.

Although there would be temporary major impacts to elk during management actions, there would be no impairment of elk as a viable population would be maintained within the South Unit.

Alternative E: Hunting Outside the Park

As described for alternative B, the gradual reduction (over 5 years per the assumptions in chapter 2) and maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) would result in long-term beneficial effects for the elk population and their habitat, including habitat outside the park.

The potential for density-dependent competition for resources among elk would be eliminated by increasing available forage and cover. This would benefit overall population health, including fecundity (reproductive capability), body condition, and other population characteristics; reduce energy expenditures and the potential for human-elk and vehicle-elk interactions; and reduce human-influenced impacts on movement from hunting. The decreased elk population would reduce the risk of diseases of concern spreading, should they be introduced (none are documented in the elk at the park). This would also have a long-term, beneficial effect on the elk population.

The smaller numbers of elk could cause the animals to become more sedentary as less movement is required to find these resources within or outside the South Unit. Ultimately, this would cause long-term, moderate changes in the number of elk that leave the park, as well as the time of year they leave, the locations where they cross the boundary fence, and the distance traveled. It is expected elk would continue to avoid roads and trails, as well as human activity, given the available habitat throughout the South Unit.

Dispersing elk out of the park to increase hunting opportunities would have similar impacts to those associated with normal roundup operations described for alternatives C and D. These impacts would be intermittent and would include long-term, negligible, and localized impacts on elk habitat as a result of trampling vegetation; and long-term moderate to major impacts on elk population movements, energy expenditures, and stress during periodic management actions. These activities could be implemented during the rut (fall), resulting in changes in breeding behavior, or during winter, a time of year when wildlife is more susceptible to mortality due to weather or reduced forage availability. Considering the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 1,358 elk over the first 5 years to approximately 200 elk once every 3 to 4 years thereafter). These impacts would be intermittent after initial reduction is complete; should be over in a matter of days when implemented; and the elk population and their habitat would recover. In addition, the NPS would attempt to minimize the distance elk would be driven, reducing the overall area impacted. Potential adverse impacts associated with increased hunting opportunities outside the park are expected to be similar to those described under alternative B (direct reduction with firearms), but slightly less intense on elk habitat because the ground would likely be frozen.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and E. The cumulative impacts from alternative E would be similar to those from the no action alternative because the beneficial long-term impacts on the elk population (primarily from reduced potential for overuse, the effect of reduced competition on population health, and the reduced potential for spreading diseases) would only slightly offset some of the adverse impacts from alternative E and the other cumulative actions. Therefore, cumulative effects would continue to be short- and long-term, moderate, and adverse.

Conclusion. Under alternative E, the reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to the elk population by decreasing competition and reducing the risk of spreading diseases of concern should they be introduced (none are documented in the elk at the park). Ultimately, the smaller numbers of elk could cause the animals to become more sedentary, which would cause long-term, moderate changes in the movement and distribution of the elk population.

Dispersing elk out of the park would have similar impacts to those associated with normal roundup operations. These impacts would be intermittent and would include long-term, negligible, and localized impacts on elk habitat as a result of trampling vegetation; and long-term moderate to major impacts on elk population movements, energy expenditures, and stress during periodic management actions. Potential adverse impacts associated with increased hunting opportunities outside the park are expected to be similar to those described for alternative B (direct reduction with firearms). Routine research and monitoring would contribute minimally to these impacts.

Past, present, and reasonably foreseeable future activities, when combined with the impacts of alternative E, would be long-term, moderate, and adverse. Although there could be temporary major impacts to elk population movement and distribution during periodic management actions, there would be no impairment of elk as a viable population would be maintained within the South Unit.

Alternative F: Fertility Control (Maintenance Only)

Fertility control in free-ranging elk is currently experimental. If a fertility control agent could be developed that meets NPS criteria and proves effective at maintaining elk population levels consistent with a lightly grazed system in the park after initial reduction, this measure would result in long-term beneficial effects for elk and their habitat, including habitat outside the park.

The potential for density-dependent competition for resources among elk would be eliminated by increasing available forage and cover. Although individual elk would lose reproductive capability, this would benefit overall population health, body condition, and other population characteristics; reduce energy expenditures and the potential for human-elk and vehicle-elk interactions; and reduce human-influenced impacts on movement from hunting. The decreased elk population would reduce the risk of diseases of concern spreading, should they be introduced (none are documented in the elk at the park). This would also have a long-term, beneficial effect on the elk population.

The smaller numbers of elk could cause the animals to become more sedentary as less movement is required to find these resources within or outside the South Unit. Ultimately, this would cause long-term, moderate changes in the number of elk that leave the park, as well as the time of year they leave, the locations where they cross the boundary fence, and the distance traveled. It is expected elk would continue to avoid roads and trails, as well as human activity, given the available habitat throughout the South Unit.

Considering the assumptions described in chapter 2, this alternative would require rounding up at least 70 elk per year after initial reduction is complete, which could be completed in a matter of days at the most. Roundups for administering fertility control during maintenance would have similar impacts to those associated with normal roundup operations described for alternatives C and D. These impacts would occur annually and would include long-term, negligible, and localized impacts on elk habitat as a result of trampling vegetation; and long-term moderate to major impacts on elk population movements, energy expenditures, and stress during periodic management actions. These activities could be implemented during the rut (fall), resulting in changes in breeding behavior, or during winter, a time of year when wildlife is more susceptible to mortality due to weather or reduced forage availability. However, elk and their habitat would recover from these impacts. Routine research and monitoring would contribute minimally to these impacts as described for alternative A.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and F. The cumulative impacts from alternative F would be similar to those from the no action alternative because the beneficial long-term impacts on the elk population (primarily from reduced potential for overuse, the effect of reduced competition on population health, and the reduced potential for spreading diseases) would only slightly offset some of the adverse impacts from alternative F and the other cumulative actions. As a result, cumulative impacts would continue to be short- and long-term, moderate, and adverse.

Conclusion. Under alternative F, maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to the elk population by decreasing competition and reducing the risk of spreading diseases of concern should they be introduced (none are documented in the elk at the park). Ultimately, the smaller numbers of elk could cause the animals to become more sedentary, which would cause long-term, moderate changes in the movement and distribution of the elk population.

Roundups for administering fertility control during maintenance would have similar impacts to those associated with normal roundup operations. These impacts would be intermittent and would include long-term, negligible, and localized impacts on elk habitat as a result of trampling vegetation; and long-term moderate to major impacts on elk population movements, energy expenditures, and stress during periodic management actions. Potential adverse impacts associated with the increased hunting opportunities outside the park are expected to be similar to those described for alternative B (direct reduction with firearms). Routine research and monitoring would contribute minimally to these impacts.

Past, present, and reasonably foreseeable future activities, when combined with the impacts of alternative F, would be long-term, moderate, and adverse. Although there could be temporary major impacts to elk population movement and distribution during periodic management actions, there would be no impairment of elk as a viable population would be maintained within the South Unit.

Preferred Alternative: Combined Techniques

As described for alternative B, the gradual reduction (over 3 to 5 years per the assumptions in chapter 2) and maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) would result in long-term beneficial effects for the elk population and their habitat, including habitat outside the park.

The potential for density-dependent competition for resources among elk would be eliminated by increasing available forage and cover. This would benefit overall population health, including fecundity (reproductive capability), body condition, and other population characteristics; reduce energy expenditures and the potential for human-elk and vehicle-elk interactions; and reduce human-influenced impacts on movement from hunting. The decreased elk population would reduce the risk of diseases of concern spreading, should they be introduced (none are documented in the elk at the park). This would also have a long-term, beneficial effect on the elk population.

The smaller numbers of elk could cause the animals to become more sedentary as less movement is required to find these resources within or outside the South Unit. Ultimately, this would cause long-term, moderate changes in the number of elk that leave the park, as well as the time of year they leave, the locations where they cross the boundary fence, and the distance traveled. It is expected that elk would continue to avoid roads and trails, as well as human activity, given the available habitat throughout the South Unit.

Activities associated with an annual direct reduction program would cause intermittent disturbances from noise associated with the use of firearms, the presence of people, field dressing and the removal of salvageable meat. With the exception of the use of firearms, these activities would have similar impacts to other routine management actions (such as bison and feral horse roundups), and could make elk more wary of people and areas of the South Unit where management actions would be undertaken. Although elk may be accustomed to some noise associated with firearms outside the park during hunting, the annual use of firearms within the park would cause substantial impacts on elk movements during management actions. If used, firearm noise suppressors could offset some of these impacts. Annual activities associated with direct reduction with firearms, which could be implemented during the rut (fall), could affect breeding behavior, and would also temporarily increase energy expenditures and stress in winter, a time of year when wildlife are more susceptible to mortality due to weather or reduced forage availability.

As a result, there would be long-term, minor to major adverse impacts on the elk population that would intermittently offset some of the benefits described previously. Impacts would be major at first, but would decrease to minor once the maintenance phase is reached and the number of elk to be removed would decrease. Potential impacts to elk habitat from trampling would contribute minimally to these impacts, especially because management actions would be carried out in fall and winter, outside the growing season, and vegetation would recover once they are complete.

If it is necessary to supplement initial reduction and maintenance actions with roundups and euthanasia/translocation in year 3, the noise and disturbances associated with using a helicopter and driving elk to the handling facility would have additional short-term major impacts on elk population movements during this management action. Increased energy expenditures and increased stress during roundups, including while elk are held in the park handling facilities before euthanasia, would contribute to these impacts. These activities could be implemented during the rut (fall), resulting in changes in breeding behavior, or during winter, a time of year when wildlife is more susceptible to mortality due to weather or reduced forage availability. However, based on the assumptions in chapter 2, the associated impacts would occur only during year 3; would last only a matter of days when management actions are implemented; and impacts to elk habitat would recover once complete. Although unlikely, if these management actions are used for maintenance, they would have impacts similar to those described for initial reduction, but would involve much smaller numbers of elk, reducing the intensity of the effect.

The use of roundups and euthanasia/translocation in year 3 would also have some effects on elk habitat from impacts normally associated with such operations, including trampling of vegetation. However, based on the assumptions in chapter 2, the associated impacts would occur only during year 3; would last only a matter of days when management actions are implemented; and impacts to elk habitat would recover once complete. In addition, management actions would be carried out in fall or winter, outside the growing season, which would reduce the effects. Given the scope and frequency of these operations, and based on past experience with elk roundups, and periodic bison and feral horse roundups, reducing the elk population with roundup and euthanasia/translocation methods in addition to using firearms would have short-term, negligible, and localized impacts on elk habitat.

Routine research and monitoring would also contribute minimally to these impacts as described for alternative A.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities would be expected under both alternative A and the preferred alternative. The cumulative impacts from the preferred alternative would be similar to those from the no action alternative because the beneficial long-term impacts on the elk population (primarily from the reduced potential for overuse, the effect of reduced competition on population health, and reduced potential for spreading diseases) would only slightly offset some of the adverse impacts from the preferred alternative and the cumulative actions. Therefore, cumulative effects would continue to be short- and long-term, moderate, and adverse.

Conclusion. The reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to the elk population and their habitat by reducing the potential for sustained, heavy use; decreasing competition; increasing available forage and cover; reducing human-influenced impacts on movement from hunting; and reducing the potential for spreading diseases of concern if they are introduced into the park (none are documented in the elk at the park). Ultimately, long-term, moderate changes would be expected in the movement and distribution of the elk population due to the smaller size.

Activities associated with direct reduction with firearms would have long-term, local, minor to major adverse impacts associated with disturbances from noise and the presence of people. Potential impacts to elk habitat from trampling would contribute minimally to these impacts, especially because management actions would be carried out in fall and winter, outside the growing season, and vegetation would recover once the management actions are complete.

If necessary, roundups for euthanasia/translocation used in year 3 would result in short-term major adverse impacts on elk population movements during periodic management actions. Increased energy expenditures and increased stress during roundups, including while elk are held in the park handling facilities before euthanasia, would contribute to these impacts. Roundups for euthanasia/translocation would also have short- term, negligible adverse impacts on elk habitat from trampling of vegetation normally associated with such operations. Routine research and monitoring would contribute minimally to these impacts.

Past, present, and reasonably foreseeable future activities, when combined with the impacts of the preferred alternative, would have long-term, moderate to major, adverse cumulative impacts. Although temporary major impacts to elk would occur during annual management actions, there would be no impairment of elk because a viable population would be maintained within the South Unit.

OTHER WILDLIFE AND WILDLIFE HABITAT

GUIDING REGULATIONS AND POLICIES

The NPS *Organic Act of 1916*, NPS *Management Policies 2006* (NPS 2006a), and NPS *Reference Manual 77: Natural Resource Management* (NPS 1991b) direct NPS managers to provide for the protection of park resources. The *Organic Act* requires that wildlife be conserved unimpaired for future generations, which has been interpreted to mean that native animal life are to be protected and perpetuated as part of a park unit's natural ecosystem. Parks rely on natural processes to control populations of native species to the greatest extent possible and they are protected from removal, harassment, or harm by human activities. The NPS *Management Policies 2006* make restoration of native species a high priority. Management goals for wildlife include maintaining components and processes of naturally evolving park ecosystems, including natural abundance, diversity, and ecological integrity of plants and animals (NPS 2006a). Policies in the NPS *Natural Resource Management Guideline* state, "the National Park Service will seek to perpetuate the native animal life as part of the natural ecosystem of parks" and that "native animal populations will be protected against…destruction…or harm through human actions."

The park's general management plan and resource management plan outline goals related to wildlife that include restoring and/or maintaining endemic plants and animals and the associated biological and ecological processes of the Little Missouri badlands. See chapter 1 for more details on these plans and their management goals.

ASSUMPTIONS, METHODOLOGY, AND INTENSITY THRESHOLDS

The evaluation of wildlife (other than elk) was based on a qualitative assessment of how expected changes to park vegetation (as a result of increased or decreased elk browsing pressure) would affect the habitat of other wildlife. The park's wildlife species are directly and indirectly affected by the natural abundance, biodiversity, and the ecological integrity of the vegetation that comprises their habitat.

Impacts to wildlife and wildlife habitat were assessed by determining the species present in the South Unit that would likely be affected by the alternatives, and by identifying the effects of management actions implemented under each alternative.

Available information on known wildlife, including unique or important wildlife or wildlife habitat, was compiled and analyzed in relation to the management actions. The thresholds for the intensity of an impact are defined as follows:

Negligible: There would be no observable or measurable impacts to native species, their habitats, or the natural processes sustaining them. Impacts would be well within natural fluctuations. Habitat would retain current ecological integrity to support wildlife species.

Minor: Impacts on native species, their habitats, or the natural processes sustaining them would be detectable. Small changes to population numbers, population structure, genetic variability, and other demographic factors not affecting population viability or stability might occur. Occasional responses to disturbance by some individual wildlife could be expected, but without interference to factors affecting population levels. Habitat would retain adequate ecological integrity to support viability of all native species. Impacts would be outside critical reproduction periods for sensitive native species.

Moderate: Impacts on native species, their habitats, or the natural processes sustaining them would be detectable. Changes to population numbers, population structure, genetic variability, and other demographic factors would occur, but species would remain stable and viable. Frequent responses to disturbance by some individual wildlife could be expected, with some impacts to factors affecting population levels possible. Habitat would retain adequate ecological integrity to support viability of all native species. Some impacts might occur during critical periods of reproduction or in key habitat.

Major: Impacts on native species, their habitats, or the natural processes sustaining them would be detectable. Population numbers, population structure, genetic variability, and other demographic factors might experience large-scale changes. Frequent responses to disturbance by some individual wildlife would be expected, with resulting decreases in population levels. Loss of habitat might affect the viability of at least some native species. Impacts would regularly occur during critical periods of reproduction or in key habitat.

Duration: **Short-term**: Impacts occurring during initial management actions.

Long-term: Impacts occurring from after initial management actions and as long as the lifetime of the plan or beyond.

Area of Analysis

The study area for this analysis is primarily the South Unit and the surrounding habitat. The area of analysis for cumulative impacts is the park and adjacent lands used seasonally by elk.

IMPACTS OF THE ALTERNATIVES

Alternative A: No Action (Continue Existing Elk Management Program)

Under alternative A, there would be no measures to actively reduce the number of elk in the South Unit. As a result, it is expected that the elk population under alternative A would continue to grow, with limited decreases that could result from variables such as herd health or weather conditions in any particular year.

The continued growth of the population increases the potential for habitat degradation from sustained heavy use by elk, including decreased native plant diversity and increased nonnative plants, in elk use areas of the South Unit.

Based on data collected regarding elk use of vegetation as habitat and forage (Marlow et al. 1984; Westfall 1989; Westfall et al. 1989; and Sullivan et al. 1988; Irby et al. 2002; Sargeant et al. 2005; see "Elk Population" section of chapter 3 for details), habitat provided by all of the herbaceous alliances within the South Unit, with the exception of the Prairie Sandreed Herbaceous Alliance, could be affected by sustained, heavy use as they support many forage species for elk (see "Vegetation" section of chapter 3).

Elk also forage in communities that support winterfat and other shrubby browse such as chokecherry, including the badlands sparse vegetation, the Green Ash – American Elm Woodland Alliance (found in draws), and the Rocky Mountain Juniper Woodland Alliance (also found in draws) described in chapter 3. Elk also use habitat provided by the Green Ash – American Elm Woodland Alliance and the Rocky Mountain Juniper Woodland Alliance for cover, especially during hot summer months.

Small mammals (such as mice, rabbits), snakes, lizards, frogs, as well as ground-nesting birds (such as sharp-tailed grouse, vesper sparrow, horned lark) and their nests, would be increasingly vulnerable to predation. In woodland areas, birds that nest in shrubs or saplings (such as the red-eyed vireo, yellow warbler, brown thrasher) could be affected by increased elk browsing. Habitat degradation and greater numbers of elk would also displace these animals to other areas, which would increase competition for available resources. If the habitat of the prey species deteriorates to the point where prey could no longer maintain viable populations within the South Unit, then predator species would also decline.

Species that depend primarily on other habitats would be less affected by high elk numbers. Some frogs, salamanders, and turtles (e.g., boreal frogs, tiger salamander, and snapping turtles) live close to water during much of their lives. Waterfowl and shorebirds rely on aquatic and riparian habitats during much of their life history. High elk foraging rates could contribute to a decline or loss of habitat for these animals and may result in an increase in predation of bird nests due to a decline or loss of cover. However, studies in the South Unit have shown that elk do not use these areas routinely (see “Summary of Research/Modeling” in chapter 1). In addition, birds that use the upper canopy or nest in cavities in woodlands are not likely to be affected.

Competition among elk for forage and habitat can affect the population size and distribution of other ungulates, as well as prairie dogs, in the park. As described in the “Ungulate Diets in the South Unit” section of chapter 3, several studies (Sullivan et al. 1988; Westfall 1989; Marlow et al. 1992) reported an overlap of food habits among elk, mule deer, white-tailed deer, bison, and feral horses at various times throughout the year. Winterfat, chokecherry, and western snowberry, among other shrubs, all provided browse for the multiple populations of ungulates in the South Unit. Grasses used by these ungulates included, but were not limited to, wheatgrass, bluegrass, and needlegrass. Several of these species were identified as constraining forage species for these ungulates. Through effects on forage availability and plant succession, high elk populations could threaten the available food sources of bison and feral horses, which are confined to the park by a boundary fence. As a result, the park may need to maintain smaller populations of bison and horses. However, some of these studies (Westfall 1989; Marlow et al. 1992) reported correlations between elk and feral horse were weak, and Westfall (1989) concluded there was limited potential for competition between elk and bison because, during the growing season, bison used more grasses and elk used more forbs. This same study concluded elk diets were not correlated greatly with mule or white-tailed deer diets.

Similarly, elk do use some grass species (e.g., wheatgrass) which also provide preferred forage for prairie dogs in summer, and could create competition for resources. However, as described in the “Other Wildlife and Wildlife Habitat” section of chapter 3, prairie dogs forage selectively from the plants available in their habitat, and feed seasonally on several other grasses, forbs, cactus, and even roots (Shefferly 1999).

A larger elk population size could also contribute to transmission of wildlife disease if they become established in the park. For example high densities of elk would be considered an amplification factor for CWD and could increase nose-to-nose contact and environmental contamination that could increase exposure to other ungulates susceptible to the disease (e.g., mule deer, white-tailed deer) in the South Unit (Miller et al. 2004).

Therefore, alternative A could have adverse, long term, and negligible to major impacts, depending on the species. Species that depend on grasses and shrubs for food, cover, or nesting could be reduced or displaced from the South Unit, while impacts on species that depend primarily on other habitats (riparian areas, wetlands) or on the upper canopy (great horned owl, golden eagle, great blue heron) for food and cover would be negligible.

Other species that use elk as a food source, including coyotes and bobcats (which may prey on young elk), as well as the occasional mountain lion that may be found in the South Unit, could benefit from high elk populations (as a result of more calves and carcasses) and the reduction of cover. Scavengers rely on carrion as a primary diet item. An increased elk population in the park could provide an increased number of carcasses for wildlife such as coyotes, badgers, bald eagles, crows, black-billed magpies, turkey vultures, and other species that consume carrion. This would have long-term beneficial effects to these predators and scavengers.

Population surveys and routine elk research would have long-term, negligible adverse impacts as a result of displacement and increased energy expenditures that result from the associated noise.

Cumulative Impacts. Past translocations of elk in 1993 and 2000 temporarily reduced the number of elk in the South Unit, and were followed by rapid growth of the population. These activities had short-term, negligible to minor adverse impacts on wildlife habitat (as a result of impacts from trampling), and long-term, minor, adverse impacts from displacement. Hunting outside the park also contributes to adverse impacts on individual wildlife, but ultimately, these activities have long-term benefits for other wildlife and their habitat because they help maintain the elk population and ensure adequate forage. Bison and feral horse roundups, similar to the potential elk roundups described in this plan, could also affect wildlife habitat and movements in the short- and long-term, and have a direct impact on the species themselves but also result in beneficial impacts from ensuring adequate forage is available. Grazing by other herbivores in the park (e.g., other ungulates and prairie dogs) also contributes to impacts on wildlife and wildlife habitat, although at appropriate levels, these have beneficial effects by encouraging vegetation growth.

A lack of predators in and outside the park has reduced a source of mortality, which benefits individual animals, but ultimately has long-term, moderate adverse impacts on wildlife populations from the changes in predator-prey relationships.

Approximately 42 % of the Little Missouri River watershed is pasture or rangeland that provide modified foraging habitat for elk. Long-term, minor, adverse impacts on wildlife habitat are expected from livestock grazing in areas outside the park boundaries which could increase loss of vegetative ground cover. Wildlife grazing, including that associated with elk since their reintroduction, contributes to such impacts. U.S. Forest Service implementation of the Land and Resource Management Plan for the Dakota Prairie Grasslands, and the seral stage goals described previously, would help offset some of these impacts by managing livestock grazing at appropriate levels to maintain healthy plant communities.

Oil and gas operations surrounding the park have the potential to affect wildlife and wildlife habitat. Although seismic operations are not likely to contribute to such impacts, the development of the wells requires pipelines, reserve pits, storage tanks, as well as an extensive network of roads. The Medora Golf Course, agricultural lands surrounding the park, and other developments (roads, rail roads, buildings, etc.) have contributed to habitat loss and fragmentation as well, causing displacement and mortality (including wildlife-vehicle collisions). These developments have short- and long-term, minor to moderate adverse impacts on wildlife and wildlife habitat.

Past fire suppression in the South Unit has altered natural structure and composition of elk habitat; however, more recently, prescribed burns have been conducted. There would be short-term, minor adverse impacts from the loss of vegetative cover initially associated with fires, increasing the susceptibility of some species (e.g., ground-nesting birds, small mammals, reptiles, and amphibians) to predation. But fire has long-term benefits as a result of restoring habitat promoted by such disturbances. Exotic plant management; the use of vegetation exclosures for research and monitoring; and the implementation of a weed-free hay policy also have long-term beneficial effects on wildlife habitat.

Small disturbances associated with visitor use, maintenance of existing facilities, utilities, and roads, both inside and outside the park, temporarily displace wildlife and result in some mortality. Infrastructure projects such as road improvements and building construction also contribute to these effects, which would have short- and long-term, negligible to minor, adverse impacts on wildlife and wildlife habitat.

All of these activities, when combined with the short-term beneficial effects to some species (e.g., small predators and scavengers) and the potential long-term, negligible to major adverse impacts from continued elk population growth in the South Unit under the no action alternative, would result in short- and long-term, moderate adverse, impacts on wildlife and wildlife habitat.

Conclusion. Under alternative A, habitat for wildlife species other than elk would be adversely affected by a large elk population and related browsing, resulting in decreased plant diversity, increased nonnative plants, and a reduction in cover for other species. A few predator species would tend to benefit from a large elk population and reduced cover, enabling them to better see and catch prey. However, the impacts of large numbers of elk browsing on vegetation would adversely affect habitats for other wildlife (e.g., birds, small mammals, other ungulates, reptiles), resulting in adverse, long-term, and potentially major impacts, depending on the species.

Past, present and reasonably foreseeable future actions, when combined with the short-term beneficial effects to some species (e.g., small predators and scavengers) and the long-term, negligible to major impacts from continued elk population growth under the no action alternative, would result in short- and long-term, minor to moderate, adverse, impacts on wildlife and wildlife habitat. Continued growth of the elk population could lead to impairment of some wildlife and wildlife habitat available in elk use areas, specifically grassland communities, in the South Unit due to degradation from the long-term effects of sustained heavy use by elk.

Alternative B: Direct Reduction with Firearms

The gradual reduction (over 5 years) and maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) would decrease the potential for sustained, heavy use of vegetation by elk. This would thereby increase available resources for other wildlife and help protect their habitat, which would result in long-term beneficial effects. Species that depend on grasses and shrubs for food, cover, or nesting (e.g., sharp-tailed grouse, horned lark, lizards) would benefit most. Birds that nest in shrubs or saplings in wooded areas (such as the red-eyed vireo, yellow warbler, brown thrasher) would also benefit from reduced elk use and browsing in wooded areas. Species that use riparian areas and wetlands (e.g., waterfowl, salamanders) would not likely be affected, nor would there be any effects on species that depend on the upper canopy (e.g., great horned owl, golden eagle, great blue heron).

The reduction in the elk population would reduce competition with other ungulates and other herbivores, such as prairie dogs, for available resources. Maintaining a lightly grazed system would help protect habitat for these species, and could increase available browse and forage, such as winterfat, chokecherry, western snowberry, wheatgrass, bluegrass, and needlegrass. The benefit would level off during maintenance because the elk numbers would remain relatively stable and park managers can adjust actions depending on monitoring results. By decreasing the overall elk population, the potential for transmission (Miller et al. 2004) of wildlife disease to other ungulates would be reduced. As a result there would be long-term beneficial effects to these species.

Coyotes and other small predators would experience a range of effects as a result of the implementation of alternative B. With the less intensive grazing on vegetation communities, they would likely support more small mammal and bird species, creating more opportunities for predators. However, the greater cover would likely make it more difficult for these animals to hunt. In addition, there would be fewer elk calves which would be available as part of the diet for some of these predators. Over the long-term, it is expected the numbers of predator and prey species would stabilize within a natural range. Because these animals rely on multiple food sources, it is expected that long-term, adverse impacts would be negligible to minor.

A decrease in elk population in the park would reduce the number of carcasses available to those scavengers that consume carrion (i.e., coyotes, badgers, bald eagles, crows, black-billed magpies, and turkey vultures). Despite leaving some carcasses in the field, the majority would be donated, and there would be long-term, negligible to minor, adverse impacts to scavenger species as a result of a decreased food source.

Activities associated with an annual direct reduction program, including field dressing, and removing carcasses, would have similar impacts to other routine management actions, with the exception of the use of firearms. This includes the trampling of vegetation, and intermittent disturbances and displacement from noise associated the presence of people, and the removal of carcasses. Although wildlife may be accustomed to some noise associated with firearms outside the park during hunting, the annual use of firearms within the park would cause substantial impacts on wildlife during annual management actions. The use of firearm noise suppressors could offset some of these impacts. These management actions would be taken in the fall or winter, and the NPS would avoid sensitive portions of species' life cycles or sensitive locations (i.e., breeding or nesting seasons, migration corridors, nesting habitat) to minimize potential adverse effects. Annual activities associated with direct reduction with firearms would temporarily increase energy expenditures and increase stress in winter, a time of year when wildlife are more susceptible to mortality due to weather or reduced forage availability.

As a result, there would be long-term, minor to moderate adverse impacts during initial reduction and annual maintenance activities. Given the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (removal of a maximum of 275 elk over several months each year for the first 5 years, versus 20 to 24 elk removed in a minimal period of time each year thereafter). Routine research and monitoring would contribute minimally to these impacts as described for alternative A.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and B. The cumulative impacts from alternative B would be similar to those from the no action alternative because the beneficial long-term impacts on wildlife and wildlife habitat under alternative B would only slightly offset some of the adverse cumulative impacts, which would continue to be short- and long-term, minor to moderate, and adverse.

Conclusion. The reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to other wildlife by reducing the potential for sustained, heavy use of vegetation by elk, thereby increasing available resources, especially for species that rely on grasses, shrubs, and saplings. Other ungulates and herbivores such as prairie dogs would also benefit from increase forage and habitat, and the decreased potential for transmission of diseases.

Although their prey populations (e.g., small mammal and ground-nesting birds) would likely increase, there would be long-term, negligible to minor, adverse impacts to coyotes and other small predators because increased ground cover would make it more difficult to hunt. Scavengers that consume carrion would also experience long-term, negligible to minor, adverse impacts as a result of a decreased food source.

The use of firearms for an annual direct reduction program for elk would have long-term, minor to moderate adverse impacts on wildlife from the disturbance, displacement, and temporary increases in energy expenditures and stress. Other aspects of direct reduction would have similar impacts to routine management actions, including trampling of vegetation, and would contribute minimally to these effects. The beneficial long-term impacts on wildlife and wildlife habitat alternative B would only slightly offset some of the adverse cumulative impacts, which would continue to be short- and long-term, minor to moderate, and adverse.

Although temporary moderate impacts to wildlife could occur during annual management actions, there would be no impairment to wildlife as viable populations would be maintained within the South Unit.

Alternative C: Roundup and Euthanasia

The rapid decrease of the elk population over 1 year and maintenance between 100 and 400 animals would decrease the potential for sustained, heavy use of vegetation by elk. As described for alternative B, this would result in long-term beneficial effects to wildlife and wildlife habitat, especially for species that depend on grasses, shrubs, and/or saplings for food, cover, or nesting (e.g., sharp-tailed grouse, horned lark, lizards, red-eyed vireo, yellow warbler, brown thrasher). However, these benefits would be realized sooner under alternative C as initial reduction would last one year versus five years under alternative B. Species that use riparian areas and wetlands (e.g., waterfowl, salamanders) would not likely be affected, nor would there be any effects on species that depend on the upper canopy (e.g., great horned owl, golden eagle, great blue heron).

As described for alternative B, the reduction in the elk population would reduce competition with other ungulates and other herbivores, such as prairie dogs, for available resources. Maintaining a lightly grazed system would help protect habitat for these species, and could increase available browse and forage, which would have a long-term beneficial effect. The decreased potential for transmission of diseases from elk to other ungulates would contribute to these beneficial effects. However, these benefits would be realized sooner under alternative C as initial reduction would last one year versus five years under alternative B.

Coyotes and other small predators would experience a range of effects as described for alternative B (e.g., increased prey, more difficult hunting), but over the long-term, it is expected the numbers of predator and prey species would stabilize within a natural range. Because these animals rely on multiple food sources, it is expected that long-term, adverse impacts would be negligible to minor. There would also be a reduction in the number of carcasses available to those scavengers that consume carrion (i.e., coyotes, badgers, bald eagles, crows, black-billed magpies, and turkey vultures), which would represent long-term, negligible to minor, adverse impacts to these species.

Use of the helicopter and the disturbances associated with the herding and driving of elk would have impacts normally associated with such operations at the park (e.g., displacement, trampling). Activities associated with roundup and euthanasia would temporarily increase energy expenditures and increase stress in winter, a time of year when wildlife are more susceptible to mortality due to weather or reduced forage availability. However, the NPS would avoid sensitive portions of species' life cycles or sensitive locations (i.e., breeding or nesting seasons, migration corridors, nesting habitat), which would also minimize potential adverse effects. Considering the assumptions described in chapter 2, the potential for such impacts would be greatest in the first year, but would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 800 elk the first year to approximately 200 elk once every 3 to 4 years thereafter). The associated impacts would be intermittent over the life of this plan, would last only a matter of days when management actions are implemented, and would dissipate with distance from the activity. Routine research and monitoring would contribute minimally to these impacts as described for alternative A. In addition, wildlife and their habitat would be expected to recover once management actions are completed.

Given the scope and frequency of these operations, and based on past experience with elk roundups, and periodic bison and feral horse roundups, these impacts would be long-term, minor, and adverse. Euthanasia or processing elk carcasses for donation/distribution after the roundups would have no impacts on wildlife or wildlife habitat.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and C. The cumulative impacts from alternative C would be similar to those from the no action alternative because the beneficial long-term impacts on wildlife and wildlife habitat under alternative C would only slightly offset some of the adverse cumulative impacts, which would continue to be short- and long-term, minor to moderate, and adverse.

Conclusion. Under alternative C, the reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to other wildlife by reducing the potential for sustained, heavy use of vegetation by elk, thereby increasing available resources, especially for species that rely on grasses, shrubs, and saplings. Other ungulates and herbivores such as prairie dogs would also benefit from increase forage and habitat, and the decreased potential for transmission of diseases. Although their prey populations (e.g., small mammal and ground-nesting birds) would likely increase, there would be long-term, negligible to minor, adverse impacts to coyotes and other small predators because increased ground cover would make it more difficult to hunt. Scavengers that consume carrion would also experience long-term, negligible to minor, adverse impacts as a result of a decreased food source.

Use of the helicopter and the disturbances associated with the herding and driving of elk would have impacts normally associated with such operations at the park (e.g., displacement, trampling, increased energy expenditures, and increased stress), which would be long-term, minor, and adverse. Routine research and monitoring would contribute minimally to these impacts as described for alternative A. Euthanasia or processing elk carcasses for donation/distribution after the roundups would have no impacts on other wildlife or wildlife habitat.

The beneficial long-term impacts on wildlife and wildlife habitat alternative C would only slightly offset some of the adverse effects of this alternative and other cumulative impacts, which would continue to be short- and long-term, minor to moderate, and adverse. There would be no impairment of wildlife and wildlife habitat from implementing alternative C.

Alternative D: Testing and Translocation

As described for alternative B, the gradual reduction (over at least 3 years) and maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) would result in long-term beneficial effects to wildlife and wildlife habitat, especially for species that depend on grasses, shrubs, and/or saplings for food, cover, or nesting (e.g., sharp-tailed grouse, horned lark, lizards, red-eyed vireo, yellow warbler, brown thrasher). Species that use riparian areas and wetlands (e.g., waterfowl, salamanders) would not likely be affected, nor would there be any effects on species that depend on the upper canopy (e.g., great horned owl, golden eagle, great blue heron).

As described for alternative B, the reduction in the elk population would reduce competition with other ungulates and other herbivores, such as prairie dogs, for available resources. Maintaining a lightly grazed system would help protect habitat for these species, and could increase available browse and forage, which would have a long-term beneficial effect. The decreased potential for transmission of diseases from elk to other ungulates would contribute to these beneficial effects.

Coyotes and other small predators would experience a range of effects as described for alternative B (e.g., increased prey, more difficult hunting), but over the long-term, it is expected the numbers of predator and prey species would stabilize within a natural range. Because these animals rely on multiple food sources, it is expected that long-term, adverse impacts would be negligible to minor. There would also be a reduction in the number of carcasses available to those scavengers that consume carrion (i.e., coyotes, badgers, bald eagles, crows, black-billed magpies, and turkey vultures), which would represent long-term, negligible to minor, adverse impacts to these species.

Roundups for CWD testing and translocation would have similar impacts to those normally associated with such operations at the park, as described for alternative C, including displacement and trampling. Activities associated with these roundups and euthanasia could temporarily increase energy expenditures and increase stress in winter, a time of year when wildlife are more susceptible to mortality due to weather or reduced forage availability. However, the NPS would avoid sensitive portions of species’ life cycles or sensitive locations (i.e., breeding or nesting seasons, migration corridors, nesting habitat), which would minimize potential adverse effects. Wildlife and their habitat would be expected to recover once management actions are completed.

Considering the assumptions described in chapter 2, the potential for such impacts would be greatest in the first year, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 1,036 over the first 3 years to approximately 375 elk in year 10). Each management action would last a matter of days, and given the scope and frequency of these operations, as well as past experience with roundups, these impacts would be long-term, minor, and localized. Routine research and monitoring would contribute minimally to these impacts as described for alternative A.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under this alternative as have been described for the previous alternatives. The cumulative impacts from alternative D would be similar to those from the other alternatives because the beneficial long-term impacts on wildlife and wildlife habitat under this alternative would only slightly offset some of the adverse cumulative impacts, which would continue to be short-term and long-term, minor to moderate, and adverse.

Conclusion. Under alternative D, the reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to other wildlife by reducing the potential for sustained, heavy use of vegetation by elk, thereby increasing available resources, especially for species that rely on grasses, shrubs, and saplings. Other ungulates and herbivores such as prairie dogs would also benefit from increased forage and habitat, and the decreased potential for transmission of diseases. Although their prey populations (e.g., small mammal and ground-nesting birds) would likely increase, there would be long-term, negligible to minor, adverse impacts to coyotes and other small predators because increased ground cover would make it more difficult to hunt. Scavengers that consume carrion would also experience long-term, negligible to minor, adverse impacts as a result of a decreased food source.

Use of the helicopter and the disturbances associated with roundups for CWD testing and translocation would have impacts normally associated with such operations at the park (e.g., displacement, trampling, increased energy expenditures, and increased stress), which would be long-term, minor, and adverse. The beneficial long-term impacts on wildlife and wildlife habitat under alternative D would only slightly offset some of the adverse impacts of this alternative and the cumulative impacts, which would continue to be short-term and long-term, minor to moderate, and adverse. There would be no impairment of wildlife and wildlife habitat from implementing alternative D.

Alternative E: Hunting Outside the Park

As described for alternative B, the gradual reduction (over at least 5 years) and maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) would result in long-term beneficial effects to wildlife and wildlife habitat, especially for species that depend on grasses, shrubs, and/or saplings for food, cover, or nesting (e.g., sharp-tailed grouse, horned lark, lizards, red-eyed vireo, yellow warbler, brown thrasher). Species that use riparian areas and wetlands (e.g., waterfowl, salamanders) would not likely be affected, nor would there be any effects on species that depend on the upper canopy (e.g., great horned owl, golden eagle, great blue heron).

As described for alternative B, the reduction in the elk population would reduce competition with other ungulates and other herbivores, such as prairie dogs, for available resources. Maintaining a lightly grazed system would help protect habitat for these species, and could increase available browse and forage, which would have a long-term beneficial effect. The decreased potential for transmission of diseases from elk to other ungulates would contribute to these beneficial effects.

Coyotes and other small predators would experience a range of effects as described for alternative B (e.g., increased prey, more difficult hunting), but over the long-term, it is expected the numbers of predator and prey species would stabilize within a natural range. Because these animals rely on multiple food sources, it is expected that long-term, adverse impacts would be negligible to minor. There would also be a reduction in the number of carcasses available to those scavengers that consume carrion (i.e., coyotes, badgers, bald eagles, crows, black-billed magpies, and turkey vultures), which would represent long-term, negligible to minor, adverse impacts to these species.

Dispersing elk out of the park to increase hunting opportunities would have similar impacts to those associated with normal roundup operations described for alternatives C and D, including displacement and trampling. Activities associated with these roundups and euthanasia could temporarily increase energy expenditures and increase stress in winter, a time of year when wildlife are more susceptible to mortality due to weather or reduced forage availability. However, the NPS would avoid sensitive portions of species' life cycles or sensitive locations (i.e., breeding or nesting seasons, migration corridors, nesting habitat), which would minimize potential adverse effects.

Considering the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 1,358 elk over the first 5 years to approximately 200 elk once every 3 to 4 years thereafter). These impacts would be intermittent after initial reduction is complete, and should be completed in a matter of days when implemented. In addition, the NPS would attempt to minimize the distance elk would be driven, reducing the overall area impacted. Potential adverse impacts associated with increased hunting opportunities outside the park are expected to be similar to those described for routine field activities under alternative B (direct reduction with firearms). Given the scope and frequency of these operations, and based on past experience with elk roundups, and periodic bison and feral horse roundups, these impacts would be long-term, minor, and localized. Routine research and monitoring would contribute minimally to these impacts as described for alternative A.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under this alternative as have been described for the previous alternatives. The cumulative impacts from alternative E would be similar to those from the other alternatives because the beneficial long-term impacts on wildlife and wildlife habitat under alternative E would only slightly offset some of the adverse impacts of this alternative and cumulative effects, which would continue to be short- and long-term, minor to moderate, and adverse.

Conclusion. Under alternative E, the reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to other wildlife by reducing the potential for sustained, heavy use of vegetation by elk, thereby increasing available resources, especially for species that rely on grasses, shrubs, and saplings. Other ungulates and herbivores such as prairie dogs would also benefit from increase forage and habitat, and the decreased potential for transmission of diseases. Although their prey populations (e.g., small mammal and ground-nesting birds) would likely increase, there would be long-term, negligible to minor, adverse impacts to coyotes and other small predators because increased ground cover would make it more difficult to hunt. Scavengers that consume carrion would also experience long-term, negligible to minor, adverse impacts as a result of a decreased food source.

Dispersing elk out of the park would have similar impacts to those associated with normal roundup operations, including displacement, trampling, and temporary increases in energy expenditures and stress, which would be long-term, minor, and adverse. Potential adverse impacts associated with increased hunting opportunities outside the park are expected to be similar to those described for routine field activities under alternative B (direct reduction with firearms). The beneficial long-term impacts on wildlife and wildlife habitat under alternative D would only slightly offset some of the adverse impacts of this alternative and the cumulative impacts, which would continue to be short-term and long-term, minor to moderate, and adverse. There would be no impairment of wildlife and wildlife habitat from implementing alternative D.

Alternative F: Fertility Control (Maintenance Only)

Fertility control in free-ranging elk is currently experimental, but if a fertility control agent could be developed that meets NPS criteria and proves effective at maintaining elk population levels (i.e., 100 to 400) consistent with a lightly grazed system in the park would result in long-term beneficial effects to wildlife and wildlife habitat, especially for species that depend on grasses, shrubs, and/or saplings for food, cover, or nesting (e.g., sharp-tailed grouse, horned lark, lizards, red-eyed vireo, yellow warbler, brown thrasher). Species that use riparian areas and wetlands (e.g., waterfowl, salamanders) would not likely be affected, nor would there be any effects on species that depend on the upper canopy (e.g., great horned owl, golden eagle, great blue heron).

As described for alternative B, the reduction in the elk population would reduce competition with other ungulates and other herbivores, such as prairie dogs, for available resources. Maintaining a lightly grazed system would help protect habitat for these species, and could increase available browse and forage, which would have a long-term beneficial effect. The decreased potential for transmission of diseases from elk to other ungulates would contribute to these beneficial effects.

Coyotes and other small predators would experience a range of effects as described for alternative B (e.g., increased prey, more difficult hunting), but over the long-term, it is expected the numbers of predator and prey species would stabilize within a natural range. Because these animals rely on multiple food sources, it is expected that long-term, adverse impacts would be negligible to minor. There would also be a reduction in the number of carcasses available to those scavengers that consume carrion (i.e., coyotes, badgers, bald eagles, crows, black-billed magpies, and turkey vultures), which would represent long-term, negligible to minor, adverse impacts to these species.

Considering the assumptions described in chapter 2, this alternative would require rounding up at least 70 elk per year after initial reduction is complete, which could be completed in a matter of days at the most. Roundups for administering fertility control during maintenance would have similar impacts to those associated with normal roundup operations described for alternatives C and D, including displacement and trampling. Activities associated with these roundups could temporarily increase energy expenditures and stress in winter, a time of year when wildlife are more susceptible to mortality due to weather or reduced forage availability. However, the NPS would avoid sensitive portions of species' life cycles or sensitive locations (i.e., breeding or nesting seasons, migration corridors, nesting habitat), which would minimize potential adverse effects. Based on past experience with elk roundups, and periodic bison and feral horse roundups, these impacts would be long-term, minor, and localized. Routine research and monitoring would contribute minimally to these impacts as described for alternative A.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under this alternative as have been described for the previous alternatives. The cumulative impacts from alternative F would be similar to those from the other alternatives because the beneficial long-term impacts on wildlife and wildlife habitat would only slightly offset some of the adverse impacts of this alternative and cumulative effects. As a result, cumulative impacts would continue to be short- and long-term, minor to moderate, and adverse.

Conclusion. Under alternative F, the reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to other wildlife by reducing the potential for sustained, heavy use of vegetation by elk, thereby increasing available resources, especially for species that rely on grasses, shrubs, and saplings. Other ungulates and herbivores such as prairie dogs would also benefit from increase forage and habitat, and the decreased potential for transmission of diseases. Although their prey populations (e.g., small mammal and ground-nesting birds) would likely increase, there would be long-term, negligible to minor, adverse impacts to coyotes and other small predators because increased ground cover would make it more difficult to hunt. Scavengers that consume carrion would also experience long-term, negligible to minor, adverse impacts as a result of a decreased food source.

Conducting roundups for fertility control treatments would have similar impacts to those associated with normal roundup operations, including displacement, trampling, and temporary increases in energy expenditures and stress, which would be long-term, minor, and adverse. The beneficial long-term impacts on wildlife and wildlife habitat under alternative F would only slightly offset some of the adverse impacts of this alternative and the cumulative impacts, which would continue to be short-term and long-term, minor to moderate, and adverse. There would be no impairment of wildlife and wildlife habitat from implementing alternative F.

Preferred Alternative: Combined Techniques

The gradual reduction (over 3 to 5 years) and maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) would decrease the potential for sustained, heavy use of vegetation by elk. This would thereby increase available resources for other wildlife and help protect their habitat, which would result in long-term beneficial effects. Species that depend on grasses and shrubs for food, cover, or nesting (e.g., sharp-tailed grouse, horned lark, lizards) would benefit most. Birds that nest in shrubs or saplings in wooded areas (such as the red-eyed vireo, yellow warbler, brown thrasher) would also benefit from reduced elk use and browsing in wooded areas. Species that use riparian areas and wetlands (e.g., waterfowl, salamanders) would not likely be affected, nor would there be any effects on species that depend on the upper canopy (e.g., great horned owl, golden eagle, great blue heron).

As described for alternative B, the reduction in the elk population would reduce competition with other ungulates and other herbivores, such as prairie dogs, for available resources. Maintaining a lightly grazed system would help protect habitat for these species, and could increase available browse and forage, which would have a long-term beneficial effect. The decreased potential for transmission of diseases from elk to other ungulates would contribute to these beneficial effects.

Coyotes and other small predators would experience a range of effects as a result of the implementation of the preferred alternative. With the less intensive grazing on vegetation communities, they would likely support more small mammal and bird species, creating more opportunities for predators. However, the greater cover would likely make it more difficult for these animals to hunt. In addition, there would be fewer elk calves which would be available as part of the diet for some of these predators. Over the long term, it is expected the numbers of predator and prey species would stabilize within a natural range. Because these animals rely on multiple food sources, it is expected that long-term, adverse impacts would be negligible to minor.

A decrease in elk population in the park would reduce the number of carcasses available to those scavengers that consume carrion (i.e., coyotes, badgers, bald eagles, crows, black-billed magpies, and turkey vultures). The majority of salvageable meat would also be removed from the field and donated, and there would be long-term, negligible to minor, adverse impacts to scavenger species as a result of a decreased food source.

Activities associated with an annual direct reduction program would cause intermittent disturbances from noise associated with the use of firearms, the presence of people, field dressing and the removal of salvageable meat. With the exception of the use of firearms, these activities would have similar impacts to other routine management actions (e.g., trampling of vegetation, and intermittent disturbances and displacement from noise). Although wildlife may be accustomed to some noise associated with firearms outside the park during hunting, the annual use of firearms within the park would cause substantial impacts on wildlife during annual management actions. The use of firearm noise suppressors could offset some of these impacts. The NPS would avoid sensitive portions of species' life cycles or sensitive locations (i.e., breeding or nesting seasons, migration corridors, nesting habitat) to minimize potential adverse effects, but annual activities associated with direct reduction with firearms would temporarily increase energy expenditures and stress in winter, a time of year when wildlife are more susceptible to mortality due to weather or reduced forage availability. As a result, there would be long-term, and minor to moderate impacts to other wildlife or wildlife habitat would occur from the use of direct reduction with firearms to initially reduce and maintain the elk population.

If it is necessary to supplement initial reduction and maintenance actions with roundup and euthanasia/translocation in year 3, helicopter use and the disturbances associated with the herding and driving of elk would have additional impacts normally associated with such operations at the park (e.g., displacement, trampling). The NPS would avoid sensitive portions of species' life cycles or sensitive locations (i.e., breeding or nesting seasons, migration corridors, nesting habitat), but activities associated with roundups would temporarily increase energy expenditures and increase stress on wildlife in winter, a time of year when animals are more susceptible to mortality due to weather or reduced forage availability. However, based on the assumptions in chapter 2, the associated impacts would occur only during year 3; would last only a matter of days when management actions are implemented; and impacts would dissipate with distance from the activity. Given the scope and frequency of these operations, and based on past experience with elk roundups, and periodic bison and feral horse roundups, there would be short-term, minor adverse impacts. Although unlikely, if these management actions are used for maintenance, they would have impacts similar to those described for initial reduction, but would involve much smaller numbers of elk, reducing the intensity of the effect. Routine research and monitoring would contribute minimally to these impacts as described for alternative A.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternative A and the preferred alternative. The cumulative impacts from the preferred alternative would be similar to those from the no action alternative because the beneficial long-term impacts on wildlife and wildlife habitat under the preferred alternative would only slightly offset some of the adverse cumulative impacts, which would continue to be short- and long-term, and minor to moderate.

Conclusion. The reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to other wildlife and wildlife habitat by reducing the potential for sustained, heavy use of vegetation by elk, thereby increasing available resources, especially for species that rely on grasses, shrubs, and saplings. Other ungulates and herbivores such as prairie dogs would also benefit from increased forage and habitat, and the decreased potential for transmission of diseases. Although their prey populations (e.g., small mammal and ground-nesting birds) would likely increase, there would be long-term, negligible to minor, adverse impacts to coyotes and other small predators because increased ground cover would make it more difficult to hunt. Scavengers that consume carrion would also experience long-term, negligible to minor, adverse impacts as a result of decreased food sources.

The use of firearms for an annual direct reduction program for elk would have long-term, minor to moderate adverse impacts on wildlife from the disturbance, displacement, and temporary increases in energy expenditures and stress. Other aspects of direct reduction would have similar impacts to routine management actions, including trampling of vegetation, and would contribute minimally to these effects.

If it is necessary to supplement initial reduction with roundup and euthanasia/translocation in year 3, helicopter use and the disturbances associated with the herding and driving of elk would have impacts normally associated with such operations at the park (e.g., displacement, trampling, increased energy expenditures, and increased stress), which would be short-term, minor, and adverse. Routine research and monitoring would contribute minimally to these impacts as described for alternative A.

Under the preferred alternative, the beneficial long-term impacts on wildlife and wildlife habitat would only slightly offset some of the adverse cumulative impacts, which would continue to be short- and long-term, and minor to moderate. Although temporary moderate impacts to wildlife could occur during annual management actions, there would be no impairment to wildlife and wildlife habitat; viable wildlife populations would be maintained within the South Unit.

SPECIAL STATUS SPECIES

GUIDING REGULATIONS AND POLICIES

According to the NPS *Management Policies 2006*, the NPS will inventory, monitor, and manage state-listed and locally listed species in a manner similar to its treatment of federally listed species to the greatest extent possible. Director's Order-77: Natural Resource Management is currently being developed, until which time the former NPS-77 still applies. NPS-77 addresses the management of state species of concern which need to be considered in the NEPA process.

SPECIES TO BE EVALUATED

The species retained for a full evaluation of the effects of the elk management plan are listed in chapter 3. None of the species retained for evaluation are listed under the *Endangered Species Act of 1973*. As a result, none of the alternatives would have any effect on federally listed species or designated critical habitat. Therefore, the analysis of special status species focuses on state-listed species of special concern. Impacts on some of these species would be minimal, and therefore, they have been dismissed from further evaluation (see “Issues Dismissed from Further Consideration” in chapter 1). Impacts to the remainder of the state species of special concern are evaluated in this section.

ASSUMPTIONS, METHODOLOGY, AND INTENSITY THRESHOLDS

To assess impacts on listed species, the following process was used:

- Identification of which species are in areas likely to be affected by management actions described in the alternatives
- Analysis of habitat loss or alteration caused by the alternatives
- Analysis of disturbance potential of the actions and the species’ potential to be affected by the actions

The information in this analysis was obtained through best professional judgment of park staff and experts in the field (as cited in the text), and by conducting a literature review. The following thresholds were used to determine impacts to species of special concern.

Negligible: There would be no observable or measurable impacts to native species, their habitats, or the natural processes sustaining them. Impacts would be well within natural fluctuations. Habitat would retain current ecological integrity to support wildlife species.

Minor: Impacts on native species, their habitats, or the natural processes sustaining them would be detectable. Small changes to population numbers, population structure, genetic variability, and other demographic factors not affecting population viability or stability might occur. Occasional responses to disturbance by some individuals could be expected but without interference to factors affecting population levels. Habitat would retain adequate ecological integrity to support viability of all native species. Impacts would be outside critical reproduction periods for sensitive native species.

Moderate: Impacts on native species, their habitats, or the natural processes sustaining them would be detectable. Changes to population numbers, population structure, genetic variability, and other demographic factors would occur, but species would remain stable and viable. Frequent responses to disturbance by some individuals could be expected, with some impacts to factors affecting population levels possible. Habitat would retain adequate ecological integrity to support viability of all native species. Some impacts might occur during critical periods of reproduction or in key habitat.

Major: Impacts on native species, their habitats, or the natural processes sustaining them would be detectable. Population numbers, population structure, genetic variability, and other demographic factors might experience large-scale changes. Frequent responses to disturbance by some individuals would be expected, with resulting decreases in population levels. Loss of habitat might affect the viability of at least some native species. Impacts would regularly occur during critical periods of reproduction or in key habitat.

Duration: **Short-term**: Impacts occurring during initial management actions.

Long-term: Impacts occurring after initial management actions, as long as the lifetime of the plan and beyond.

Area of Analysis

The direct and indirect impacts of the alternatives on special-status species are analyzed for the South Unit of Theodore Roosevelt National Park. The cumulative impacts of the alternatives are analyzed for the park and adjacent lands.

IMPACTS OF THE ALTERNATIVES

Alternative A: No Action (Continue Existing Elk Management Program)

Upland Sandpiper, Long-Billed Curlew, Baird's Sparrow, Grasshopper Sparrow, Lark Bunting, Sprague's Pipit, and the Chestnut-Collared Longspur (State Sensitive Species). All of these ground nesting birds utilize short-grass to mixed-grass prairie habitat found within the South Unit of the park. The continued growth of the population increases the potential for habitat degradation from sustained heavy use by elk, including decreased native plant diversity and increased nonnative plants, in elk use areas of the South Unit. Based on data collected regarding elk use of vegetation as habitat and forage (Marlow et al. 1984; Westfall 1989; Westfall et al. 1989; and Sullivan et al. 1988; Irby et al. 2002; Sargeant et al. 2005; see "Elk Population" section of chapter 3 for details), habitat provided by all of the herbaceous alliances within the South Unit, with the exception of the Prairie Sandreed Herbaceous Alliance, could be affected by sustained, heavy use as they support many forage species for elk (see "Vegetation" section of chapter 3).

As described for under alternative A for "Wildlife and Wildlife Habitat," increased elk use of grassland environments could decrease cover for these birds making them and their nests more susceptible to predation. These species could also be displaced from elk use areas by greater numbers of elk increasing the competition for available resources (food, cover, and breeding habitat) in the surrounding area. As a result, there would be long-term, moderate to major, adverse impacts to these grassland nesting birds from changes in habitat.

Routine research and monitoring would have long-term, negligible to minor adverse impacts to these birds as a result of displacement from noise and impacts of limited foot traffic (e.g., trampling of vegetation). However, because annual elk population surveys would be conducted in the winter, when these birds are not present, they would not be affected by this effort. In addition, these birds and their habitat would recover once research and monitoring is complete.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that would contribute to cumulative impacts to special status species would be similar those described under alternative A for "Wildlife and Other Wildlife Habitat" And "Vegetation" This includes long-term, negligible to moderate adverse impacts on special status species from livestock grazing; bison and horse management; habitat loss and fragmentation from oil and gas, community, and transportation development; fire suppression; maintenance of existing facilities, utilities, and roads, both inside and outside the park; and infrastructure projects (road improvements and building construction). There would be long-term beneficial effects from the current use of prescribed burns and wildland fires that have restored habitat, as well as exotic plant management (as a result of increasing native species and improving habitat conditions). Grazing by other herbivores in the park (e.g., other ungulates and prairie dogs) also contributes to habitat impacts, although at appropriate levels, these have beneficial effects by encouraging vegetation growth.

All of these activities, when combined with the long-term, moderate to major adverse impacts to other species of special concern under the no action alternative, would result in short- and long-term, moderate to major, cumulative adverse impacts on special status species.

Conclusion. There would be long-term, moderate to major, adverse impacts to state sensitive ground nesting birds (upland Sandpiper, long-billed curlew, Baird's sparrow, grasshopper sparrow, lark bunting, Sprague's Pipit, and the chestnut-collared longspur) from displacement and the loss of cover from increased numbers of elk.

Past, present, and reasonably foreseeable future actions with the potential to impact special status species, when combined with the impacts of the no action alternative, would result in short- and long-term, moderate to major cumulative adverse, impacts on special status species. Continued growth of the elk population could lead to impairment of state sensitive ground nesting, grassland birds available in elk use areas in the South Unit due to degradation from the long-term effects of sustained heavy use by elk.

Alternative B: Direct Reduction with Firearms

Upland Sandpiper, Long-Billed Curlew, Baird's Sparrow, Grasshopper Sparrow, Lark Bunting, Sprague's Pipit, and the Chestnut-Collared Longspur (State Sensitive Species). The gradual reduction (over 5 years) and maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) would decrease the potential for sustained, heavy use of vegetation by elk. This would have long-term, beneficial effects for these grassland, ground-nesting birds by increasing and enhancing their habitat and populations.

Activities associated with an annual direct reduction program, including field dressing, and removing carcasses/salvageable meat, would have similar impacts to other routine management actions. This includes the trampling of vegetation, intermittent disturbances and displacement from noise and the presence of people, increased energy expenditures, and increased stress. The use of firearm noise suppressors could offset some of these impacts. These management actions would be taken in the fall or winter, and as a result, the NPS would avoid sensitive portions of these species' life cycles or sensitive locations (i.e., breeding or nesting seasons, migration corridors). This would minimize potential adverse effects, and actions taken in winter would have no impact on these birds as they are typically not present during this time of year.

Given the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (removal of a maximum of 275 elk over several months each year for the first 5 years, versus 20 to 24 elk removed in a minimal period of time each year thereafter). As a result, there would be long-term, negligible adverse impacts during initial reduction and annual maintenance activities. Routine research and monitoring would contribute minimally to these impacts, as described for alternative A.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that could contribute to cumulative impacts to special status species would be the same as those described under alternative A. The cumulative impacts from alternative B would be similar to those from the alternative A because the beneficial long-term impacts on special status birds under alternative B would only slightly offset some of the adverse impacts of this alternative and other cumulative effects. As a result, there would be short- and long-term, minor to moderate adverse cumulative impacts on special status species.

Conclusion. Under alternative B, the reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result have long-term, beneficial effects for the upland sandpiper, long-billed curlew, Baird’s sparrow, grasshopper sparrow, lark bunting, Sprague’s Pipit, and the chestnut-collared longspur.

Activities associated with an annual direct reduction program would have similar impacts to other routine management actions, with the exception of the use of firearms, including the trampling of vegetation, intermittent disturbances and displacement from noise and the presence of people, increased energy expenditures, and increased stress. As a result, there would be short-term, negligible adverse impacts during initial reduction and annual maintenance activities. Routine research and monitoring would contribute minimally to these impacts, as described for alternative A. Past, present, and reasonably foreseeable future actions with the potential to impact special status species, when combined with the impacts of the alternative B, would result in short- and long-term, minor to moderate cumulative adverse, impacts on special status species. There would be no impairment of special status species as a result of the implementation of alternative B.

Alternative C: Roundup and Euthanasia

Upland Sandpiper, Long-Billed Curlew, Baird’s Sparrow, Grasshopper Sparrow, Lark Bunting, Sprague’s Pipit, and the Chestnut-Collared Longspur (State Sensitive Species). The rapid decrease of the elk population over 1 year and maintenance between 100 and 400 animals would decrease the potential for sustained, heavy use of vegetation by elk. This would have long-term, beneficial effects for these grassland, ground-nesting birds by increasing and enhancing their habitat and populations.

Use of the helicopter and the disturbances associated with the herding and driving of elk would have impacts normally associated with such operations at the park, including trampling, intermittent disturbances and displacement from noise and the presence of people, increased energy expenditures, and increased stress. These management actions would be taken in the fall or winter, and as a result, the NPS would avoid sensitive portions of these species’ life cycles or sensitive locations (i.e., breeding or nesting seasons, migration corridors). This would minimize potential adverse effects, and actions taken in winter would have no impact on these birds as they are typically not present during this time of year.

Considering the assumptions described in chapter 2, the potential for such impacts would be greatest in the first year, but would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 800 elk the first year to approximately 200 elk once every 3 to 4 years thereafter). The associated impacts would be intermittent over the life of this plan; would last only a matter of days when management actions are implemented; and these birds and their habitat would recover once actions are complete. Given the scope and frequency of these operations, and based on past experience with elk roundups, and periodic bison and feral horse roundups, these impacts would be long-term, minor, and adverse. Routine research and monitoring would contribute minimally to these impacts, as described for alternative A. Euthanasia or processing elk carcasses for donation/distribution after the roundups would have no impacts on special status species.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that could contribute to cumulative impacts to special status species would be the same as those described under alternative A. The cumulative impacts from alternative C would be similar to those from the other alternatives because the beneficial long-term impacts on special status birds under alternative C would only slightly offset some of the adverse impacts of this alternative and other cumulative effects. As a result, there would be long-term, minor, adverse cumulative impacts on special status species.

Conclusion. Under alternative C, the reduction and maintenance of the elk population at levels consistent with a lightly grazed system would have long-term, beneficial effects for the upland sandpiper, long-billed curlew, Baird's sparrow, grasshopper sparrow, lark bunting, Sprague's Pipit, and the chestnut-collared longspur.

Use of the helicopter and the disturbances associated with the herding and driving of elk would have impacts normally associated with such operations at the park (e.g., displacement, trampling, increased energy expenditures, and increased stress), which would have long-term, minor, adverse impacts on these birds. Past, present, and reasonably foreseeable future actions with the potential to impact special status species, when combined with the impacts of alternative C, would result in short- and long-term, minor to moderate cumulative adverse, impacts on special status species. There would be no impairment of special status species as a result of the implementation of alternative C.

Alternative D: Testing and Translocation

Upland Sandpiper, Long-Billed Curlew, Baird's Sparrow, Grasshopper Sparrow, Lark Bunting, Sprague's pipit, and the Chestnut-Collared Longspur (State Sensitive Species). The gradual decrease of the elk population over at least 3 years and maintenance between 100 and 400 animals would decrease the potential for sustained, heavy use of vegetation by elk. This would have long-term, beneficial effects for these grassland, ground-nesting birds by increasing and enhancing their habitat and populations.

Normal operations associated with roundups for CWD testing and translocations during initial reduction and periodic maintenance would have similar impacts to the roundups described under alternative C, including trampling, intermittent disturbances and displacement from noise and the presence of people, increased energy expenditures, and increased stress. These management actions would be taken in the fall or winter, and as a result, the NPS would avoid sensitive portions of these species' life cycles or sensitive locations (i.e., breeding or nesting seasons, migration corridors). This would minimize potential adverse effects, and actions taken in winter would have no impact on these birds as they are typically not present during this time of year.

Considering the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 1,036 elk over the first 3 years to approximately 375 elk in year 10). Each management action would last a matter of days, and these birds and their habitat would recover once actions are complete. Given the scope and frequency of the proposed operations, as well as past experience with roundups, impacts on these ground-nesting birds and their habitat would be long-term and minor. Routine research and monitoring would contribute minimally to these impacts, as described for alternative A.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that could contribute to cumulative impacts to special status species would be the same as those described under alternative A. The cumulative impacts from alternative D would be similar to those from the other alternatives because the beneficial long-term impacts on special status birds under alternative D would only slightly offset some of the adverse impacts of this alternative and other cumulative effects. As a result, there would be short- and long-term, minor adverse cumulative impacts on special status species.

Conclusion. Under alternative D, the reduction and maintenance of the elk population at levels consistent with a lightly grazed system would have long-term, beneficial effects for the upland sandpiper, long-billed curlew, Baird's sparrow, grasshopper sparrow, lark bunting, Sprague's Pipit, and the chestnut-collared longspur.

Use of the helicopter and the disturbances associated with roundups for CWD testing and translocation would have impacts normally associated with such operations at the park (e.g., displacement, trampling, increased energy expenditures, and increased stress), which would be long-term, minor, and adverse impacts on these birds. Routine research and monitoring would contribute minimally to these impacts, as described for alternative A.

Past, present, and reasonably foreseeable future actions with the potential to impact special status species, when combined with the impacts of alternative D, would result in short- and long-term, minor to moderate cumulative adverse, impacts on special status species. There would be no impairment of special status species as a result of the implementation of alternative D.

Alternative E: Hunting Outside the Park

Upland Sandpiper, Long-Billed Curlew, Baird's Sparrow, Grasshopper Sparrow, Lark Bunting, Sprague's Pipit, and the Chestnut-Collared Longspur (State Sensitive Species). The gradual decrease of the elk population over at least 5 years and maintenance between 100 and 400 animals would decrease the potential for sustained, heavy use of vegetation by elk. This would have long-term, beneficial effects for these grassland, ground-nesting birds by increasing and enhancing their habitat and populations.

Dispersing elk out of the park to increase hunting opportunities would have similar impacts to those associated with normal roundup operations described for alternatives C and D (e.g., displacement, trampling, increased energy expenditures, and increased stress). These management actions would be taken in the fall or winter, and as a result, the NPS would avoid sensitive portions of these species' life cycles or sensitive locations (i.e., breeding or nesting seasons, migration corridors). This would minimize potential adverse effects, and actions taken in winter would have no impact on these birds as they are typically not present during this time of year.

Considering the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced. In addition, the NPS would attempt to minimize the distance elk would be driven, reducing the overall area impacted. Potential adverse impacts associated with increased hunting opportunities outside the park would be similar to those described for routine field activities under alternative B (direct reduction with firearms). Given the scope and frequency of these operations, and based on past experience with elk roundups, and periodic bison and feral horse roundups, these impacts would be long-term, minor, and localized. Routine research and monitoring would contribute minimally to these impacts.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that could contribute to cumulative impacts to special status species would be the same as those described under alternative A. The cumulative impacts from alternative E would be similar to those from the other alternatives because the beneficial long-term impacts on special status birds under alternative E would only slightly offset some of the adverse impacts of this alternative and other cumulative effects. As a result, there would be short- and long-term, minor adverse cumulative impacts on special status species.

Conclusion. Under alternative E, the reduction and maintenance of the elk population at levels consistent with a lightly grazed system would have long-term, beneficial effects for the upland sandpiper, long-billed curlew, Baird's sparrow, grasshopper sparrow, lark bunting, Sprague's Pipit, and the chestnut-collared longspur.

Dispersing elk out of the park would have similar impacts to those associated with normal roundup operations, including displacement, trampling, and temporary increases in energy expenditures and stress, which would be long-term, minor, and adverse. Potential adverse impacts associated with increased hunting opportunities outside the park are expected to be similar to those described for routine field activities under alternative B (direct reduction with firearms).

Past, present, and reasonably foreseeable future actions with the potential to impact special status species, when combined with the impacts of alternative E, would result in short- and long-term, minor to moderate cumulative adverse, impacts on special status species. There would be no impairment of special status species as a result of the implementation of alternative E.

Alternative F: Fertility Control (Maintenance Only)

Upland Sandpiper, Long-Billed Curlew, Baird's Sparrow, Grasshopper Sparrow, Lark Bunting, Sprague's Pipit, and the Chestnut-Collared Longspur (State Sensitive Species). Fertility control in free-ranging elk is currently experimental, but if a fertility control agent could be developed that meets NPS criteria and proves effective at maintaining elk population levels (i.e., 100 to 400) consistent with a lightly grazed system in the park would result in long-term beneficial effects for these grassland, ground-nesting birds by increasing and enhancing their habitat and populations.

Roundups for administering fertility control during maintenance could have similar impacts to those associated with normal roundup operations described for alternatives C and D (e.g., displacement, trampling, increased energy expenditures, and increased stress). However, these management actions would be taken in the winter, and actions taken in winter would have no impact on these birds as they are typically not present during this time of year. Routine research and monitoring would long-term, negligible adverse impacts, as described for alternative A.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that could contribute to cumulative impacts to special status species would be the same as those described under alternative A. The cumulative impacts from alternative F would be similar to those from the other alternatives because the beneficial long-term impacts on special status birds under alternative F would only slightly offset some of the other adverse cumulative effects. As a result, there would be short- and long-term, minor adverse cumulative impacts on special status species.

Conclusion. Under alternative F, the reduction and maintenance of the elk population at levels consistent with a lightly grazed system would have long-term, beneficial effects for the upland sandpiper, long-billed curlew, Baird's sparrow, grasshopper sparrow, lark bunting, Sprague's Pipit, and the chestnut-collared longspur.

Conducting roundups for fertility control treatments would have similar impacts to those associated with normal roundup operations; however, these management actions would be taken in the winter, and actions taken in winter would have no impact on these birds as they are typically not present during this time of year.

Past, present, and reasonably foreseeable future actions with the potential to impact special status species, when combined with the impacts of alternative F, would result in short- and long-term, minor to moderate cumulative adverse, impacts on special status species. There would be no impairment of special status species as a result of the implementation of alternative F.

Preferred Alternative: Combined Techniques

Upland Sandpiper, Long-Billed Curlew, Baird's Sparrow, Grasshopper Sparrow, Lark Bunting, Sprague's Pipit, and the Chestnut-Collared Longspur (State Sensitive Species). The gradual reduction (over 3 to 5 years) and maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) would decrease the potential for sustained, heavy use of vegetation by elk. This would have long-term, beneficial effects for these grassland, ground-nesting birds by increasing and enhancing their habitat and populations.

Activities associated with an annual direct reduction program would cause intermittent disturbances from noise associated with the use of firearms, the presence of people, field dressing and the removal of salvageable meat. With the exception of the use of firearms, these activities would have similar impacts to other routine management actions (e.g., trampling of vegetation, intermittent disturbances and displacement from noise and the presence of people, increased energy expenditures, and increased stress). Although wildlife may be accustomed to some noise associated with firearms outside the park during hunting, the annual use of firearms within the park would cause substantial impacts during annual management actions. The use of firearm noise suppressors could offset some of these impacts. These management actions would be taken in the fall or winter, and as a result, the NPS would avoid sensitive portions of these species' life cycles or sensitive locations (i.e., breeding or nesting seasons, migration corridors). This would minimize potential adverse effects, and actions taken in winter would have no impact on these birds as they are typically not present during this time of year. As a result, long-term, negligible impacts to these special status species would occur if firearms are used to initially reduce and maintain the elk population.

If it is necessary to supplement initial reduction and maintenance actions with roundup and euthanasia/translocation in year 3, helicopter use and the disturbances associated with the herding and driving of elk would have additional impacts normally associated with such operations at the park, including trampling, intermittent disturbances and displacement from noise and the presence of people, increased energy expenditures, and increased stress. These management actions would be taken in the fall or winter, and as a result, the NPS would avoid sensitive portions of these species' life cycles or sensitive locations (i.e., breeding or nesting seasons, migration corridors). This would minimize potential adverse effects, and actions taken in winter would have no impact on these birds as they are typically not present during this time of year. In addition, based on the assumptions in chapter 2, the associated impacts would occur only during year 3; would last only a matter of days when management actions are implemented; impacts would dissipate with distance from the activity; and these birds and their habitat would recover once actions are complete. Given the scope and frequency of these operations, and based on past experience with elk roundups, and periodic bison and feral horse roundups, the adverse impacts on these ground-nesting birds would be short-term and negligible. Although unlikely, if these management actions are used for maintenance, they would have impacts similar to those described for initial reduction, but would involve much smaller numbers of elk, reducing the intensity of the effect. Routine research and monitoring would contribute minimally to these impacts, as described for alternative A.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that could contribute to cumulative impacts to special status species would be the same as those described under alternative A. The cumulative impacts from the preferred alternative would be similar to those from the alternative A because the beneficial long-term impacts on special status birds under the preferred alternative would only slightly offset some of the adverse impacts of this alternative and other cumulative effects. As a result, there would be short- and long-term, minor to moderate adverse cumulative impacts on special status species.

Conclusion. Under the preferred alternative, the reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result have long-term, beneficial effects for the upland sandpiper, long-billed curlew, Baird's sparrow, grasshopper sparrow, lark bunting, Sprague's Pipit, and the chestnut-collared longspur.

Activities associated with an annual direct reduction program using firearms would have similar impacts to other routine management actions, with the exception of the use of firearms, including the trampling of vegetation, intermittent disturbances and displacement from noise and the presence of people, increased energy expenditures, and increased stress. These management actions would be taken in the fall or winter, and as a result, the NPS would avoid sensitive portions of these species' life cycles or sensitive locations (i.e., breeding or nesting seasons, migration corridors). This would minimize potential adverse effects, and actions taken in winter would have no impact on these birds as they are typically not present during this time of year. As a result, the use of firearms for an annual direct reduction program for elk would have short-term, negligible adverse impacts during initial reduction and annual maintenance activities.

If it is necessary to supplement initial reduction and maintenance actions with roundup and euthanasia/translocation in year 3, helicopter use and the disturbances associated with the herding and driving of elk would have additional impacts normally associated with such operations at the park (e.g., displacement, trampling, increased energy expenditures, and increased stress), which would have short-term, negligible, adverse impacts on these birds. Although unlikely, if these management actions are used for maintenance, they would have impacts similar to those described for initial reduction, but would involve much smaller numbers of elk, reducing the intensity of the effect. Routine research and monitoring would contribute minimally to these impacts, as described for alternative A.

Past, present, and reasonably foreseeable future actions with the potential to impact special status species, when combined with the impacts of the preferred alternative, would result in short- and long-term, minor to moderate cumulative adverse, impacts on special status species. There would be no impairment of special status species as a result of the implementation of the preferred alternative.

WILDERNESS

GUIDING REGULATIONS AND POLICIES

The Wilderness Act, passed on September 3, 1964, established a national wilderness preservation system, "administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness" (16 USC § 1131). The Wilderness Act further defined wilderness as "an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, and which is protected and managed to preserve its natural conditions" (16 USC § 1131). The Wilderness Act gives the agency managing the wilderness responsibility for preserving the wilderness character of the area and devoting the area to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use (16 USC § 1133). Certain uses are specifically prohibited, except for areas where these uses have already become established. The act states that "there shall be no commercial enterprise and no permanent road within any wilderness area designated by this chapter and except as necessary to meet minimum requirements for the administration of the area

> …there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area" (16 USE § 1133).

Section 6.3.5 of NPS *Management Policies 2006* requires that all management decisions affecting wilderness must be consistent with the minimum requirement concept. This concept is a documented process used to determine if administrative actions, projects, or programs undertaken by the NPS or its agents and affecting wilderness character, resources, or the visitor experience are necessary, and if so how to minimize impacts (NPS 2006a). See appendix G for this analysis.

As described in Section 6.3.7 of NPS *Management Polices 2006* (2006a) "The principle of nondegradation will be applied to wilderness management…Natural processes will be allowed, insofar as possible, to shape and control wilderness ecosystems. Management should seek to sustain the natural distribution, numbers, population composition, and interaction of indigenous species. Management intervention should only be undertaken to the extent necessary to correct past mistakes, the impacts of human use, and influences originating outside of wilderness boundaries."

Director's Order 41: *Wilderness Preservation and Management* was developed to provide accountability, consistency, and continuity to NPS wilderness management efforts and to otherwise guide NPS efforts in meeting the requirements set forth by the *Wilderness Act of 1964*.

Director's Order 41 sets forth guidance for applying the minimum requirement concept to protect wilderness and for the overall management, interpretation, and uses of wilderness. With regards to natural resource management in wilderness, it reaffirms management policies and states, "Management intervention should only be undertaken to the extent necessary to correct past mistakes, the impacts of human use, and the influences originating outside of wilderness boundaries" (NPS 1999a).

ASSUMPTIONS, METHODOLOGY, AND INTENSITY THRESHOLDS

In considering environmental impacts to wilderness, NPS *Management Policies 2006* requires that the analysis take into account (1) wilderness characteristics and values, including the primeval character and influence of the wilderness; (2) the preservation of natural conditions (including the lack of man-made noise); and (3) assurances that there will be outstanding opportunities for solitude, that the public will be provided with a primitive and unconfined type of recreational experience, and that wilderness will be preserved and used in an unimpaired condition (NPS 2006a, Section 6.3.4.3).

Negligible: A change in the wilderness character could occur, but it would be so small that it would not be of any measurable or perceptible consequence. The natural character of wilderness or its untrammeled nature would not be affected. Wilderness values would be unaffected.

Minor: Actions may result in detectable changes to the wilderness, but the majority of visitors would not notice them. The natural character of wilderness or its untrammeled nature would not be noticeably affected. Slight impacts to the wilderness values of a few may occur.

Moderate: Actions may alter wilderness character so that it is readily noticed by visitors. The natural character of portions of the wilderness or its untrammeled nature could be noticeably affected. Modest impacts to wilderness values of some visitors may occur.

Major: A highly noticeable change in the wilderness character and associated values would occur. Actions would alter wilderness character across the landscape. The natural character of wilderness or its untrammeled nature would be clearly altered on a large scale. Sizeable impacts to the wilderness values of many visitors may occur.

Duration: **Short-term**: Those impacts occurring from initial management activities.

Long-term: Impacts occurring after initial management activities through the life of the plan.

IMPACTS OF THE ALTERNATIVES

Alternative A: No Action (Continue Existing Elk Management Program)

Under alternative A, there would be no measures to actively reduce the number of elk in the South Unit. As a result, it is expected that the elk population would continue to grow, with limited decreases that could result from variables such as herd health or weather conditions in any particular year. No known impacts to wilderness are currently associated with elk or their browsing. However, as shown in see map 6 in chapter 3, movement data collected in 2003 and 2004 indicated that the designated wilderness area west of the Little Missouri River is one of three areas where elk concentrate within the South Unit. The rapid population growth increases the potential for heavy grazing of plant communities, which could cause shifts in the seral stage, increases in bare ground, and increases in exotic species. This would alter the natural and untrammeled character of the wilderness area. Therefore, there would be long-term, moderate to major adverse impacts on wilderness in the South Unit of the park.

Ground-disturbing activities associated with routine research and monitoring could affect vegetation in wilderness areas, but the impacts would not be discernable. Use of aircraft during elk population surveys would have temporary (for the duration of the activity) short-term, negligible to major adverse impacts on the solitude of the wilderness area as a result of the substantial noise that is introduced, and presence of staff conducting these activities. The intensity of the impacts would depend on the distance from the activity.

Cumulative Impacts. The reintroduction of elk in 1985 had long-term, beneficial effects on wilderness in the South Unit as a result of restoring an native species. Subsequent roundups of elk, as well as roundups of bison and feral horses creates noise that affects the solitude and natural character of the wilderness. Ultimately, long-term beneficial effects of roundups result from maintaining ungulate numbers consistent with healthy plant communities in wilderness.

Grazing by other herbivores in the park (e.g., other ungulates and prairie dogs) also contributes to impacts on vegetation in wilderness, although at appropriate levels, these have beneficial effects by encouraging vegetation growth. A lack of predators in and outside the park has minimized native species present in the wilderness at the South Unit, which also contributes to cumulative adverse effects.

Oil and gas operations surrounding the park have the potential to affect soils and water quality. Although seismic operations are not likely to contribute to such impacts, the development of the wells requires pipelines, reserve pits, storage tanks, as well as an extensive network of roads. These features can impact the solitude of wilderness as a result of the associated noise intrusions. However, this noise dissipates as it travels into the park, and the impact on solitude decreases in the interior parts of the wilderness.

Past fire suppression in the South Unit has altered natural structure and composition of wildlife habitat; however, more recently, prescribed burns have been conducted, resulting in long-term beneficial effects in wilderness areas. Exotic plant management also has long-term beneficial effects by restoring the natural character of plant communities in wilderness areas. There would be short-term, negligible to moderate adverse impacts to wilderness from the loss of vegetative cover initially associated with fires, as well as the presence of people and equipment associated with fire and exotic plant management. The presence of people during trail maintenance also contributes to these short-term impacts; however, the maintained trails provide long-term beneficial effects on the visitor experience of the wilderness.

Park operations that include the use of helicopters and/or large work crews, including bison and feral horse management, can also have adverse effects. Overall, these past, present, and reasonably foreseeable future actions have long-term, minor to moderate adverse impacts.

All of these activities, when combined with the long-term, negligible to major adverse impacts from continued elk population growth in the South Unit under the no action alternative, would result in short- and long-term, moderate to major adverse, cumulative impacts on wilderness.

Conclusion. Alternative A would have long-term, moderate to major adverse impacts on the natural character of wilderness in the South Unit of the park as a result of sustained heavy elk grazing on vegetation. Noise and the presence of people associated with routine research and monitoring would have negligible to major adverse impacts on the solitude of the wilderness area (depending on distance from the activity). Past, present, and reasonably foreseeable future activities, when combined with the impacts of alternative A, would have long-term, moderate to major, adverse impacts to wilderness.

Although there could be major adverse impacts to the natural character of wilderness (including vegetation, wildlife, and wildlife habitat) from sustained heavy use of areas of the South Unit that fall within wilderness, this would not constitute impairment because it would not change the designation of wilderness in the park (in both the South Unit and the North Unit).

Alternative B: Direct Reduction with Firearms

The gradual reduction (over 5 years) and maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) would result in the loss of native wildlife (elk) that may have adverse effects on the natural character of the wilderness area; however, despite the number of elk removed over the life of this plan under this alternative, maintaining the population between 100 and 400 would ensure elk remain as a component of the wilderness ecosystem. In addition, this elk population would eliminate the potential for sustained, heavy use of the vegetation that contributes to the natural and untrammeled character of the wilderness area. Therefore, reducing and maintaining the elk population at these levels would have long-term beneficial effects on wilderness.

Because the wilderness area is one location where elk activity is relatively high (see map 6 in chapter 3), it is likely some management actions would be conducted in this area. Although firearms are used routinely outside of the park during hunting season, their use in the wilderness area of the South Unit would create a substantial noise intrusion on solitude in areas near management actions. The presence of direct reduction teams would also contribute to the impacts. The noise impacts would dissipate with distance from the activity, and would also occur less frequently after initial reduction is complete and annual maintenance is implemented (removal of a maximum of 275 elk over several months each year for the first 5 years, versus 20 to 24 elk removed in a minimal period of time each year thereafter). If used, firearm noise suppressors could offset some of these impacts. In addition, management actions would be conducted in fall and winter, during periods of low visitation and outside the growing season. Coupled with closures, this would reduce the number of wilderness users that would be affected. Once management actions are complete, wilderness resources would recover.

As a result, there would long-term, negligible to moderate adverse impacts from the use of firearms and the presence of people during annual management actions. The intensity of impacts would depend on the distance from the activity. The human intervention associated with elk management, although not prohibited in wilderness areas, could also be considered “unnatural” and could contribute to these impacts by affecting the wilderness values of some users. Routine research and monitoring would contribute to these impacts as described for alternative A.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that could contribute to cumulative impacts to wilderness would be the same as those described under alternative A. When combined with the impacts of alternative B, there would be short- and long-term, minor to moderate adverse cumulative impacts on wilderness.

Conclusion. Despite the loss of individual elk, the reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to wilderness by eliminating the potential for sustained heavy use by elk and preserving the vegetation that contributes to the natural and untrammeled character of the wilderness area.

Activities associated with lethal sharpshooting would have long-term, negligible to moderate adverse impacts on the natural character of the wilderness area as a result of the use of firearms and the presence of direct reduction teams for the duration of annual management actions. These impacts would occur annually, but would decrease over time as the scope or removals reduces the relative duration of management. The human intervention associated with elk management, although not prohibited in wilderness areas, could also be considered “unnatural” and could contribute to these impacts by affecting the wilderness values of some users. Routine research and monitoring would contribute minimally to these impacts. Past, present, and reasonably foreseeable future activities, when combined with the impacts of alternative B, would have long-term, minor to moderate, adverse impacts to wilderness. There would be no impairment of wilderness under alternative B.

Alternative C: Roundup and Euthanasia

The rapid decrease of the elk population over 1 year and maintenance between 100 and 400 animals would result in the loss of native wildlife that may have adverse effects on the natural character of the wilderness area due to the loss of native wildlife; however, as described for alternative B, this alternative would ensure elk remain as a component of the wilderness ecosystem and would eliminate the potential for sustained, heavy use of the vegetation that contributes to the natural and untrammeled character of the wilderness area. Therefore, impacts of reducing and maintaining the elk population at these levels would have long-term beneficial effects on wilderness. These benefits would be realized sooner under alternative C as initial reduction would last one year versus five years under alternative B.

Use of the helicopter and the disturbances associated with the herding and driving of elk would have impacts normally associated with such operations at the park. The associated noise would create intrusions on solitude, and the associated human intervention could be viewed as “unnatural.” However, these impacts would be intermittent over the life of this plan (initial reduction of 800 elk would be completed in year 1, with periodic removal of 200 elk once every 3 to 4 years thereafter), would last only a matter of days when management actions are implemented, and would dissipate with distance from the activity. Management actions would be carried out in fall and winter, during periods of low visitation and outside the growing season, and coupled with closures, this would reduce the number of wilderness users that would be affected. Also, the majority of the noise impacts would occur outside the wilderness area given management actions would only be initiated in the wilderness area, after which elk would need to be driven out of the wilderness to the handling facility. Once management actions are complete, wilderness resources would recover.

Given the scope and frequency of the proposed operations, and based on past experience with elk roundups, and periodic bison and feral horse roundups, management actions would have long-term, minor adverse impacts. Routine research and monitoring would contribute to these impacts as described in alternative A.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that could contribute to cumulative impacts to wilderness would be the same as those described under alternative A. When combined with the impacts of alternative C, there would be short- and long-term, minor to moderate adverse cumulative impacts on wilderness.

Conclusion. Despite the loss of elk, the reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effect to wilderness by eliminating the potential for elk sustained, heavy use and preserving the vegetation that contributes to the natural and untrammeled character of the wilderness area.

Activities associated with roundups would have long-term, minor adverse impacts on the natural character of the wilderness area as a result of the presence of people and the use of helicopters for the duration of management actions; these impacts would be intermittent and last only a matter of days. The human intervention associated with elk management, although not prohibited in wilderness areas, could also be considered “unnatural” and could contribute to these impacts by affecting the wilderness values of some users. Routine research and monitoring would contribute minimally to these impacts.

Past, present, and reasonably foreseeable future activities, when combined with the impacts of alternative C, would have long-term, moderate, adverse impacts to wilderness. There would be no impairment of wilderness under alternative C.

Alternative D: Testing and Translocation

As described for alternative B, the gradual reduction (over 3 years) and maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) would result in the loss of native wildlife that may have adverse effects on the natural character of the wilderness area due to the loss of native wildlife; however, this alternative would ensure elk remain as a component of the wilderness ecosystem and would eliminate the potential for sustained, heavy use of the vegetation that contributes to the natural and untrammeled character of the wilderness area. Therefore, impacts of reducing and maintaining the elk population at these levels would have long-term beneficial effects on wilderness.

Normal operations associated with roundups for CWD testing and translocations during initial reduction and periodic maintenance would have similar impacts on natural character of wilderness described under alternative C, including noise and the “unnatural” human intervention. As described for alternative B, noise impacts would dissipate with distance from the management action. Impacts would also be minimized because management actions would be carried out in fall and winter, during periods of low visitation, and the majority of the impacts would be realized outside the wilderness area given the distance elk must be driven to the handling facility.

Considering the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 1,036 elk over the first 3 years to approximately 375 elk in year 10). Each management action would last a matter of days, and when complete, wilderness resources would recover. Given the scope and frequency of the proposed operations, as well as past experience with roundups, these impacts would be long-term and minor. Routine research and monitoring would contribute to these impacts as described for alternative A.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that could contribute to cumulative impacts to wilderness would be the same as those described under alternative A. When combined with the impacts of alternative D, there would be short-term and long-term, moderate adverse cumulative impacts on wilderness.

Conclusion. Despite the loss of elk, the reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effect to wilderness by eliminating the potential for elk overuse and preserving the vegetation that contributes to the natural and untrammeled character of the wilderness area.

Normal activities associated with roundups for translocation would have long-term, minor adverse impacts on the natural character of the wilderness area as a result of the presence of people and the use of helicopters for the duration of management actions; these impacts would be intermittent after initial reduction and last only a matter of days when implemented. The human intervention associated with elk management, although not prohibited in wilderness areas, could also be considered “unnatural” and could contribute to these impacts by affecting the wilderness values of some users. Routine research and monitoring would contribute minimally to these impacts.

Past, present, and reasonably foreseeable future activities, when combined with the impacts of alternative D, would have long-term, moderate, adverse impacts to wilderness. There would be no impairment of wilderness under alternative D.

Alternative E: Hunting Outside the Park

As described for alternative B, the gradual reduction (over 3 years) and maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) would have adverse effects on the natural character of the wilderness area due to the loss of native wildlife; however, this alternative would ensure elk remain as a component of the wilderness ecosystem and would eliminate the potential for sustained, heavy use of the vegetation that contributes to the natural and untrammeled character of the wilderness area. Therefore, impacts of reducing and maintaining the elk population at these levels would have long-term beneficial effects on wilderness.

Dispersing elk out of the park to increase hunting opportunities would have similar impacts to those associated with normal roundup operations described for alternatives C and D, including noise and the “unnatural” human intervention. As described for alternative A, noise impacts associated with hunting outside the park would dissipate with distance from the management action. Impacts would also be minimized because management actions would be carried out in fall and winter, during periods of low visitation.

Considering the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 1,358 elk over the first 5 years to approximately 200 elk every 3 to 4 years thereafter). These impacts would be intermittent after initial reduction is complete, and should be completed in a matter of days when implemented. In addition, the NPS would attempt to minimize the distance elk would be driven, reducing the overall area impacted. Potential adverse impacts associated with increased hunting opportunities outside the park are expected to be similar to those described for routine field activities under alternative B (direct reduction with firearms) if actions are taken in the vicinity of the park boundary near the wilderness area. Given the scope and frequency of these operations; the fact the ground would likely be frozen; and past experience with elk, bison, and feral horse roundups, the adverse impacts to the wilderness system would be temporary, moderate and short to long-term.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that could contribute to cumulative impacts to wilderness would be the same as those described under alternative A. When combined with the impacts of alternative E, there would be short- and long-term, minor to moderate adverse cumulative impacts on wilderness.

Conclusion. Despite the loss of elk, the reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effect to wilderness by eliminating the potential for sustained, heavy use by elk and preserving the vegetation that contributes to the natural and untrammeled character of the wilderness area.

Directed dispersals would have similar impacts to normal activities associated with roundups, which would be long-term, minor adverse impacts on the natural character of the wilderness area as a result of the presence of people and the use of helicopters for the duration of management actions. These impacts would be intermittent after initial reduction is complete, and should be completed in a matter of days when implemented. The human intervention associated with elk management, although not prohibited in wilderness areas, could also be considered “unnatural” and could contribute to these impacts by affecting the wilderness values of some users. Potential adverse impacts associated with increased hunting opportunities outside the park are expected to be similar to those described for routine field activities under alternative B (direct reduction with firearms) if taken in the vicinity of the park boundary near the wilderness area. Routine research and monitoring would contribute minimally to the impacts of this alternative.

Alternative F: Fertility Control (Maintenance Only)

Fertility control in free-ranging elk is currently experimental, and requires another alternative for initial reduction. If a fertility control agent could be developed that meets NPS criteria and proves effective at maintaining elk population levels (i.e., 100 to 400) consistent with a lightly grazed system in the park, it would result in long-term adverse effects on the natural character of the wilderness area due to the loss of reproductive capability of some native wildlife; however, this alternative would ensure elk remain as a component of the wilderness ecosystem and would eliminate the potential for sustained, heavy use of the vegetation that contributes to the natural and untrammeled character of the wilderness area, and ultimately would improve the overall health of the elk population. Therefore, impacts of maintaining the elk population at these levels would have long-term beneficial effects on wilderness.

Roundups for administering fertility control during maintenance could have similar impacts to those associated with normal roundup operations described for alternatives C and D, including noise and the “unnatural” human intervention. As described for alternative B, noise impacts would dissipate with distance from the management action. Impacts would also be minimized because management actions would be carried out in fall and winter, during periods of low visitation. The majority of the impacts would be realized outside the wilderness area given the distance elk must be driven to the handling facility.

Considering the assumptions described in chapter 2, this would required rounding up at least 70 elk per year after initial reduction is complete. These impacts would occur annually after initial reduction is complete, and should be completed in a matter of days when implemented. Based on past experience with elk, bison, and feral horse roundups, the adverse impacts to the wilderness system would be long-term and minor from these annual roundups.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that could contribute to cumulative impacts to wilderness would be the same as those described under alternative A. When combined with the impacts of alternative F, there would be short- and long-term, minor to moderate adverse cumulative impacts on wilderness.

Conclusion. Despite the loss of elk, the reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effect to wilderness by eliminating the potential for sustained, heavy use by elk and preserving the vegetation that contributes to the natural and untrammeled character of the wilderness area.

Roundups for administering fertility control during maintenance could have similar impacts to those associated with normal roundup operations which would be long-term, minor adverse impacts on the natural character of the wilderness area as a result of the presence of people and the use of helicopters for the duration of management actions. These impacts would be intermittent after initial reduction is complete, and should be completed in a matter of days when implemented. The human intervention associated with elk management, although not prohibited in wilderness areas, could also be considered “unnatural” and could contribute to these impacts by affecting the wilderness values of some users. Routine research and monitoring would contribute minimally to the impacts of this alternative.

Past, present, and reasonably foreseeable future actions with the potential to impact special status species, when combined with the impacts of alternative F, would result in short- and long-term, minor to moderate cumulative adverse, impacts on wilderness. There would be no impairment of wilderness as a result of the implementation of alternative F.

Preferred Alternative: Combined Techniques

The gradual reduction (over 3 to 5 years) and maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) would result in the loss of native wildlife (elk) that may have adverse effects on the natural character of the wilderness area; however, despite the number of elk removed over the life of this plan under this alternative, maintaining the population between 100 and 400, would ensure elk remain as a component of the wilderness ecosystem. In addition, this elk population would eliminate the potential for sustained, heavy use of the vegetation that contributes to the natural and untrammeled character of the wilderness area. Therefore, reducing and maintaining the elk population at these levels would have long-term beneficial effects on wilderness.

Because the wilderness area is one location where elk activity is relatively high (see map 6 in chapter 3), it is likely some management actions would be conducted in this area. Although firearms are used routinely outside of the park during hunting season, their use in the wilderness area of the South Unit would create a substantial noise intrusion on solitude in areas near management actions. The presence of direct reduction teams would also contribute to the impacts. The noise impacts would dissipate with distance from the activity, and would also occur less frequently after initial reduction is complete and annual maintenance is implemented. If firearms are used, noise suppressors could offset some of these impacts. In addition, management actions would be conducted in fall and winter, during periods of low visitation and outside the growing season. Coupled with closures, this would reduce the number of wilderness users that would be affected. Once management actions are complete, character of the wilderness would be restored. Therefore, there would be long-term, negligible to moderate adverse impacts from the use of firearms and the presence of people during annual management actions. The intensity of impacts would depend on the distance from the activity. The human intervention associated with elk management, although not prohibited in wilderness areas, could also be considered “unnatural” and could contribute to these impacts by affecting the wilderness character.

If it is necessary to supplement initial reduction and maintenance actions with roundup and euthanasia/translocation in year 3, helicopter use and the disturbances associated with the herding and driving of elk would have additional impacts normally associated with such operations at the park. The associated noise would create intrusions on solitude, and the associated human intervention could be viewed as “unnatural.” However, based on the assumptions in chapter 2, the associated impacts would occur only during year 3; would last only a matter of days when management actions are implemented; and impacts would dissipate with distance from the activity. In addition, management actions would be carried out in fall and winter, during periods of low visitation and outside the growing season, and coupled with closures, this would reduce the number of wilderness users that would be affected. Also, the majority of the noise impacts would occur outside the wilderness area given management actions would only be initiated in the wilderness area, after which elk would need to be driven out of the wilderness to the handling facility. Once management actions are complete, wilderness character would be restored. Given the scope and frequency of the proposed operations, and based on past experience with elk roundups, and periodic bison and feral horse roundups, management actions would have short-term, minor adverse impacts. Although unlikely, if these management actions are used for maintenance, they would have impacts similar to those described for initial reduction, but would involve much smaller numbers of elk, reducing the intensity of the effect. Routine research and monitoring would contribute to these impacts as described in alternative A.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that could contribute to cumulative impacts to wilderness would be the same as those described under alternative A. When combined with the impacts of the preferred alternative, there would be short- and long-term, minor to moderate adverse cumulative impacts on wilderness.

Conclusion. Despite the loss of individual elk, the reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to wilderness by eliminating the potential for sustained heavy use by elk and preserving the vegetation that contributes to the natural and untrammeled character of the wilderness area.

Shooting would have long-term, negligible to moderate adverse impacts on the natural character of the wilderness area as a result of the use of firearms and the presence of direct reduction teams for the duration of annual management actions. These impacts would occur annually, but would decrease over time as the scope of removals reduce the relative duration of the management action. The human intervention associated with elk management, although not prohibited in wilderness areas, could also be considered “unnatural” and could contribute to these impacts by affecting the wilderness character.

If it is necessary to supplement initial reduction and maintenance actions with roundup and euthanasia/translocation in year 3, there would be short-term, minor adverse impacts on the natural character of the wilderness area as a result of the presence of people and the use of helicopters for the duration of management actions. The human intervention associated with elk management, although not prohibited in wilderness areas, could also be considered “unnatural” and could contribute to these impacts by affecting the wilderness character. Routine research and monitoring would contribute minimally to these impacts.

Past, present, and reasonably foreseeable future activities, when combined with the impacts of the preferred alternative, would have long-term, minor to moderate, adverse impacts to wilderness. There would be no impairment of wilderness under the preferred alternative.

SOCIOECONOMICS

GUIDING REGULATIONS AND POLICIES

The *National Environmental Policy Act* requires that economic and social impacts be analyzed in an environmental impact statement when they are interrelated with natural or physical impacts. Economic impacts would potentially result from elk grazing damage to agricultural lands and landscaping on private lands adjacent to the park as a result of increases in the elk population of the South Unit; therefore, they are addressed in this document.

ASSUMPTIONS, METHODOLOGY, AND INTENSITY THRESHOLDS

Although North Dakota as a whole has a substantial agriculture sector supported by a variety of grain crops and livestock ventures, the primary agricultural products vary considerably by region throughout the state. The crops likely affected by elk foraging in Billings County include barley, oats, wheat, and corn. The west-central portion of the state, where Billings and McKenzie Counties are located, is characterized primarily by livestock operations, with 2005 livestock receipts for McKenzie and Billings Counties totaling approximately $36 million and $19 million, respectively. Crop receipts are somewhat less in McKenzie County than livestock, totaling approximately $32 million, and substantially less in Billings County, totaling approximately $3.7 million. Therefore, while crop damage by elk may have an impact on local industries, competition for grazing lands would be the bigger issue. Furthermore, because Billings County surrounds the South Unit, where elk management activities are proposed, impacts to specific crops or grazing lands are likely to be more heavily felt in that area. This would also be true for landscaping damage on surrounding lands. The role of elk as a potential tourist attraction, and the effects of elk management on that resource, was also considered.

Impact threshold definitions for socioeconomic conditions focus on depredation to neighboring lands and the effects on socioeconomic conditions, and were defined as follows:

Negligible: No effects would occur, or the effects on neighboring landowners or other socioeconomic conditions would be below or at the level of detection.

Minor: The effects on neighboring landowners or other socioeconomic conditions would be small but detectable. The impact would be slight, but would not be detectable outside the neighboring lands and would affect only a few adjacent landowners.

Moderate: The effects on neighboring landowners or other socioeconomic conditions would be readily apparent. Changes in economic or social conditions would be limited and confined locally, and they would affect more than a few landowners.

Major: The effects on neighboring landowners or other socioeconomic conditions would be readily apparent. Changes in social or economic conditions would be substantial, extend beyond the local area, and affect the majority of landowners.

Area of Analysis

The area of analysis, including analysis of cumulative impacts, is comprised of Billings and McKenzie Counties.

IMPACTS OF THE ALTERNATIVES

Alternative A: No Action (Continue Existing Elk Management Program)

Under alternative A, there would be no measures to actively reduce the number of elk in the South Unit. As a result, it is expected that the elk population under alternative A would continue to grow, with limited decreases that could result from variables such as herd health or weather conditions in any particular year.

Impacts to Adjacent Lands. Increased elk populations would primarily impact agricultural lands surrounding the South Unit by competing for food sources, whether in the form of grazing lands used for commercial cattle operations, food stores (hay) used to support commercial cattle operations, or in direct depredation of cereal crops such as barley, oats, wheat, and corn. Elk use of areas outside the park currently shows a seasonal pattern (beginning with limited activity in January, increasing in April, and peaking in June), but this could increase as competition for food sources increases. The increased elk population could also increase damage to fencing, as well as landscaping of homeowners near the South Unit. As a result, there would be long-term, moderate, adverse impacts to adjacent lands.

Protection Mechanisms and Costs. Landowners would most likely incur additional costs for fencing and other forms of elk control to protect their landscaping, crops, and pastures as the elk population grows under this alternative. The time and monetary costs associated with acquiring additional protection measures would result in adverse, long-term, minor impacts to landowners.

Impacts to Tourism and Recreation. Tourism and recreation related to elk in the South Unit is limited to opportunities to observe them in their natural habitat, as well as photography and educational programs. In addition, elk hunting opportunities around the South Unit contribute substantial amounts to the economy from expenditures on food, lodging, fuel, guides and outfitters, among other things. There is no documentation of the effects of increases in elk population on elk-related recreation. But the continued growth of the elk population under alternative A would likely result in changes to state management actions to help control the growth. This, coupled with potential increases in park visitation from increased opportunities to see elk, would have long-term beneficial effects.

Cumulative Impacts. Oil and gas development outside the park has and will continue to provide substantial revenue to the economy, including approximately $15 million in tax revenue. These developments also decrease the amount of available elk habitat and food around the park, which could be a contributing factor to increased use of surrounding agricultural lands and landscaped areas for forage. However, it is expected that the benefits to the economy from oil and gas development likely outweigh the costs from depredation. Grazing activities around the park, including those permitted by the Medora Grazing Association on USFS lands, as well as those on private lands, also contribute beneficial effects. In recent years, the state of North Dakota has made attempts to increase elk removals outside the South Unit by adding hunting seasons, increasing permits, and increasing the number of elk that can be taken. These additional opportunities have increased the number of hunters visiting the area, which in turn increases related expenditures. Visitation to the park also contributes expenditures for food, lodging, etc. These activities, when combined with the potential long-term, minor to moderate impacts from depredation, and long-term beneficial effects from increases in elk-related recreation, would have long-term beneficial effects on socioeconomics.

Conclusion. There would be long-term, minor to moderate, adverse impacts on surrounding agricultural and lands and landscaping on private lands as a result of increased depredation from the growing elk population. There is also the potential for long-term beneficial effects to tourism and recreation from increased opportunities for hunting, wildlife watching, and photography. Beneficial effects from past, present, and reasonably foreseeable future activities both inside and outside the park, when combined with the long-term, minor to moderate, adverse impacts, as well as the long-term beneficial effects of the no action alternative, would result in long-term beneficial cumulative effects on socioeconomics.

Under all action alternatives (B through F, and the preferred alternative), elk hunting opportunities around the South Unit would be substantially reduced after initial reduction of the elk population is complete.

Alternative B: Direct Reduction with Firearms

Impacts to Adjacent Lands. Alternative B would have long-term beneficial effects to lands adjacent to the park from the gradual reduction in the elk population. Maintaining the population between 100 and 400 elk would result in reduced pressure on pastures and croplands surrounding the park. This would create the potential for higher yield from crops and more profits. It would reduce the potential for sustained heavy grazing from elk on lands used for cattle ranching. This would reduce impacts on range conditions and loss of hay stores, as well as fencing and landscaping. As a result, there would be long-term beneficial effects to socioeconomics from reduced impacts on adjacent lands.

There would be no impacts to adjacent lands during management actions associated with direct reduction with firearms.

Protection Mechanisms and Costs. A decline in costs for fencing and other forms of elk control to protect landscaping, crops, and pastures could occur as the park elk population was reduced and maintained between 100 and 400 elk. The temporary growth of the elk population and potential for impacts from protection measures and costs would be reduced when compared to alternative A. As a result, the time and money spent by adjacent landowners on elk protection measures would be reduced, which would have long-term beneficial effects to socioeconomics, even if some costs may still be incurred.

Management actions associated with direct reduction with firearms would not affect protection mechanisms or costs.

Impacts to Tourism and Recreation. Although elk may be a draw for some visitors in the park, there is no proven correlation between a smaller ungulate population and an associated decline in visitation. In addition, outreach, public education, and interpretation of elk management and the reasons behind it would assist with preventing negative perceptions resulting from a reduction in the elk population. However, the maintenance of an elk population between 100 and 400 elk would substantially reduce the hunting opportunities outside of the park. In response, the number of hunting seasons and licenses could be scaled back, limiting the number of hunters that would travel to the area. As a result, there would be a noticeable decrease in hunting-related expenditures in the local economy that would affect more than just surrounding landowners. The changes in tourism and recreation once the elk population is reduced and maintained at smaller numbers would have long-term, moderate, and adverse effects on socioeconomics.

Annual direct reduction activities could deter visitors from traveling to the park during management actions and beyond if they disagree with this approach or if they are concerned their visit could be disrupted. This would cause changes in visitation to the park, which has increased an average of 1.4% annually for the last 10 years, but would not have impacts beyond the surrounding area. As described above, public outreach, education, and interpretation would be increased to limit negative perceptions related to the use of direct reduction with firearms. As a result, the annual management actions themselves would affect tourism and recreation and would result in long-term, negligible to minor, adverse impacts on socioeconomics.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and B, and would have long-term, beneficial effects on socioeconomics. Although there would be some long-term, moderate, adverse effects to socioeconomics under alternative B, they would not outweigh the benefits of the cumulative actions described for alternative A. Therefore cumulative effects on socioeconomics would remain long-term and beneficial.

Conclusion. The smaller elk population would have a long-term beneficial effect on socioeconomics by reducing browsing on crops, pasture lands, hay stores, and landscaping on adjacent lands. Costs for fencing and other forms of elk control to protect crops, pastures, livestock food supplies, and landscaping could also decline and would contribute to these beneficial effects. However, there would also be a long-term, moderate, adverse impact on socioeconomics as a result of decreased elk viewing/hunting opportunities that would affect tourism and recreation in the area. Annual direct reduction with firearms would contribute to impacts on tourism and recreation if visitors are deterred from traveling to the park. This would have a long-term, adverse, negligible to minor effect on socioeconomics.

When the effects of alternative B are combined with the long-term beneficial effects of past, present, and reasonably foreseeable actions, the cumulative impacts would be long-term and beneficial.

Alternative C: Roundup and Euthanasia

Impacts to Adjacent Lands. Reducing and maintaining the elk population between 100 and 400 animals under alternative C would result in less damage to crops, pastures, and landscaping as a result of decreased grazing pressure. Although the elk population would fluctuate between 100 and 400 elk after initial reduction, the temporary growth and potential for impacts to adjacent lands would still be reduced when compared to alternative A. This would have long-term beneficial effects on socioeconomics by reducing impacts on range conditions, loss of hay stores, and replacement and repair costs for food, pastures, fencing, and landscaping.

As with alternative B, management actions associated with roundup and euthanasia would not affect adjacent lands.

Protection Mechanisms and Costs. As in alternative B, a decline in costs for fencing and other forms of elk control to protect landscaping, crops, and pastures would be expected as the elk population was reduced. Although the elk population would fluctuate between 100 and 400 elk after initial reduction, the temporary growth and potential for impacts to protection measures and costs would still be reduced when compared to alternative A. As a result, the time and money spent by adjacent landowners on elk protection measures would be reduced, which would have long-term beneficial effects to socioeconomics, even if some costs may still be incurred. However, these benefits would be realized sooner under alternative C as initial reduction would last one year versus five years under alternative B.

Management actions associated with roundups and euthanasia would not affect protection mechanism or costs.

Impacts to Tourism and Recreation. As stated for alternative B, there is no proven correlation between reducing the elk population and an associated decline in visitation. In addition, outreach, public education and interpretation of elk management and the reasons behind it would be helpful in preventing negative perceptions resulting from alternative C. However, the maintenance of an elk population between 100 and 400 elk would substantially reduce the hunting opportunities outside of the park, which would result in a noticeable decrease in hunting-related expenditures in the local economy that would affect more than just surrounding landowners. As a result, the changes in tourism and recreation once the elk population is reduced and maintained at smaller numbers would have long-term, moderate, and adverse effects on socioeconomics.

Actual roundup and euthanasia activities could deter visitors from traveling to the park during management actions and beyond if they disagree with this approach or if they are concerned that their visit could be disrupted. This would cause changes in visitation to the park, which has increased an average of 1.4% annually for the last 10 years, but would not have impacts beyond the surrounding area. Public outreach, education, and interpretation would be increased to limit negative perceptions related to the use of roundup and euthanasia. As a result, the management actions themselves would affect tourism and recreation and would result in long-term, negligible to minor, adverse impacts on socioeconomics.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and C, and would have long-term, beneficial effects on socioeconomics. Although there would be some long-term, moderate, adverse effects to socioeconomics under alternative C, they would not outweigh the benefits of the cumulative actions described for alternative A. Therefore cumulative effects on socioeconomics would remain long-term and beneficial.

Conclusion. The smaller elk population would have a long-term beneficial effect on socioeconomics by reducing browsing on crops, pasture lands, hay stores, and landscaping on adjacent lands. Costs for fencing and other forms of elk control to protect crops, pastures, livestock food supplies, and landscaping could also decline and would contribute to these beneficial effects. However, there would also be a long-term, moderate, adverse impact on socioeconomics as a result of decreased elk viewing/hunting opportunities that would affect tourism and recreation in the area. Actual roundup and euthanasia and euthanasia activities would contribute to impacts on tourism and recreation if visitors are deterred from traveling to the park. This would have a long-term, adverse, negligible to minor effect on socioeconomics. When the effects of alternative C are combined with the beneficial effects of past, present, and reasonably foreseeable actions, the cumulative impacts would be long-term and beneficial.

Alternative D: Testing and Translocation

Impacts to Adjacent Lands. Reducing and maintaining the elk population to a level between 100 and 400 under alternative D would result in less damage to crops, pastures, and landscaping as a result of decreased grazing pressure. Although the elk population would fluctuate after initial reduction, the temporary growth and potential for impacts to adjacent lands would still be reduced when compared to alternative A. This would have long-term beneficial effects on socioeconomics by reducing impacts on range conditions, loss of hay stores, and replacement and repair costs for food, pastures, fencing and landscaping.

Management actions associated with roundups for translocation would not affect adjacent lands.

Protection Mechanisms and Cost. As in alternative B, costs for fencing and other forms of elk control to protect landscaping, crops, and pastures could decline as the park elk population was reduced. Although the elk population would fluctuate between 100 and 400 after initial reduction, the temporary growth and potential for impacts to protection measures and costs would still be reduced when compared to alternative A. As a result, the time and money spent by adjacent landowners on elk protection measures would be reduced, which would have long-term beneficial effects to socioeconomics, even if some costs may still be incurred.

Management actions associated with roundups for translocations would not affect protection mechanisms or costs.

Impacts to Tourism and Recreation. As stated for alternative B, there is no proven correlation between reducing the elk population and an associated decline in visitation. In addition, outreach, public education and interpretation of elk management and the reasons behind it would be helpful in preventing negative perceptions resulting from alternative D. However, the maintenance of an elk population between 100 and 400 elk would substantially reduce the hunting opportunities outside of the park, which would result in a noticeable decrease in hunting-related expenditures in the local economy that would affect more than just surrounding landowners. As a result, the changes in tourism and recreation once the elk population is reduced and maintained at smaller numbers would have long-term, moderate, and adverse effects on socioeconomics.

Actual testing and translocation activities could deter visitors from traveling to the park during management actions and beyond if they disagree with this approach or if they are concerned that their visit could be disrupted. This would cause changes in visitation to the park, which has increased an average of 1.4% annually for the last 10 years, but would not have impacts beyond the surrounding area. Public outreach, education, and interpretation would be increased to limit negative perceptions related to the use of roundup and euthanasia. As a result, the management actions themselves would affect tourism and recreation and would result in long-term, negligible to minor, adverse impacts on socioeconomics.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and D, and would have long-term, beneficial effects on socioeconomics. Although there would be some long-term, moderate, adverse effects to socioeconomics under alternative D, they would not outweigh the benefits of the cumulative actions described for alternative A. Therefore cumulative effects on socioeconomics would remain long-term and beneficial.

Conclusion. The smaller elk population would have a long-term beneficial effect on socioeconomics by reducing browsing on crops, pasture lands, hay stores, and landscaping on adjacent lands. Costs for fencing and other forms of elk control to protect crops, pastures, livestock food supplies, and landscaping could also decline and would contribute to these beneficial effects. However, there would also be a long-term, moderate, adverse impact on socioeconomics as a result of decreased elk viewing/hunting opportunities that would affect tourism and recreation in the area. Actual testing and translocation activities would contribute to impacts on tourism and recreation if visitors are deterred from traveling to the park. This would have a long-term, adverse, negligible to minor effect on socioeconomics. When the effects of alternative D are combined with the beneficial effects of past, present, and reasonably foreseeable actions, the cumulative impacts would be long-term and beneficial.

Alternative E: Hunting Outside the Park

Impacts to Adjacent Lands. The impacts to adjacent lands from ultimately reducing and maintaining the elk population between 100 and 400 animals under alternative E would be the same as those described under alternative C and D (e.g., less damage to crops, pastures, and landscaping as a result of decreased grazing pressure). This would have long-term beneficial effects on socioeconomics by reducing impacts on range conditions, loss of hay stores, and replacement and repair costs for food, pastures, fencing, and landscaping.

Dispersing elk onto adjacent lands to increase hunting opportunities could have long-term, minor to moderate, adverse impacts during periodic management actions. The potential for damage to crops, pastures, and landscaping would temporarily increase until elk are removed by hunters outside the park. In addition, dispersed elk could cause greater damage to fences on adjacent land, which could require additional repairs. Considering the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from approximately 1,358 elk over the first 5 years to approximately 200 elk every 3 to 4 years thereafter).

Protection Mechanisms and Costs. Costs for fencing and other forms of elk control to protect landscaping, crops, and pastures would decline as the elk population was reduced and maintained at approximately 100 to 400 animals. As a result, decreased time and monetary costs associated with protection measures would have long-term beneficial effects to adjacent landowners, although some costs may still be incurred.

Dispersing elk onto adjacent lands to increase hunting opportunities could have long-term, minor to moderate adverse impacts during management actions. Costs for fencing and other forms of elk control to protect landscaping, crops, and pastures would temporarily increase until elk are removed by hunters outside the park. As described for ‘Impacts to Adjacent Lands,’ the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced.

Impacts to Tourism and Recreation. As stated for alternative B, there is no proven correlation between reducing the elk population and an associated decline in visitation. In addition, outreach, public education and interpretation of elk management and the reasons behind it would be helpful in preventing negative perceptions resulting from alternative E. However, the maintenance of an elk population between 100 and 400 elk would substantially reduce the hunting opportunities outside of the park, which would result in a noticeable decrease in hunting-related expenditures in the local economy that would affect more than just surrounding landowners. As a result, the changes in tourism and recreation once the elk population is reduced and maintained at smaller numbers would have long-term, moderate, and adverse effects on socioeconomics. The adverse impacts would be slightly offset during years when elk are dispersed onto adjacent lands. This would temporarily increase elk available for hunting outside the park, which could result in more recreational visits to the park as well. But, given the assumptions in chapter 2, these benefits would decrease after initial reduction is complete, and periodic maintenance actions are implemented, greatly reducing the scope of the effort (from rounding up approximately 1,358 elk over the first 5 years to approximately 200 elk every 3 to 4 years thereafter) and potentially the number of hunters that would visit the area.

In addition, the actual dispersal and increased hunting opportunities outside the park could deter visitors from traveling to the park during management actions, and beyond, if they disagree with this approach or if they are concerned that their visit could be disrupted. This would cause changes in visitation to the park, which has increased an average of 1.4% annually for the last 10 years, but would not have impacts beyond the surrounding area. Public outreach, education, and interpretation would be increased to limit negative perceptions related to the use of roundup and euthanasia. As a result, the management actions themselves would affect tourism and recreation and would result in long-term, negligible to minor, adverse impacts on socioeconomics.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and E, and would have long-term, beneficial effects on socioeconomics. Although there would be some long-term, moderate, adverse effects to socioeconomics under alternative E, they would not outweigh the benefits of the cumulative actions described for alternative A. Therefore cumulative effects on socioeconomics would remain long-term and beneficial.

Conclusion. The smaller elk population would have a long-term beneficial effect on adjacent socioeconomics by reducing browsing on crops, pasture lands, hay stores, and landscaping on adjacent lands. A corresponding decline in costs for fencing and other forms of elk control to protect crops, livestock food supplies, and landscaping could also be expected and would contribute to these beneficial effects. However, there would also be a long-term, moderate, adverse impact on socioeconomics as a result of decreased elk viewing/hunting opportunities that would affect tourism and recreation in the area. Increased hunting opportunities during years elk are dispersed, including associated recreational trips to the park, would only offset these impacts slightly. In addition, dispersing elk onto adjacent lands could have long-term, minor to moderate adverse impacts during periodic management actions, as a result of temporary increases in the potential for damage to fences, crops, pastures, and landscaping, as well as increased protection costs, until elk are removed by hunters outside the park. Actual management activities under alternative E would contribute to impacts on tourism and recreation if visitors are deterred from traveling to the park. This would have a long-term, adverse, negligible to minor effect on socioeconomics. When the effects of alternative E are combined with the beneficial effects of past, present, and reasonably foreseeable actions, the cumulative impacts would be long-term and beneficial.

Alternative F: Fertility Control (Maintenance Only)

Impacts to Adjacent Lands. Fertility control in free-ranging elk is currently experimental, and requires another alternative for initial reduction. If a fertility control agent could be developed that meets NPS criteria and proves effective at maintaining elk population levels (i.e., 100 to 400) consistent with a lightly grazed system in the park, it would result in less damage to crops, pastures, and landscaping as a result of decreased grazing pressure. Although the elk population could fluctuate after initial reduction, any growth would be minimal if the fertility control agent meets NPS criteria, and potential for impacts to adjacent lands would be reduced when compared to alternative A. This would have long-term beneficial effects on socioeconomics by reducing impacts on range conditions, loss of hay stores, and replacement and repair costs for food, pastures, fencing, and landscaping on adjacent lands.

Management actions associated with roundups for administration of fertility control agents would not affect adjacent lands.

Protection Mechanisms and Cost. As in alternative B, costs for fencing and other forms of elk control to protect landscaping, crops, and pastures could decline as the park elk population was reduced. Although the elk population could fluctuate between 100 and 400 after initial reduction, any growth would be minimal if the fertility control agent meets NPS criteria, and potential for impacts to protection measures and costs would be reduced when compared to alternative A. As a result, the time and money spent by adjacent landowners on elk protection measures would be reduced, which would have long-term beneficial effects to socioeconomics, even if some costs may still be incurred.

Management actions associated with roundups for administration of fertility agents would not affect protection mechanisms or costs.

Impacts to Tourism and Recreation. As stated for alternative B, there is no proven correlation between maintaining a smaller elk population and an associated decline in visitation. In addition, outreach, public education and interpretation of elk management and the reasons behind it would be helpful in preventing negative perceptions resulting from alternative F. However, the maintenance of an elk population between 100 and 400 elk would substantially reduce the hunting opportunities outside of the park, which would result in a noticeable decrease in hunting-related expenditures in the local economy that would affect more than just surrounding landowners. As a result, the changes in tourism and recreation once the elk population is reduced and maintained at smaller numbers would have long-term, moderate, and adverse effects on socioeconomics.

In addition, the actual roundup of elk and administration of fertility control agents annually after initial reduction could deter visitors from traveling to the park during, and beyond, management actions if they disagree with this approach or if they are concerned that their visit could be disrupted. This would cause changes in visitation to the park, which has increased an average of 1.4% annually for the last 10 years, but would not have impacts beyond the surrounding area. Public outreach, education, and interpretation would be increased to limit negative perceptions related to the use of roundup and euthanasia. As a result, the management actions themselves would affect tourism and recreation and would result in long-term, negligible to minor, adverse impacts on socioeconomics.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and F, and would have long-term, beneficial effects on socioeconomics. Although there would be some long-term, moderate, adverse effects to socioeconomics under alternative F, they would not outweigh the benefits of the cumulative actions described for alternative A. Therefore cumulative effects on socioeconomics would remain long-term and beneficial.

Conclusion. Maintaining a smaller elk population would have a long-term beneficial effect on socioeconomics and land owners by reducing browsing on crops, pasture lands, hay stores, and landscaping on adjacent lands. Costs for fencing and other forms of elk control to protect crops, livestock food supplies, and landscaping could also decline and contribute to these beneficial effects. However, there would be long-term, moderate adverse impacts on tourism and recreation as a result of decreased elk viewing/hunting opportunities. Actual management activities under alternative F would contribute to impacts on tourism and recreation if visitors are deterred from traveling to the park. This would have a long-term, adverse, negligible to minor effect on socioeconomics. When the effects of alternative F are combined with the beneficial effects of past, present, and reasonably foreseeable actions, the cumulative impacts would be long-term and beneficial.

Preferred Alternative: Combined Techniques

Impacts to Adjacent Lands. The preferred alternative would have long-term beneficial effects to lands adjacent to the park from the gradual reduction in the elk population. Maintaining the population between 100 and 400 elk would result in reduced pressure on pastures and croplands surrounding the park. This would create the potential for higher yield from crops and more profits. It would reduce the potential for sustained heavy grazing from elk on lands used for cattle ranching. This would reduce impacts on range conditions and loss of hay stores, as well as fencing and landscaping.

There would be no impacts to adjacent lands during management actions associated with direct reduction with firearms and, if necessary, supplemental initial reduction or maintenance actions using roundups and euthanasia/translocation to manage the elk population.

Protection Mechanisms and Costs. A decline in costs for fencing and other forms of elk control to protect landscaping, crops, and pastures could occur as the park elk population was reduced and maintained between 100 and 400 elk. The temporary growth of the elk population and potential for impacts from protection measures and costs would be reduced when compared to alternative A. As a result, the time and money spent by adjacent landowners on elk protection measures would be reduced, which would have long-term beneficial effects to socioeconomics, even if some costs may still be incurred.

Management actions associated with direct reduction with firearms or supplemental initial reduction or maintenance actions using roundups and euthanasia/translocation to manage the elk population would not affect protection mechanisms or costs.

Impacts to Tourism and Recreation. Although elk may be a draw for some visitors in the park, there is no proven correlation between a smaller ungulate population and an associated decline in visitation. In addition, outreach, public education, and interpretation of elk management and the reasons behind it would assist with preventing negative perceptions resulting from a reduction in the elk population. However, the maintenance of an elk population between 100 and 400 elk would substantially reduce the hunting opportunities outside of the park. In response, the number of hunting seasons and licenses could be scaled back, limiting the number of hunters that would travel to the area. As a result, there would be a noticeable decrease in hunting-related expenditures in the local economy that would affect more than just surrounding landowners. The changes in tourism and recreation once the elk population is reduced and maintained at smaller numbers would have long-term, moderate, and adverse effects on socioeconomics.

Annual direct reduction activities and, if necessary, roundup and euthanasia/translocation activities in year 3, could deter visitors from traveling to the park during management actions and beyond if they disagree with this approach or if they are concerned their visit could be disrupted. This would cause changes in visitation to the park, which has increased an average of 1.4% annually for the last 10 years, but would not have impacts beyond the surrounding area. As described above, public outreach, education, and interpretation would be increased to limit negative perceptions related to the use of direct reduction with firearms. As a result, the annual management actions themselves would affect tourism and recreation and would result in long-term, negligible to minor, adverse impacts on socioeconomics.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternative A and the preferred alternative, and would have long-term, beneficial effects on socioeconomics. Although there would be some long-term, moderate, adverse effects to socioeconomics under the preferred alternative, they would not outweigh the benefits of the cumulative actions described for alternative A. Therefore cumulative effects on socioeconomics would remain long-term and beneficial.

Conclusion. The smaller elk population would have a long-term beneficial effect on socioeconomics by reducing browsing on crops, pasture lands, hay stores, and landscaping on adjacent lands. Costs for fencing and other forms of elk control to protect crops, pastures, livestock food supplies, and landscaping could also decline and would contribute to these beneficial effects. However, there would also be a long-term, moderate, adverse impact on socioeconomics as a result of decreased elk viewing/hunting opportunities that would affect tourism and recreation in the area. Annual direct reduction with firearms and roundup and euthanasia/translocation activities in year 3 would contribute to impacts on tourism and recreation if visitors are deterred from traveling to the park. This would have a short and long-term, adverse, negligible to minor effect on socioeconomics.

When the effects of the preferred alternative are combined with the long-term beneficial effects of past, present, and reasonably foreseeable actions, the cumulative impacts would be long-term and beneficial.

LAND MANAGEMENT ADJACENT TO THE PARK

GUIDING REGULATIONS AND POLICIES

The CEQ regulations implementing NEPA (40 CFR 1502.16 and 1506.2(d)) and Director's Order 12 require that the NPS consider the possible conflicts between an action and the objectives of other federal, state, local, or tribal land use plans, policies, and controls for an area.

ASSUMPTIONS, METHODOLOGY, AND INTENSITY THRESHOLDS

The assessment of potential impacts to land management adjacent to the park focuses on the effects of elk management activities within the South Unit on the goals and objectives for, as well as administration of, the surrounding state elk hunting units and USFS lands. Elk management is assumed to be compatible with the goals and objectives of the other land use plans/policies of Billings County, described in the "Related Laws, Policies, Plans, and Constraints" section of chapter 1 and would not affect these other plans and policies. The social and economic effects to adjacent lands are considered under the "Socioeconomics" impact topic discussed previously in this chapter.

As a result, the impact intensities were defined as follows:

Negligible: Goals and objectives for adjacent land management would not be impacted, and there would be minimal changes in how these areas are administered. These changes would not be of any measurable or perceptible consequence.

Minor: Impacts would not preclude an agency's ability to meet goals and objectives for surrounding lands, although there could be some effects that are not compatible. Changes in how areas are administered could occur, but they would be simple and would not appreciably affect the agency responsible for managing the land.

Moderate: Impacts would not be compatible with an agency's goals and objectives for surrounding lands, although impacts would not preclude their ability to meet the related desired conditions. Changes in how areas are administered would be required, but they would be simple and would not appreciably affect the agency responsible for managing the land.

Major: Impacts would not be compatible with an agency's goals and objectives for surrounding lands and would preclude their ability to meet the related desired conditions. Changes in how areas are administered would be required and would appreciably affect the agency responsible for managing the land.

Duration: **Short-term**: Effects would be perceptible on an intermittent basis and would last for less than one year.

Long-term: Effects would be repeatedly perceptible and would last a year or more.

Area of Analysis

The area of analysis for assessment of impacts, including cumulative impacts, of the various alternatives is the South Unit and adjacent lands.

IMPACTS OF THE ALTERNATIVES

Alternative A: No Action (Continue Existing Elk Management Program)

Elk use of areas outside the park currently shows a seasonal pattern (beginning with limited increases in January, increasing through April, and peaking in June), but this could change as the population grows and pressure for food sources causes elk to leave the park more regularly. A greater number of elk outside the park could require the state to substantially change management options outside the park to help control population growth and depredation associated with a larger elk population (as evidenced by the changes made between 2007 and 2008; see "Land Management Adjacent to the Park" section in chapter 3).

A larger elk population that spends more time outside the park could also reduce forage available for cattle that graze on surrounding lands. Increased elk grazing could require that the USFS reduce permitted grazing to continue to meet vegetation objectives while still providing some grazing opportunities in the management areas in the vicinity of the park. Management goals for wildlife in USFS management areas with more of an emphasis on natural resources (including Non-motorized Backcountry Recreation and Rangeland with Diverse Natural-Appearing Landscapes described in chapter 3) generally pertain to management indicator species, threatened and endangered species, and sensitive species, and do not address elk. A larger elk population would have limited effects on USFS goals related to these other wildlife because elk generally do not use areas within the Little Missouri National Grasslands where these species occur. Therefore, impacts to land management adjacent to the park would be long-term, minor to moderate, and adverse as a result of changes that could occur in management (please see "Socioeconomics" section for a discussion of impacts to private lands).

Cumulative Impacts. Oil and gas development outside the park has and will continue to influence land management adjacent to the South Unit. These developments are found in USFS management areas (including Non-motorized Backcountry Recreation) and are managed per current planning documents (the Land and Resource Management Plan for the Dakota Prairie Grasslands). Grazing activities around the park, including those permitted by the Medora Grazing Association on USFS lands, also influence management operations per current planning documents. In recent years, the state of North Dakota has made attempts to increase elk hunting opportunities outside the South Unit by adding hunting seasons, increasing permits, and increasing the number of elk that can be taken. These activities have long-term, negligible to minor adverse impacts on land management adjacent to the park. When combined with the potential long-term, minor to moderate impacts from alternative A, there would be long-term, minor adverse impacts to land management adjacent to the South Unit.

Conclusion. There would be long-term, minor to moderate, adverse impacts on land management adjacent to the park as a result of potential changes to how the state manages the surrounding hunting units and as a result of effects on management of grazing programs on USFS lands. Past, present, and reasonably foreseeable future actions, when combined with the effects of alternative A, would have long-term, minor adverse impacts on land management adjacent to the park.

Alternative B: Direct Reduction with Firearms

The gradual reduction (over 5 years) and annual maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) within the South Unit would likely reduce the number of elk that temporarily move outside the park, and in turn hunting opportunities. This could potentially result in changes to state management options outside the park for controlling elk population growth. These impacts would not preclude the state's ability to meet goals and objectives for surrounding lands, although there could be some effects that are not compatible (e.g., a reduction in elk hunting opportunities). As a result, there would be long-term, minor, adverse impacts to the state.

The smaller elk population would reduce the potential for impacts to grazing operations as a result of overuse and would reduce management of depredation issues on grazing lands. The potential impacts on goals and objectives for vegetation in these areas would also be reduced. There would be minimal change in potential effects from elk on goals for other wildlife, as elk and these other species tend to use different parts of the Little Missouri National Grassland. As a result, there would be limited beneficial effects on USFS management of lands surrounding the park (please see "Socioeconomics" section for a discussion of impacts to private lands).

Management actions under this alternative would be conducted only within the South Unit and would not affect goals and objectives for, or administration of, surrounding lands.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and B and would have long-term, minor effects on land management adjacent to the park. When combined with the long-term, beneficial effects of reducing the elk population, there would be long-term, minor adverse cumulative effects.

Conclusion. The reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long term, minor, adverse impacts on the state as a result of changing management actions in light of fewer hunting opportunities. Limited long-term, beneficial effects would occur for the USFS by reducing the potential for impacts to grazing operations and management of depredation issues on grazing lands; and reducing the potential for impacts to vegetation goals. Management actions under this alternative would be conducted only within the South Unit and would not affect goals and objectives for, or administration of, surrounding lands. Past, present, and reasonably foreseeable future activities, when combined with the impacts of alternative B, would have long-term, minor adverse cumulative effects on land management adjacent to the park.

Alternative C: Roundup and Euthanasia

The potential for impacts to adjacent land management would be substantially reduced compared to alternative A by rapidly reducing the elk population within 1 year, and maintaining it at levels consistent with a lightly grazed system (i.e., between 100 and 400 animals). Although the elk population would fluctuate between 100 and 400 elk after initial reduction, a population this size would likely reduce the number of elk that temporarily move outside the park, and in turn hunting opportunities. This could potentially result in changes to state management options outside the park for controlling elk population growth. These impacts would not preclude the state's ability to meet goals and objectives for surrounding lands, although there could be some effects that are not compatible (e.g., a reduction in elk hunting opportunities). As a result, there would be long-term, minor, adverse impacts to the state.

The smaller elk population would reduce the potential for impacts to grazing operations as a result of overuse and would reduce management of depredation issues on grazing lands. The potential impacts on goals and objectives for vegetation in these areas would also be reduced. There would be minimal change in potential effects from elk on goals for other wildlife, as elk and these other species tend to use different parts of the Little Missouri National Grassland. As a result, there would be limited beneficial effects on USFS management of lands surrounding the park (please see "Socioeconomics" section for a discussion of impacts to private lands).

Management actions associated with alternative C would not affect land management adjacent to the park as they would be carried out in the South Unit and at an offsite commercial facility.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and C and would have long-term, minor effects on land management adjacent to the park. When combined with the long-term, beneficial effects from reducing the elk population there would be long-term minor adverse cumulative effects.

Conclusion. The reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long term, minor, adverse impacts on the state as a result of changing management actions in light of fewer hunting opportunities. Limited long-term, beneficial effects would occur for the USFS by reducing the potential for impacts to grazing operations and management of depredation issues on grazing lands; and reducing the potential for impacts to vegetation goals. Actions under this alternative would be conducted only within the South Unit and would not affect goals and objectives for, or administration of, surrounding lands. Past, present, and reasonably foreseeable future activities, when combined with the impacts of alternative C, would have long-term, minor adverse cumulative effects on land management adjacent to the park.

Alternative D: Testing and Translocation

The gradual reduction (over at least 3 years) and periodic maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) within the South Unit would likely reduce the number of elk that temporarily move outside the park, and in turn hunting opportunities. This could potentially result in changes to state management options outside the park for controlling elk population growth. These impacts would not preclude the state's ability to meet goals and objectives for surrounding lands, although there could be some effects that are not compatible (e.g., a reduction in elk hunting opportunities). As a result, there would be long-term, minor, adverse impacts to the state.

The smaller elk population would reduce the potential for impacts to grazing operations as a result of overuse and would reduce management of depredation issues on grazing lands. The potential impacts on goals and objectives for vegetation in these areas would also be reduced. There would be minimal change in potential effects from elk on goals for other wildlife, as elk and these other species tend to use different parts of the Little Missouri National Grassland. As a result, there would be limited beneficial effects on USFS management of lands surrounding the park (please see "Socioeconomics" section for a discussion of impacts to private lands).

Roundups associated with alternative D would not affect land management adjacent to the park as they would be carried out in the South Unit, nor would translocations themselves.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and D and would have long-term, minor effects on land management adjacent to the park. When combined with the long-term, beneficial effects from reducing the elk population there would be long-term, minor, adverse cumulative effects.

Conclusion. The reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long term, minor, adverse impacts on the state as a result of changing management actions in light of fewer hunting opportunities. Limited long-term, beneficial effects would occur for the USFS by reducing the potential for impacts to grazing operations and management of depredation issues on grazing lands; and reducing the potential for impacts to vegetation goals. Roundups for translocations would not affect management of adjacent lands. Past, present, and reasonably foreseeable future activities, when combined with the impacts of alternative D, would have long-term, minor adverse cumulative effects on land management adjacent to the park.

Alternative E: Hunting Outside the Park

The gradual reduction (over at least 5 years) and periodic maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) would likely reduce the number of elk that temporarily move outside the park, and in turn hunting opportunities. This could potentially result in changes to state management options outside the park for controlling elk population growth. These impacts would not preclude the state’s ability to meet goals and objectives for surrounding lands, although there could be some effects that are not compatible (e.g., a reduction in elk hunting opportunities). As a result, there would be long-term, minor, adverse impacts to the state.

The reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long term, minor, adverse impacts on the state as a result of changing management actions in light of fewer hunting opportunities. Limited long-term, beneficial effects would occur for the USFS by reducing the potential for impacts to grazing operations and management of depredation issues on grazing lands; and reducing the potential for impacts to vegetation goals.

Directed dispersals to increase hunting opportunities would temporarily increase the impacts to surrounding land management during initial reduction and maintenance as a result of increased oversight and coordination needed to manage state actions. Potential increases in depredation from increased elk use of adjacent lands after dispersal before they are removed would contribute to these effects. It is expected that state actions would require a substantial amount of oversight, and would cause substantial changes to management options adjacent to the park. As a result, there could be long-term moderate adverse impacts during periodic management actions.

Considering the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 1,358 elk over the first 5 years to approximately 200 elk every 3 to 4 years thereafter).

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and E and would have long-term, minor effects on land management adjacent to the park. When combined with the short-term, negligible adverse impacts and the long-term, beneficial effects from reducing the elk population, there would be long-term, minor, adverse cumulative effects.

Conclusion. The reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long term, minor, adverse impacts on the state as a result of changing management actions in light of fewer hunting opportunities. Limited long-term, beneficial effects would occur for the USFS by reducing the potential for impacts to grazing operations and management of depredation issues on grazing lands; and reducing the potential for impacts to vegetation goals. Increasing the elk population on surrounding lands following directed dispersal—prior to removal during state actions—as well as the changes needed to implement state actions would have long-term, negligible to moderate adverse impacts to land management adjacent to the park. Past, present, and reasonably foreseeable future activities, when combined with the impacts of alternative E, would have long-term, minor adverse cumulative effects on land management adjacent to the park.

Alternative F: Fertility Control (Maintenance Only)

Fertility control in free-ranging elk is currently experimental, and requires another alternative for initial reduction. If a fertility control agent could be developed that meets NPS criteria and proves effective at maintaining elk population levels (i.e., 100 to 400) consistent with a lightly grazed system in the park, a population this size would likely reduce the number of elk that temporarily move outside the park, and in turn hunting opportunities. This could potentially result in changes to state management options outside the park for controlling elk population growth. The state could also alter management outside the park to address the presence of female elk that have been treated with fertility control agents. These impacts would not preclude state's ability to meet goals and objectives for surrounding lands, although there could be some effects that are not compatible (e.g., fewer elk hunting opportunities and the presence of female elk treated with fertility control agents). As a result, there would be long-term, minor, adverse impacts to the state.

The smaller elk population would reduce the potential for impacts to grazing operations as a result of overuse and would reduce management of depredation issues on grazing lands. The potential impacts on goals and objectives for vegetation in these areas would also be reduced. There would be minimal change in potential effects from elk on goals for other wildlife, as elk and these other species tend to use different parts of the Little Missouri National Grassland. As a result, there would be limited beneficial effects on USFS management of lands surrounding the park (please see "Socioeconomics" section for a discussion of impacts to private lands).

Roundups associated with alternative F would not affect land management adjacent to the park as fertility control would only be conducted within the South Unit.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and E and would have long-term, minor effects on land management adjacent to the park. When combined with the short-term, negligible adverse impacts and the long-term, beneficial effects from reducing the elk population, there would be long-term, minor, adverse cumulative effects.

Conclusion. The reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long term, minor, adverse impacts on the state as a result of changing management actions in light of fewer hunting opportunities. Limited long-term, beneficial effects would occur for the USFS by reducing the potential for impacts to grazing operations and management of depredation issues on grazing lands; and reducing the potential for impacts to vegetation goals. Roundups for fertility control would not affect management of adjacent lands. Past, present, and reasonably foreseeable future activities, when combined with the impacts of alternative F, would have long-term, minor adverse cumulative effects on land management adjacent to the park.

Preferred Alternative: Combined Techniques

The gradual reduction (over 3 to 5 years) and annual maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) within the South Unit would likely reduce the number of elk that temporarily move outside the park, and in turn hunting opportunities. This could result in changes to state management options outside the park for controlling elk population growth. These impacts would not preclude the state's ability to meet goals and objectives for surrounding lands, although there could be some effects that are not compatible (e.g., a reduction in elk hunting opportunities). As a result, there would be long-term, minor, adverse impacts to the state.

The smaller elk population would reduce the potential for impacts to grazing operations as a result of overuse and would reduce management of depredation issues on grazing lands. The potential impacts on goals and objectives for vegetation in these areas would also be reduced. There would be minimal change in potential effects from elk on goals for other wildlife, as elk and these other species tend to use different parts of the Little Missouri National Grassland. As a result, there would be limited beneficial effects on USFS management of lands surrounding the park (refer to the "Socioeconomics" section for a discussion of impacts to private lands).

Firearm use to initially reduce and maintain the elk population under this alternative would be conducted only within the South Unit and would not affect goals and objectives for, or administration of, surrounding lands. If roundup and euthanasia/translocation are necessary, these management actions would not affect land management adjacent to the park because these activities would be carried out in the South Unit and at an offsite commercial facility (euthanasia).

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternative A and the preferred alternative and would have long-term, minor effects on land management adjacent to the park. When combined with the long-term, beneficial effects of reducing the elk population, there would be long-term, minor adverse cumulative effects.

Conclusion. The reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long term, minor, adverse impacts on the state as a result of changing management actions in light of fewer hunting opportunities. Limited long-term, beneficial effects would occur for the USFS by reducing the potential for impacts to grazing operations and management of depredation issues on grazing lands; and reducing the potential for impacts to vegetation goals. Management actions under this alternative would be conducted only within the South Unit and would not affect goals and objectives for, or administration of, surrounding lands. Past, present, and reasonably foreseeable future activities, when combined with the impacts of the preferred alternative, would have long-term, minor adverse cumulative effects on land management adjacent to the park.

VISITOR USE AND EXPERIENCE

GUIDING REGULATIONS AND POLICIES

The NPS *Management Policies 2006* (NPS 2006a) state that the enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks and that the National Park Service is committed to providing appropriate, high-quality opportunities for visitors to enjoy the parks.

The importance of visitor use and experience is highlighted in Theodore Roosevelt National Park's purpose that states that the park will conserve, unimpaired, the scenery and the natural and cultural resources, and facilitate scientific interests in the park as well as provide for the benefit, use, and enjoyment of the people. The value of the visitor experience is also stated in the park's significance, which emphasizes the variety of natural and cultural resource experiences that the park provides to visitors. These include opportunities to view wildlife, the recovery of native flora and fauna, and management of exotic species.

While preservation and conservation are key components of the NPS *Management Policies 2006*, they also instruct park units to provide for recreational opportunities. The National Park Service achieves its preservation and conservation purposes by working to maintain all native plants and animals as parts of the natural ecosystem, emphasizing preservation and conservation over recreation. The National Park Service will achieve this by preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems in which they are found (NPS 2006a, Section 4.4.1).

ASSUMPTIONS, METHODOLOGY, AND INTENSITY THRESHOLDS

Past visitor use data, comments from the public, and personal observations of visitation patterns were used to estimate the effects of the alternative actions on visitors, including soundscapes. The impact on the ability of visitors to experience a full range of resources in the South Unit was analyzed by examining resources mentioned in the park's significance statement. It is assumed that visitation will increase approximately 1.5% per year in the immediate future, based on the average increase in park visitation to the South Unit from 1998 to 2007. The thresholds for the intensity of an impact are defined as follows:

Negligible: The impact would be barely detectable and/or would affect few visitors. Visitors would not likely be aware of the effects associated with management actions.

Minor: The impact would be detectable and/or would only affect some visitors. Visitors would likely be aware of the effects associated with management actions. The changes in visitor use and experience would be slight but detectable; however, visitor satisfaction would not be measurably affected.

Moderate: The impact would be readily apparent and/or would affect many visitors. Visitors would be aware of the effects associated with management actions. Visitor satisfaction might be measurably affected (visitors could be either satisfied or dissatisfied). Some visitors would choose to pursue activities in other available local or regional areas.

Major: The impact would affect the majority of visitors. Visitors would be highly aware of the effects associated with management actions. Changes in visitor use and experience would be readily apparent. Some visitors would choose to pursue activities in other available local or regional areas.

Duration: **Short-term**: Effects would be perceptible to visitors only temporarily and/or these management actions would persist for less than one year.

Long-term: Effects would be repeatedly perceptible to visitors, lasting for at least a year or more.

Area of Analysis

The area of analysis is the South Unit of Theodore Roosevelt National Park for all alternatives, including cumulative assessments.

IMPACTS OF THE ALTERNATIVES

Alternative A: No Action (Continue Existing Elk Management Program)

Visitor Experience Impacts. With no measures to actively reduce the number of elk in the South Unit, it is expected that the elk population under alternative A would continue to grow, with limited decreases that could result from variables such as herd health or weather conditions in any particular year. Routine research and monitoring would continue, including annual surveys for population estimates, movement/distribution studies, population dynamics, and vegetation monitoring.

The most common activities visitors engage in at Theodore Roosevelt National Park are viewing wildlife and taking pictures, with other popular activities including visiting the museum, horseback riding, camping, and participating in interpretive programs. Current routine research and monitoring activities would not impact the areas visitors could access or what visitors would view while there were visiting the South Unit as this alternative would not include any park closures or restrictions.

As part of Theodore Roosevelt National Park's ecosystem, elk play an important role and are valued by wildlife viewers. Surveys of park visitors indicate that approximately 88% spend their time viewing wildlife, with only 26% seeing elk during their visit (NPS 2002c). Opportunities to see elk could increase as the elk population increases which could benefit park visitors that desire this experience. However, an increase in population could result in increased competition for resources with other wildlife, and have adverse impacts on those species, many of which park visitors also want to see. If the increase in the elk population results in the decrease of other populations in the South Unit, such as mule deer, or should bison and feral horse populations have to be reduced more than normal, visitor experience could be adversely affected.

Those park visitors who indicated they spend their time viewing other wildlife also experienced the natural setting and habitat of those animals, including vegetation. As the elk population continues to increase, foraging on native vegetation in the South Unit would also increase, decreasing the diversity and abundance of these species in elk use areas, and increasing the potential spread of exotic species. This would affect not only the habitat for wildlife, but could also cause a change in distribution of wildlife. For those visitors wanting to see native wildlife in their habitat, there could be long-term, minor to moderate adverse impacts to visitor use and experience. These impacts would mainly be felt by those visiting the South Unit in the spring, summer, and fall months. Those engaging in winter activities would not notice a change in vegetation.

Current educational and interpretive programs available to park visitors would continue under the no action alternative. These programs may decrease some adverse impacts to park visitors as they would educate visitors about the effects of an unmanaged elk population on South Unit resources, including the changes in diversity and abundance of wildlife and vegetation.

Noise Impacts. The soundscapes at Theodore Roosevelt National Park are those associated with a backcountry experience, where natural sounds predominate. Some traffic noise can be heard along the boundaries of the South Unit, but does not dominate the soundscape. Under this alternative, no management actions, other than continued routine research and monitoring, would be taken that would alter the soundscape of the South Unit. On an annual basis, noise associated with the small aircraft used to conduct the annual aerial survey of the elk population would be temporary, lasting only a few hours, a day or two a year, and would not alter the soundscape of the South Unit. Therefore, impacts would be long-term, negligible, and adverse.

Cumulative Impacts. Many past actions have had long-term beneficial effects on the current visitor experience at the South Unit, including reintroduction of elk; exotic plant management; elk, bison, and horse management; management of adjacent lands including elk hunting; prescribed burns; and wildland fires.

Past actions, many of which continue today, that contribute to an adverse experience for the park visitor include visual intrusions and/or noise from oil and gas development; siting cell towers; traffic/trains; use of firearms on adjacent lands; park operations that use aircraft, off-road vehicles, and/or large work crews; lights near the park boundaries; rural development, including the conversion of ranches to ranchettes; Actions the park has taken, and will continue to take, to manage wildlife and their habitat (such as prescribed burns, roundups of elk and bison, etc.) have short-term effects from closures or changes in the visual appearance of the park, but would have beneficial effects to the visitor experience, as these actions result in a more natural viewing experience. The lack of natural predators in the park may also have an adverse effect on visitors wishing to see native wildlife.

Reasonably foreseeable future actions, which involve further development of the area, would contribute to adverse impacts to visitor use and experience. Construction of a coal gasification plant near South Heart could affect air quality, and road and other highway construction or improvements would temporarily introduce construction noise to the area in the. Introduction of new noise into the soundscape would detract from the current visitor experience at the South Unit. The conversion of large ranches to small ranchettes could also adversely impact the visitor experience by changing the rural character of the area surrounding the park, but these changes would be expected to be negligible. Overall, the combination of past, present, and reasonably foreseeable future actions when combined with alternative A would have long-term, minor, adverse impacts to visitor use and experience.

Conclusion. Impacts to visitors under alternative A would be both beneficial and adverse, with long-term benefits for visitors who are primarily interested in viewing elk, and long-term, minor to moderate adverse impacts to visitors that enjoy other wildlife in their native habitats. As no elk management actions would be taken, there would be no impacts to visitors from closures. Impacts to soundscapes would be negligible from annual aerial population surveys. Beneficial effects would also result from the continuation of interpretive programs at the park. However, overall impacts would be long-term, minor to moderate, and adverse as not managing the elk population in the South Unit would adversely impact other areas of the South Unit and other wildlife viewing experiences. Cumulative impacts under alternative A would be long-term, minor, and adverse.

Alternative B: Direct Reduction with Firearms

Visitor Experience Impacts. The gradual reduction (over 5 years) and annual maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) within the South Unit would have long-term beneficial effects to visitors as a lightly grazed system would be maintained in elk use areas, and would allow other wildlife, their habitat, and the associated vegetation to be observed in natural conditions. For those visitors wishing to see elk, reduction of the population would decrease the chance for seeing elk. Based on one survey, approximately 26% of visitors to Theodore Roosevelt National Park saw an elk during their visit and this percentage could decline. Although the chances of seeing elk could go down, it is unlikely that a decline in the elk population would be noticed by most visitors, resulting in negligible to minor adverse impacts for those visitors.

Under alternative B, both initial reduction and maintenance activities would be taken during the fall and winter months. While most meat would be donated, a small number of carcasses could be left in the South Unit given the difficulty for removal and recovery in this environment. As a result, there would be some potential for visitors to encounter wastes or carcasses from direct reduction activities. Landfills would be used for surface disposal per state requirements, as needed (e.g., if CWD is found) and would not affect visitors.

During the first 5 years of initial reduction, up to 275 elk would be removed per year, and 20 to 24 would be taken annually thereafter for maintenance. Although management actions could last several months during fall and winter for initial reduction, closures in any one area of the South Unit are not expected to last more than a week. During the maintenance phase, the time required for these activities would be minimal.

As described under alternative A, one of the most popular activities at Theodore Roosevelt National Park is viewing wildlife and taking pictures. Visitor use under alternative B would be mainly affected by the closures required to conduct the management actions. Direct reduction would be implemented during the fall and winter, when visitation is low. Few visitors would be affected because most visitation occurs in June, July, and August, with visitation dropping off slightly in September and more drastically in October through April. Those camping at the Cottonwood Campground could be impacted by noise or closures associated with direct reduction actions, although the duration of these closures would be short as described above. Users of the Roundup Group Horse Campground are less likely to be affected as this campground is closed between November and March.

Some winter users do visit the South Unit of the park and could be impacted by any closures required for shooting activities as management actions would be taken during the day. These impacts would be long-term, occurring annually, and would decrease from several months to a matter of days once initial reduction is complete. While one area of the South Unit could be closed for management, other areas would be available for those wishing to engage in winter activities, and these uses would not be precluded.

Current educational and interpretive programs available to park visitors would be expanded under alternative B, to help communicate the purpose and need for the elk management program and explain potential effects, which would offset some of the adverse impacts. The public would be notified of any park closures in advance of the activities and information would be provided to the public on the park website and the visitor centers. Considering these factors impacts to visitor use and experience would be long-term, minor to moderate, and adverse during annual management actions.

Noise Impacts. The natural soundscape found at Theodore Roosevelt National Park would be affected by noise from direct reduction efforts; however, these activities, with the exception of the use of firearms, would have similar impacts to routine activities that occur in the park (e.g., roundups for bison and horses), and would occur during times of year with low visitation. Although firearms are used routinely outside of the park during hunting season, their use in the South Unit would create a substantial noise intrusion on the natural soundscape. These impacts would occur over several months for the first 5 years of initial reduction and would be less frequent during annual population maintenance, resulting in intermittent, long-term, minor to moderate, adverse impacts. Routine research and monitoring would contribute minimally to these impacts, as described for alternative A. If used, firearm noise suppressors could offset some of these impacts.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities expected under alternative A would apply under alternative B. When combined with the impacts of alternative B, there would be long-term, minor, and adverse cumulative effects.

Conclusion. The reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term, negligible to minor, adverse impacts to those visitors that include seeing elk as part of their visitor experience as a decrease in the population could result in a decreased chance of seeing elk. These impacts would be partially off set by long-term benefits from the overall enhancement to the vegetation, wildlife, and wildlife habitat in elk use areas through elk management that would improve the experience of those visitors wanting to see all of the resources of the South Unit in their natural condition. Alternative B would have long-term, minor to moderate, adverse impacts of short duration adverse impacts as some visitors may be affected by closures and noise from firearms within the park during annual management actions. Cumulative impacts under alternative B would be long-term, minor, and adverse.

Alternative C: Roundup and Euthanasia

Visitor Experience Impacts. The rapid reduction of the elk population within 1 year, and maintaining it at levels consistent with a lightly grazed system (i.e., between 100 and 400 animals), would have the same long-term beneficial impacts to visitors as described for alternative B, including the opportunity to view vegetation, wildlife, and wildlife habitat in natural conditions. However, these benefits would be realized sooner under alternative C as initial reduction would last one year versus five years under alternative B. For those visitors wishing to see elk, reduction of the population could decrease the chance, but would only have negligible to minor, long-term adverse impacts as it is unlikely the decline would be noticed by most visitors.

Visitor use under alternative C would be mainly affected by the closures required to conduct the roundups. This alternative could include closing certain areas of the South Unit on rare occasion. Although this is a possibility, it is expected that any closure would be temporary and not last in any one place for more than a day or two. Activities related to euthanasia would occur off-site or at the park handling facility in the South Unit and would not impact visitor access to any area of the South Unit. Few visitors would be affected during either of these activities because most visitation is in June, July, and August, with visitation dropping off slightly in September and more drastically in October through April. Those camping at the Cottonwood Campground could be impacted by noise or closures associated with roundups, although the duration of these closures would be short as described above. Users of the Roundup Group Horse Campground are less likely to be affected as this campground is closed between November and March.

As described under alternative B, those wishing to engage in winter uses may be impacted by any closures required. As with alternative B, the majority of users would be able to recreate in one area of the South Unit, even if another area is closed. Considering the assumptions described in chapter 2, the potential for such impacts would be greatest in the first year, but would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 800 elk the first year to approximately 200 elk every 3 to 4 years thereafter). The associated impacts would be intermittent over the life of this plan, and would last only a matter of days when management actions are implemented. Given the scope and frequency of these operations, and based on past experience with elk roundups, and periodic bison and feral horse roundups, these impacts would be long-term, moderate, and adverse.

Visitors would not be exposed to the actual euthanasia of an animal. In all instances, the public would be notified of any South Unit closures in advance of the activities and information would be provided to the public on the park website and the visitor centers. Current educational and interpretive programs available to park visitors would also be expanded under alternative C, to help communicate the purpose and need for the elk management program and explain potential effects, which would offset some of the adverse impacts.

Noise Impacts. The natural soundscape found at Theodore Roosevelt National Park would be affected by noise from roundups, primarily the use of helicopters; however, the effects would be similar to those experienced during normal roundup operations at the park; would occur during times of year with low visitation; and would only occur over a few days. Further, these impacts would be more pronounced during the initial reduction and would be expected to decrease and be less frequent after year 5 for population maintenance. As a result, the impacts to the soundscape from helicopter flights would be long-term, minor, and adverse. Routine research and monitoring would contribute minimally to these impacts, as described for alternative A.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities expected under alternative A would occur under alternative C. As a result, when combined with the effects of alternative C, the cumulative impacts would be long-term, minor, and adverse.

Conclusion. There would be long-term, negligible to minor adverse impacts to those visitors that include seeing elk as part of their visitor experience. These impacts would be partially off set by the overall enhancement to wildlife and wildlife habitat in elk use areas that would improve the experience of those visitors wanting to see all of the resources in the South Unit in natural conditions. Alternative C would have long-term, minor to moderate adverse impacts as visitors may be restricted from engaging in a desired activity during management actions and would be exposed to noise associated with normal roundup operations. Visitors would not be impacted by the actual euthanasia of the elk, as this would be handled off-site, or within the NPS handling facility and would not be exposed to elk carcasses. Cumulative impacts under alternative C would be long-term, minor, and adverse.

Alternative D: Testing and Translocation

Visitor Experience Impacts. As with alternative B, the gradual reduction (over at least 3 years per assumptions in chapter 2) and annual maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) within the South Unit would have long-term beneficial effects because other wildlife, their habitat, and the associated vegetation would be observed in natural conditions. For those visitors wishing to see elk, reduction of the population could decrease the chance, but would only have negligible to minor, long-term adverse impacts given the limited numbers that currently see elk.

Visitor use under alternative D would be mainly affected by the closures required to conduct the roundups for CWD testing and translocation. This alternative could include closing certain areas of the South Unit on rare occasion. Although this is a possibility, it is expected that any closure would be temporary and not last in any one place for more than a day or two. As with alternative B, those camping at the Cottonwood Campground could be impacted by noise or closures associated with roundups, although the duration of these closures would be short as described above. Users of the Roundup Group Horse Campground are less likely to be affected as this campground is closed between November and March. As described under alternative B, those wishing to engage in winter uses may be impacted by any closures required for roundups.

Considering the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 1,036 elk over the first 3 years to approximately 375 elk in year 10). As with alternative B, the majority of users would be able to recreate in one area of the South Unit, even if another area is closed, and it is likely that access to the Little Missouri River for winter activities would not be precluded completely. Given the scope and frequency of these operations and past experience with elk, bison, and feral horse roundups, impacts to visitor use from closures would be long-term, moderate, and adverse. Routine research and monitoring would contribute minimally to these impacts.

In all instances, the public would be notified of any South Unit closures in advance of the activities and information would be provided to the public on the park website and the visitor centers. Current educational and interpretive programs available to park visitors would also be expanded under alternative D, to help communicate the purpose and need for the elk management program and explain potential effects, which would offset some of the adverse impacts.

Noise Impacts. The natural soundscape found at Theodore Roosevelt National Park would be affected by noise from roundups, primarily the use of helicopters; however, the effects would be similar to those experienced during normal roundup operations at the park; would occur during times of year with low visitation; and would only occur over a few days. Further, these impacts would be more pronounced during the initial reduction and would be expected to decrease and be less frequent after year 5 for population maintenance. As a result, the impacts to the soundscape from helicopter flights would be long-term, minor, and adverse. Routine research and monitoring would contribute minimally to these impacts, as described for alternative A.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities expected under alternative A would occur under alternative D. As a result, when combined with the effects of alternative D, the cumulative impacts would be long-term, minor, and adverse.

Conclusion. There would be long-term, negligible to minor adverse impacts to those visitors that include seeing elk as part of their visitor experience. These impacts would be partially off set by the overall enhancement to wildlife and wildlife habitat in elk use areas that would improve the experience of those visitors wanting to see all of the resources in the South Unit in natural conditions. Alternative D would have long-term, minor to moderate adverse impacts as visitors may be restricted from engaging in a desired activity during management actions and would be exposed to noise associated with normal roundup operations. Cumulative impacts under alternative D would be long-term, minor, and adverse.

Alternative E: Hunting Outside the Park

Visitor Experience Impacts. As with alternative B, the gradual reduction (over at least 5 years per assumptions in chapter 2) and annual maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) within the South Unit would have long-term beneficial effects because other wildlife, their habitat, and the associated vegetation could be observed in natural conditions. For those visitors wishing to see elk, reduction of the population would decrease the chance, but would only have negligible to minor, long-term adverse impacts as it is unlikely the decline would be noticed by most visitors.

Dispersing elk out of the park to increase hunting opportunities would have similar impacts to those associated with normal roundup operations described for alternatives C and D, including the potential for closures. It is expected that any closure would be temporary and not last in any one place for more than a few days. In addition, the NPS would attempt to minimize the distance elk would have to be driven, minimizing the area that would have to be closed. Few visitors would be affected during dispersals, which would be conducted in fall and winter, because most visitation is in June, July, and August, with visitation dropping off slightly in September and more drastically in October through April. As with alternative B, those camping at the Cottonwood Campground could be impacted by noise or closures associated with dispersals, although the duration of these closures would be short as described above. Users of the Roundup Group Horse Campground are less likely to be affected as this campground is closed between November and March. As described under alternative B, those wishing to engage in winter uses may be impacted by any closures required for roundups.

Considering the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 1,358 elk over the first 5 years to approximately 200 elk every 3 to 4 years thereafter). As with alternative B, the majority of users would be able to recreate in one area of the South Unit, even if another area is closed, and it is likely that access to the Little Missouri River for winter activities would not be precluded completely. Given the scope and frequency of these operations, impacts to visitor use from closures would be long-term, moderate, and adverse. Routine research and monitoring would contribute minimally to these impacts.

In all instances, the public would be notified of any South Unit closures in advance of the activities and information would be provided to the public on the park website and the visitor centers. Current educational and interpretive programs available to park visitors would also be expanded under alternative E, to help communicate the purpose and need for the elk management program and explain potential effects, which would offset some of the adverse impacts.

Increased hunting opportunities outside the park are expected to have similar impacts to those described for alternative B, but the impacts would be less intense considering distance from the park. Because few visitors would be at the park, the chance that visitor experience would be disturbed is greatly reduced. As a result, there would be long-term, minor, adverse impacts on visitor use.

Noise Impacts. The natural soundscape found at Theodore Roosevelt National Park would be affected by noise from directed dispersals, primarily the use of helicopters; however, the effects would be similar to those experienced during normal roundup operations at the park; would occur during times of year with low visitation; would only occur over a few days.; and would ultimately be concentrated near the park boundary. Further, these impacts would be more pronounced during the initial reduction and would be expected to decrease and be less frequent after year 5 for population maintenance. As a result, the impacts to the soundscape from helicopter flights would be long-term, negligible, and adverse. Routine research and monitoring would contribute minimally to these impacts, as described for alternative A. Increased hunting opportunities outside the park are expected to have similar impacts to those described for alternative B, but the impacts would be less intense considering distance from the park. The impacts to the soundscape would be long-term, minor, adverse impacts.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities expected under alternative A would occur under alternative E. As a result, when combined with the effects of alternative E, the cumulative impacts would be long-term, minor, and adverse.

Conclusion. There would be long-term, negligible to minor adverse impacts to those visitors that include seeing elk as part of their visitor experience. These impacts would be partially off set by the overall enhancement to wildlife and wildlife habitat in elk use areas that would improve the experience of those visitors wanting to see all of the resources in the South Unit in natural conditions. Alternative E would have long-term, minor to moderate adverse impacts as visitors may be restricted from engaging in a desired activity during management actions and would be exposed to noise associated with directed dispersals, as well as the increased hunting opportunities around the park. These impacts would be similar to those that occur during normal roundup operations in the park. Cumulative impacts under alternative E would be long-term, minor, and adverse.

Alternative F: Fertility Control (Maintenance Only)

Visitor Experience Impacts. Fertility control in free-ranging elk is currently experimental, and requires another alternative for initial reduction. If a fertility control agent could be developed that meets NPS criteria and proves effective at maintaining elk population levels (i.e., 100 to 400) consistent with a lightly grazed system in the park, it could have long-term beneficial effects because other wildlife, their habitat, and the associated vegetation would be observed in natural conditions. For those visitors wishing to see elk, maintaining a smaller population could decrease the chance, but would only have negligible to minor, long-term adverse impacts as it is unlikely the decline would be noticed by most visitors.

Rounding up elk for fertility control would have similar impacts to those associated with normal roundup operations described for alternatives C and D, including the potential for closures. It is expected that any closure would be temporary and not last in any one place for more than a few days. Few visitors would be affected during these roundups, which would be conducted in winter, because most visitation is in June, July, and August, with visitation dropping off slightly in September and more drastically in October through April. As with alternative B, those camping at the Cottonwood Campground could be impacted by noise or closures associated with direct roundups, although the duration of these closures would be short as described above. Users of the Roundup Group Horse Campground are less likely to be affected as this campground is closed between November and March. As described under alternative B, those wishing to engage in winter uses may be impacted by any closures required for roundups.

Considering the assumptions described in chapter 2, this would required rounding up at least 70 elk per year after initial reduction is complete, which could be completed in a matter of days at the most. These impacts would occur annually after initial reduction is complete, and should be completed in a matter of days when implemented. As with alternative B, the majority of users would be able to recreate in one area of the South Unit, even if another area is closed, and it is likely that access to the Little Missouri River for winter activities would not be precluded completely. As a result, impacts to visitor use from closures would be long-term, moderate, and adverse. Routine research and monitoring would contribute minimally to these impacts.

In all instances, the public would be notified of any South Unit closures in advance of the activities and information would be provided to the public on the park website and the visitor centers. Current educational and interpretive programs available to park visitors would also be expanded under alternative F, to help communicate the purpose and need for the elk management program and explain potential effects, which would offset some of the adverse impacts.

Noise Impacts. The natural soundscape found at Theodore Roosevelt National Park would be affected by noise from roundups, primarily the use of helicopters; however, the effects would be similar to those experienced during normal roundup operations at the park; would occur during times of year with low visitation; would only occur over a few days.; and would ultimately be concentrated near the park boundary. Further, these impacts would be more pronounced during the initial reduction and would be expected to decrease and be less frequent after year 5 for population maintenance. As a result, the impacts to the soundscape from helicopter flights would be long-term, minor, and adverse. Routine research and monitoring would contribute minimally to these impacts, as described for alternative A.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities expected under alternative A would occur under alternative F. As a result, when combined with the effects of alternative F, the cumulative impacts would be long-term, minor, and adverse.

Conclusion. There would be long-term, negligible to minor adverse impacts to those visitors that include seeing elk as part of their visitor experience as a result of the smaller elk population in the park. These impacts would be partially off set by the overall enhancement to wildlife and wildlife habitat in elk use areas that would improve the experience of those visitors wanting to see all of the resources in the South Unit in natural conditions. Alternative F would have long-term, minor to moderate adverse impacts as visitors may be restricted from engaging in a desired activity during management actions and would be exposed to noise associated with roundups. These impacts would be similar to those that occur during normal roundup operations in the park. Cumulative impacts under alternative F would be long-term, minor, and adverse.

Preferred Alternative: Combined Techniques

Visitor Experience Impacts. The gradual reduction (over 3 to 5 years) and annual maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) within the South Unit would have long-term beneficial effects to visitors as other wildlife, their habitat, and the associated vegetation could be observed in natural conditions. For those visitors wishing to see elk, reduction of the population would decrease the chance for seeing elk. Based on one survey, approximately 26% of visitors to Theodore Roosevelt National Park saw an elk during their visit and this percentage would be expected to decline. Although the chances of seeing elk could go down, it is unlikely that a decline in the elk population would be noticed by most visitors, resulting in negligible to minor adverse impacts for those visitors.

As described under alternative A, one of the most popular activities at Theodore Roosevelt National Park is viewing wildlife and taking pictures. During management actions, visitor use under the preferred alternative would be mainly affected by the closures required. Direct reduction and, if necessary, roundup and euthanasia/relocation would be implemented during the fall and winter, when visitation is low, and would generally be conducted on weekdays (Monday –Friday) when park visitation is lowest. Few visitors would be affected because most visitation occurs in June, July, and August, with visitation dropping off slightly in September and more drastically in October through April. Those camping at the Cottonwood Campground could be impacted by noise or closures associated with direct reduction and roundup and euthanasia/translocation activities. Users of the Roundup Group Horse Campground are less likely to be affected as this campground is closed between November and March. Closures during direct reduction that could last for several months at a time would decrease to a matter of days once the initial reduction is complete. These impacts would be long-term, occurring annually, and would decrease from several months to a matter of days once initial reduction is complete. While one area of the South Unit could be closed for management, other areas would be available for those wishing to engage in winter activities and these uses would not be precluded. While most salvageable meat would be removed and donated, some elk carcasses could be left in the South Unit given the difficulty for removal and recovery in this environment. As a result, there would be some potential for visitors to encounter wastes or carcasses from direct reduction activities. Landfills would be used for surface disposal per state requirements, as needed (e.g., if CWD is found) and would not affect visitors.

In all instances, the public would be notified of any South Unit closures in advance of the activities and information would be provided to the public on the park website and the visitor centers. Current educational and interpretive programs available to park visitors would be expanded under the preferred alternative, to help communicate the purpose and need for the elk management program and explain potential effects, which would offset some of the adverse impacts. Considering these factors, impacts to visitor use and experience would be long-term, minor to moderate, and adverse during annual management actions.

If it is necessary to supplement initial reduction and maintenance actions with roundup and euthanasia/translocation in year 3, helicopter use and disturbances associated with herding and driving of elk would impact visitor experience. Based on the assumptions in chapter 2, the associated impacts would occur only during year 3; would last only a matter of days when management actions are implemented; and impacts would dissipate with distance. Given the scope and frequency of these operations, and based on past experience with elk roundups, and periodic bison and feral horse roundups, these impacts would be short-term, minor, and adverse. Although unlikely, if these management actions are used for maintenance, they would have impacts similar to those described for initial reduction, but would involve much smaller numbers of elk, reducing the intensity of the effect. If elk are euthanized, visitors would not be exposed to this action. Although unlikely, if these management actions are used for maintenance, they would have impacts similar to those described for initial reduction, but would involve much smaller numbers of elk, reducing the intensity of the effect.

Noise Impacts. The natural soundscape found at Theodore Roosevelt National Park would be affected by noise from direct reduction efforts, and roundups; however, these activities, with the exception of the use of firearms, would have similar impacts to routine activities that occur in the park (e.g., roundups for bison and horses), and would occur during times of year and days of the week with low visitation. Although firearms are used routinely outside of the park during hunting season, their use in the South Unit would create a substantial noise intrusion on the natural soundscape. These impacts would occur over several months for the first 5 years of initial reduction and would be less frequent during annual population maintenance, resulting in intermittent long-term, minor to moderate, adverse impacts. If used, firearm noise suppressors could offset some of these impacts.

If it is necessary to supplement initial reduction and maintenance actions with roundup and euthanasia/translocation in year 3, the natural soundscape found at Theodore Roosevelt National Park would be affected by noise from roundups, primarily the use of helicopters; however, the effects would be similar to those experienced during normal roundup operations at the park; would occur during times of year and days of the week with low visitation; and would only occur over a few days. As a result, the impacts to the soundscape from helicopter flights would be short-term, minor, and adverse. Although unlikely, if these management actions are used for maintenance, they would have impacts similar to those described for initial reduction, but would involve much smaller numbers of elk, reducing the intensity of the effect. Routine research and monitoring would contribute minimally to these impacts, as described for alternative A.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities expected under alternative A would apply under the preferred alternative. When combined with the impacts of the preferred alternative, there would be long-term, minor, and adverse cumulative effects.

Conclusion. The reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term, negligible to minor, adverse impacts to those visitors that include seeing elk as part of their visitor experience as a decrease in the population could result in a decreased chance of seeing elk. These impacts would be partially off set by long-term benefits from the overall enhancement to the vegetation, wildlife, and wildlife habitat in elk use areas which would improve the experience of those visitors wanting to see all of the resources of the South Unit in their natural condition. Direct reduction with firearms would have intermittent long-term, minor to moderate, adverse impacts as some visitors may be affected by closures and noise from firearm use. If it is necessary to supplement initial reduction with roundup and euthanasia/translocation in year 3, visitor use and experience may be affected by closures and noise from helicopters, which would have short-term, minor adverse impacts. Cumulative impacts under the preferred alternative would be long-term, minor, and adverse.

EMPLOYEE AND VISITOR HEALTH AND SAFETY

The safety of both visitors and NPS employees at Theodore Roosevelt National Park would be affected by implementation of the proposed elk management actions. Impacts to employee and visitor health and safety would be related to the use of firearms, the use of helicopters to herd elk during roundups or capture them for fertility control, handling of elk either in the field or after roundups, and potential for wildlife/vehicle collisions.

GUIDING REGULATIONS AND POLICIES

The NPS *Management Policies 2006* state that, "While recognizing that there are limitations on its capability to totally eliminate all hazards, the Service …will seek to provide a safe and healthful environment for visitors and employees." The policies also state that "the Service will reduce or remove known hazards and apply other appropriate measures, including closures, guarding, signing, or other forms of education" (NPS 2006a, Section 8.2.5.1).

ASSUMPTIONS, METHODOLOGY, AND INTENSITY THRESHOLDS

The purpose of this impact analysis is to identify the level of impact that implementing each of the proposed alternatives would have on the safety of visitors and employees at Theodore Roosevelt National Park.

The impact thresholds for visitor and employee safety are defined below.

Negligible: There would be no discernible effects to visitor or employee safety; slight injuries could occur, but none would be reportable.

Minor: Any reported visitor or employee injury would require first aid that could be provided by park staff. The employee injury would involve less than eight hours of lost work time.

Moderate: Any reported visitor or employee injury would require medical attention beyond what is available at the park. The employee injury would be serious enough to involve eight or more hours of lost work time.

Major: A visitor or employee injury could result in permanent disability or death.

Duration: **Short-term**: Those impacts occurring from management activities and lasting the duration of the activity (a few days to a few weeks).

Long-term: Impacts occurring either from on-going management activities, from outcomes such as elk reduction, or with effects lasting beyond initial elk reduction efforts.

Area of Analysis

The area of analysis is the South Unit. For cumulative impacts, the area of analysis is the South Unit and adjacent lands.

IMPACTS OF THE ALTERNATIVES

Alternative A: No Action (Continue Existing Elk Management Program)

Under the no action alternative, elk management activities would include vegetation monitoring and population surveys, as well as CWD surveillance, which would not affect visitor safety. Current health and safety risks for employees related to elk management activities include the use of aircraft for population monitoring. However, there are standard safety procedures associated with aircraft use, including visual flight rules, and wildlife handling, and all individuals involved would be properly trained. Therefore, impacts from management activities would have temporary short-term, minor adverse impacts.

As the population grows, the spread of diseases that may be transmitted by animals to humans (such as tuberculosis) would increase. However, the potential for interactions that would cause the exchange of respiratory secretions between infected elk and humans would remain very low. The larger elk population could increase the potential for wildlife-vehicle interactions, which could affect visitor safety, including increasing the potential for reportable injuries. As a result, there would be long-term, minor adverse impacts to health and safety.

Cumulative Impacts. Actions associated with the management of the bison and horse populations, including the use of helicopters during roundups, and working animals through the handling facility, and loading them to be shipped, have long-term, minor impacts on employee safety. Accidents may be a result of visitor and employee activities, such as slipping, tripping, and falling and would have long-term, negligible adverse cumulative effects. Hunting and oil and gas developments outside the park also have the potential to affect health and safety, considering the use of firearms and risks encountered during drilling, production, and transportation. These have the potential for long-term, negligible adverse impacts, considering standard safety precautions. All of these activities, when combined with the long-term, minor adverse impacts to health and safety from alternative A, would result in long-term, minor adverse cumulative effects.

Conclusion. Vegetation monitoring and population surveys, as well as CWD surveillance, would not affect visitor safety, but could have long-term, minor adverse impacts to employee safety (from the use of aircraft and handling of elk). Past, present, and reasonably foreseeable future actions inside and outside the park, when combined with the long-term, minor adverse impacts of alternative A, would result in long-term, minor adverse cumulative impacts.

Alternative B: Direct Reduction with Firearms

The gradual reduction (over 5 years) and annual maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) within the South Unit would have long-term beneficial effects to employee and visitor safety by reducing the potential for wildlife-vehicle collisions and wildlife-human interactions.

Under alternative B, qualified federal employees and authorized agents (which include other agency and tribal personnel, contractors, or skilled volunteers) would engage in direct reduction of the elk population at the park through the use of firearms, and would also perform field dressing and CWD testing of carcasses, as well as manage carcass handling and transport. Every precaution would be taken to ensure the safety of employees, authorized agents, and visitors, and employees would apply safety training and awareness activities designed to reduce safety risks. In addition, the NPS would ensure compliance with all relevant directives related to firearms use in parks, as well as federal firearm laws administered by the Bureau of Alcohol, Tobacco, and Firearms. The park would also develop specific guidelines for firearms use. The personnel engaged in direct reduction of elk would have the appropriate skills and proficiencies in the use of firearms, including use for the removal of wildlife, and protecting public safety. Their experience in such efforts would help ensure the safety of park employees and visitors. Considering the badland environment and timing of these activities (November through January), implementation of this alternative would increase the potential for employee and volunteer injury and accidents, including the potential for sprains, broken bones, hypothermia, and even heart attacks.

Considering the precautions that would be taken, it is expected most accidents or injuries could be treated by park staff or nearby medical facilities, resulting in long-term, minor to moderate adverse impacts on employee and authorized agent safety during initial reduction and annual maintenance actions. However, some of the injuries that could occur could result in permanent disabilities, which would be a major adverse impact.

In addition, the timing of direct reduction activities would be planned to coincide with lower visitor use periods in the park (fall and winter), to minimize safety hazards resulting from the use of firearms. Park closures and usage restrictions would also be enacted to ensure no direct visitor contact with shooting activities. As a result, direct reduction with firearms would have long-term, negligible to minor, adverse impacts on visitors from the use of firearms during initial reduction and annual maintenance conducted throughout the life of this plan.

Effects of direct reduction activities on health and safety would be temporary for the duration of management actions, and would occur less frequently after initial reduction is complete and annual maintenance is implemented (removal of a maximum of 275 elk over several months each year for the first 5 years, versus 20 to 24 elk removed in a minimal period of time each year thereafter).

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and B and would have long-term, minor adverse impacts to health and safety. When combined with impacts of alternative B there would be long-term, minor cumulative effects on health and safety.

Conclusion. The reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to employee and visitor safety by reducing the potential for wildlife-vehicle collisions and wildlife-human interactions. Considering the safety precautions to be used, impacts to health and safety of employees and authorized agents from activities associated with shooting are expected to be long-term, minor to moderate and adverse, with the potential for major impacts if accidents or injuries result in permanent disability. There would also be long-term, negligible to minor adverse impacts on visitor health and safety, during annual management actions under alternative B. Past, present, and reasonably foreseeable future actions inside and outside the park, when combined with the effects of alternative B, would result in long-term, minor adverse cumulative impacts.

Alternative C: Roundup and Euthanasia

The rapid reduction within 1 year and periodic maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) within the South Unit would have long-term beneficial effects to employee and visitor safety by reducing the potential for wildlife-vehicle collisions and wildlife-human interactions.

Roundups for initial reduction and periodic maintenance of the elk population (expected three or four times during the life of this plan) would result in the temporary increases in the potential for injury and accidents normally associated with such operations. Working animals through the handling facility at the South Unit for shipping to the commercial facility would contribute to these impacts. Every precaution would be taken to ensure the safety of employees, and employees would apply safety training and awareness activities designed to reduce safety risks. Management actions associated with the roundup would be carried out by qualified federal employees and authorized agents. The personnel engaged in these activities would have the appropriate skills and proficiencies in their area of expertise. Their experience in such efforts would help ensure the safety of park employees.

In addition to these precautions, the timing of activities related to roundup and euthanasia would be planned to coincide with lower visitor use periods in the park (fall and winter), to minimize safety hazards resulting from the use of helicopters and driving of elk. In addition, park closures and usage restrictions would be enacted to ensure no direct visitor contact with roundups or other activities associated with euthanasia.

Considering the assumptions described in chapter 2, the potential for such impacts would be greatest in the first year, but would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 800 elk the first year to approximately 200 elk every 3 to 4 years thereafter). The associated impacts would be intermittent over the life of this plan, and would last only a matter of days when management actions are implemented. Given the scope and frequency of these operations, and based on past experience with elk roundups, and periodic bison and feral horse roundups, there would be negligible to minor adverse impacts to employee and visitor safety from the use of helicopters and driving of elk during initial reduction and periodic maintenance conducted throughout the life of this plan.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and C and would have long-term, minor adverse impacts to health and safety. When combined with impacts of alternative C there would be long-term, minor cumulative effects on health and safety.

Conclusion. The rapid reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to employee and visitor safety by reducing the potential for wildlife-vehicle collisions and wildlife-human interactions. Considering the safety precautions to be used, there would be long-term, minor adverse impacts on health and safety of employees, and long-term, negligible to minor adverse impacts on visitor health and safety, during periodic management actions under alternative C. Past, present, and reasonably foreseeable future actions inside and outside the park, when combined with the effects, of alternative C, would result in long-term, minor adverse cumulative impacts.

Alternative D: Testing and Translocation

The gradual reduction (over at least 3 years based on the assumptions in chapter 2) and maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) within the South Unit would have long-term beneficial effects to employee and visitor safety by reducing the potential for wildlife-vehicle collisions and wildlife-human interactions.

Management actions associated with the testing and translocation (i.e. use of helicopters for roundups, working animals through the handling facility for CWD testing and into trucks for shipping) would temporarily increase the potential for injuries or accidents normally associated with such operations at the park. Testing and translocation would be conducted by qualified federal employees and/or authorized agents with the appropriate skills and proficiencies which would help ensure the safety of park employees. In addition, employees would apply safety training and awareness activities designed to reduce safety risks.

Because it is unknown when willing recipients might be available to receive elk, management actions could be conducted during the high visitor use periods, which could increase the potential for impacts to visitor health and safety; however, park closures and usage restrictions would be enacted to ensure no direct visitor contact with roundups or other activities associated with translocation.

Considering the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 1,036 elk over the first 3 years to approximately 375 elk in year 10). In addition, these activities would only last a matter of days. Given the scope and frequency of the proposed operations, and based on past experience with elk roundups and two elk translocations (in 1993 and 2000), there would be long-term, negligible to minor, adverse impacts to employee and employee health and safety.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and D and would have long-term, minor adverse impacts to health and safety. When combined with impacts of alternative D there would be long-term, minor cumulative effects on health and safety.

Conclusion. The gradual reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to employee and visitor safety by reducing the potential for wildlife-vehicle collisions and wildlife-human interactions. Considering the safety precautions to be used, there would be long-term, negligible to minor adverse impacts on health and safety of employees and visitors during periodic management actions under alternative D. Past, present, and reasonably foreseeable future actions inside and outside the park, when combined with the effects, of alternative D, would result in long-term, minor adverse cumulative impacts.

Alternative E: Hunting Outside the Park

The gradual reduction (over 5 years) and annual maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) within the South Unit would have long-term beneficial effects to employee and visitor safety by reducing the potential for wildlife-vehicle collisions and wildlife-human interactions.

Dispersing elk out of the park to increase hunting opportunities would have similar impacts to those associated with normal roundup operations described for alternatives C and D, including the increase in potential for employee injuries and accidents. However, management actions associated with the dispersals would be carried out by qualified federal employees and authorized agents. The personnel engaged in these activities would have the appropriate skills and proficiencies in their area of expertise. In addition, employees would apply safety training and awareness activities designed to reduce safety risks. Increased hunting opportunities are expected to have similar impacts to those described for alternative B, but the impacts would be less intense considering they would be conducted outside the park.

In addition to these precautions, the timing of activities related to direct dispersals and increased hunting opportunities would be planned to coincide with lower visitor use periods in the park (fall and winter), to minimize safety hazards resulting from the use of helicopters, driving elk, and the temporary increase in the use of firearms around the park. In addition, park closures and usage restrictions would be enacted to ensure no direct visitor contact with dispersals.

Considering the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 1,358 elk over the first 5 years to approximately 200 elk every 3 to 4 years thereafter). In addition, the NPS would conduct dispersal activities in the winter, which would avoid high visitor use seasons. Park closures and usage restrictions would be enacted to ensure no direct visitor contact with dispersal activities. As a result, there would be long-term, negligible to minor, adverse impacts on employee and visitor health and safety under alternative E.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and E. When combined with the impacts on employee and visitor safety under alternative E, there would be long-term, minor adverse cumulative effects on health and safety.

Conclusion. The gradual reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to employee and visitor safety by reducing the potential for wildlife-vehicle collisions and wildlife-human interactions. Considering the safety precautions to be used, there would be long-term, negligible to minor adverse impacts on health and safety of employees and visitors during periodic management actions under alternative E. Past, present, and reasonably foreseeable future actions inside and outside the park, when combined with the effects, of alternative E, would result in long-term, minor adverse cumulative impacts.

Alternative F: Fertility Control (Maintenance Only)

Fertility control in free-ranging elk is currently experimental, and requires another alternative for initial reduction. If a fertility control agent could be developed that meets NPS criteria and proves effective at maintaining elk population levels (i.e., 100 to 400) consistent with a lightly grazed system in the park, it would result in long-term beneficial effects to employee and visitor safety by reducing the potential for wildlife-vehicle collisions and wildlife-human interactions.

Rounding up elk for fertility control would have similar impacts to those associated with normal roundup operations described for alternatives C and D, including the increase in potential for employee injuries and accidents. However, management actions associated with the roundups would be carried out by qualified federal employees and authorized agents. The personnel engaged in these activities would have the appropriate skills and proficiencies in their area of expertise. In addition, employees would apply safety training and awareness activities designed to reduce safety risks.

In addition to these precautions, the timing of roundups would coincide with lower visitor use periods in the park (winter), which would minimize safety hazards resulting from the use of helicopters and driving elk. In addition, park closures and usage restrictions would be enacted to ensure no direct visitor contact with dispersals.

Considering the assumptions described in chapter 2, this would required rounding up at least 70 elk per year after initial reduction is complete, which could be completed in a matter of days at the most. These impacts would occur annually after initial reduction is complete, and should be completed in a matter of days when implemented. As a result, there would be long-term, negligible to minor, adverse impacts on employee and visitor health and safety under alternative F.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and F. When combined with the impacts on employee and visitor safety under alternative F, there would be long-term, minor adverse cumulative effects on health and safety.

Conclusion. The maintenance of a smaller elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to employee and visitor safety by reducing the potential for wildlife-vehicle collisions and wildlife-human interactions. Considering the safety precautions to be used, there would be long-term, negligible to minor adverse impacts on health and safety of employees and visitors during periodic management actions under alternative F. Past, present, and reasonably foreseeable future actions inside and outside the park, when combined with the effects, of alternative F, would result in long-term, minor adverse cumulative impacts.

Preferred Alternative: Combined Techniques

The gradual reduction (over 3 to 5 years) and annual maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) within the South Unit would have long-term beneficial effects to employee and visitor safety by reducing the potential for wildlife-vehicle collisions and wildlife-human interactions.

Under the preferred alternative, qualified federal employees and skilled volunteers would engage in direct reduction of the elk population at the park through the use of firearms, and would also perform field dressing and CWD testing of carcasses. Every precaution would be taken to ensure the safety of employees, volunteers, and visitors, and employees would apply safety training and awareness activities designed to reduce safety risks. In addition, the NPS would ensure compliance with all relevant directives related to firearms use in parks, as well as federal firearm laws administered by the Bureau of Alcohol, Tobacco, and Firearms. The park would also develop specific guidelines for firearms use. The personnel engaged in direct reduction of elk would have the appropriate skills and proficiencies in the use of firearms, including use for the removal of wildlife, and protecting public safety. Their experience in such efforts would help ensure the safety of park employees and visitors. Considering the badland environment and timing of these activities (November through January), implementation of this alternative would increase the potential for employee and volunteer injury and accidents, including the potential for sprains, broken bones, hypothermia, and even heart attacks. Although the NPS may require health certifications for volunteers, there is still the potential for such injuries to occur.

Considering the precautions that would be taken, it is expected most accidents or injuries could be treated by park staff or nearby medical facilities, resulting in long-term, minor to moderate adverse impacts on employee and volunteer safety during initial reduction and annual maintenance actions. However, some of the injuries that could occur could result in permanent disabilities, which would be a major adverse impact.

In addition, the timing of direct reduction activities would be planned to coincide with lower visitor use periods in the park (fall and winter), to minimize safety hazards resulting from the use of firearms. Park closures and usage restrictions would also be enacted to ensure no direct visitor contact with shooting activities. As a result, direct reduction with firearms would have long-term, negligible to minor, adverse impacts on visitors from the use of firearms during initial reduction and annual maintenance conducted throughout the life of this plan.

Effects of direct reduction activities on health and safety would be temporary for the duration of management actions, and would occur less frequently after initial reduction is complete and annual maintenance is implemented (removal of a maximum of 275 elk over several months each year for the first 5 years, versus 20 to 24 elk removed in a minimal period of time each year thereafter).

If necessary in year 3, management actions associated with the roundups for euthanasia and/or testing and translocation (i.e. use of helicopters for roundups, working animals through the handling facility and into trucks for shipping) would be carried out by qualified federal employees and skilled volunteers. The personnel engaged in these activities would have the appropriate skills and proficiencies in their area of expertise. Their experience in such efforts would help ensure the safety of park employees. Every precaution would be taken to ensure the safety of employees, and employees would apply safety training and awareness activities designed to reduce safety risks.

When possible, the roundup and euthanasia/translocation activities would be planned to coincide with lower visitor use periods in the park (fall and winter, weekdays), to minimize safety hazards resulting from roundups. In addition, park closures and usage restrictions would be enacted to ensure no direct visitor contact with roundup and euthanasia/translocation activities. Based on the assumptions in chapter 2, the associated impacts would occur only during year 3 and would last only a matter of days when management actions are implemented. Management actions associated with roundup and translocation, if necessary, may extend into the high visitor use periods because it is unknown when willing recipients might be available to receive elk which could increase the potential for impacts to visitor health and safety; however, park closures and usage restrictions would be enacted to ensure no direct visitor contact with roundups or other activities associated with translocation.

Considering past experience with elk roundups, and periodic bison and feral horse roundups, there would be additional short-term, negligible to minor adverse impacts to employee and visitor safety from the use of helicopters and driving of elk during initial reduction and periodic maintenance. Although unlikely, if these management actions are used for maintenance, they would have impacts similar to those described for initial reduction, but would involve much smaller numbers of elk, reducing the intensity of the effect.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternative A and the preferred alternative and would have long-term, minor adverse impacts to health and safety. When combined with impacts of the preferred alternative there would be long-term, minor cumulative effects on health and safety.

Conclusion. The reduction and maintenance of the elk population at levels consistent with a lightly grazed system would result in long-term beneficial effects to employee and visitor safety by reducing the potential for wildlife-vehicle collisions and wildlife-human interactions. Considering the safety precautions to be used, impacts to health and safety of employees and volunteers from activities associated with shooting are expected to be long-term, minor to moderate and adverse, with the potential for major impacts if accidents or injuries result in permanent disability. Direct reduction with firearms would have long-term, negligible to minor, adverse impacts on visitors. There would be short-term, negligible to minor adverse impacts on visitor and employee health and safety if roundups and euthanasia/translocation are used during year 3. Past, present, and reasonably foreseeable future actions inside and outside the park, when combined with the effects of the preferred alternative, would result in long-term, minor adverse cumulative impacts.

PARK MANAGEMENT AND OPERATIONS

Park management and operations refers to the current staff available to adequately protect and preserve vital park resources and provide for an effective visitor experience. This topic also includes the operating budget necessary to conduct park operations.

ASSUMPTIONS, METHODOLOGY, AND INTENSITY THRESHOLDS

The discussion of impacts to park operations focuses on (1) the number of staff available, and (2) the cost of each alternative. It was assumed under all alternatives the park's annual budget would be increased to implement a particular alternative. However, this funding is not guaranteed; each alternative discusses the impacts of receiving or not receiving additional funding.

Park staff knowledge was used to evaluate the impacts of each alternative, and the evaluation is based on the description of park operations presented in chapter 3. Definitions of impact levels are as follows:

Negligible: Park operations would not be affected or the effect would not be noticeable outside normal variability.

Minor: Park operations would be affected to a degree noticeable by some park staff, but probably not be noted by visitors. Current levels of funding and staff would not be reduced or increased, but priorities may need to be changed.

Moderate: Changes in park operations would be readily apparent to park staff, but probably not be noted by most visitors. Increases or decreases in staff and funding would be needed or other park operations would have to be reduced and/or priorities changed.

Major: Substantial changes to park operations would result, apparent to both staff and members of the public. Increases or decreases in staff and funding would be needed and/or other park programs would have to be substantially changed or eliminated.

Duration: **Short-term**: Effects would be perceptible on an intermittent basis and would last for less than one year.

Long-term: Effects would be repeatedly perceptible and would last a year or more

Area of Analysis

The area of analysis, including the cumulative impacts analysis, is Theodore Roosevelt National Park.

IMPACTS OF THE ALTERNATIVES

Alternative A: No Action (Continue Existing Elk Management Program)

Under the no action alternative, the elk population in the South Unit would continue to grow, although numbers and growth rates would fluctuate on an annual basis due to a variety of factors, including weather, forage availability, and reproduction and mortality rates due to herd health, among others. Existing park staff would be sufficient to continue performing vegetation monitoring, and elk population surveys, which would costs approximately $578,750 over the life of this plan, as well as CWD surveillance. However, as the elk population continued to grow, more time would be devoted to vegetation surveys and CWD surveillance, which would leave less time for other duties. These activities, and aerial surveys, are generally carried out by existing resource management staff as part of their duties. In addition, through effects on forage availability and plant succession, high elk populations could threaten the available food sources of bison and feral horses, which are confined to the park by a boundary fence. As a result, the park may need to maintain smaller populations of bison and horses. Additional management responsibilities, as well as any additional funding that might be needed to maintain the park fence or manage other ungulates as a result of impacts from a larger elk population, would result in adverse, short- and long-term, minor to moderate impacts.

These activities would become a permanent component of the resource management program at Theodore Roosevelt National Park, as the potential for impacts to vegetation and the potential for increased disease transmission would continue indefinitely into the future. The USGS would continue to provide support for elk population surveys and the USFS would continue to provide support for vegetation monitoring. Other research activities would take place as funding becomes available.

Cumulative Impacts. Bison and feral horse management diverts park staff from everyday duties to assist with roundups and processing of animals for shipping. However, recent updates and improvements to the handling facility in the South Unit (increasing size and capacity) would make these efforts more efficient. Wildland fire fighting, as well as demands related to the implementation of other park plans and resource programs (e.g., maintenance, safety and health program, exotic plant management, vegetation monitoring, and public involvement), also affects park budgets and staffing. As the cost of goods and services rises faster than the park’s operating budget, staff continue to accomplish the park’s mission and maintain the visitor experience with fewer financial resources. As a result, short- and long-term, moderate impacts to park operations would continue. These actions, in combination with the impacts of alternative A, would have long-term, moderate adverse cumulative impacts on park operations and management.

Conclusion. Existing park staff would be sufficient to continue performing vegetation monitoring, elk population surveys, and CWD surveillance. However, an increase in the elk population could require additional management actions be taken to reduce the bison and feral horse populations, to ensure adequate forage availability. Additional management responsibilities, as well as any additional funding needed, would result in adverse, short- and long-term, minor to moderate impacts. Past, present, and reasonably foreseeable future actions, when combined with alternative A, would result in long-term, moderate adverse cumulative impacts.

Alternative B: Direct Reduction with Firearms

The gradual reduction (over 5 years) and annual maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) within the South Unit would require additional staff commitments and funding, but the smaller elk population would reduce potential impacts on the park ecosystem from sustained over use by a large elk population and ease potential management issues (e.g., fence maintenance, bison/feral horse management), which would have a long-term, beneficial effect.

Annual direct reduction activities under alternative B would require additional staff time to accompany qualified federal employees or authorized agents during management actions. Arrangements would be needed to store carcasses/salvageable meat until CWD test results are received, which would likely require a refrigeration truck. Time would be required to coordinate the details of donating the meat or disposing of CWD positive carcasses. These impacts would occur annually, but would be temporary for the duration of management actions, and would occur less frequently after initial reduction is complete and annual maintenance is implemented (removal of a maximum of 275 elk over several months each year for the first 5 years, versus 20 to 24 elk removed in a minimal period of time each year thereafter).

As part of this alternative, both elk population studies and vegetation monitoring would be conducted to document changes in elk grazing that may result from reduced elk numbers. This monitoring program would continue for at least 10 years. Monitoring would be similar to park efforts scheduled to continue under alternative A. This alternative would also involve increased educational and interpretive activities that would be handled by existing staff and within existing budgets.

The staff time needed to conduct direct reductions with firearms would require temporary shifts in priorities by most divisions during management actions. Although not necessarily noticeable to visitors, overseeing a skilled volunteer program for direct reduction with firearms on an annual basis would require a substantial change in park management and operations. As a result, there would be long-term, moderate to major, adverse impacts on park operations and management during initial reduction and annual maintenance activities, with the intensity being greater if skilled volunteers are used.

Although not necessarily noticeable to visitors, overseeing a skilled volunteer program for direct reduction with firearms on an annual basis would require a substantial change in park management and operations.

Besides staff time, the costs to the park would vary based on several factors, including the number of elk to be removed, removal methods, use of NPS staff versus authorized agents, accessibility of the elk, training requirements, equipment availability, data to be collected from the elk, and carcass processing or disposal requirements. Estimated cost for direct reduction using qualified federal employees and/or authorized agents would be $500 per elk during initial reduction and $550 per elk during maintenance (the cost increase reflects the added degree of difficulty of finding elk after the population reduction). In addition, other costs would include $25 per head for testing CWD samples removed during handling of the carcass and preparing it for distribution or donation, as well as a refrigeration truck for storing carcasses until CWD test results are received. Including these and the other costs identified in chapter 2, the average annual costs of this alternative are estimated to be approximately $100,000 per year (or approximately $1.5 million over 15 years), with costs higher during initial reduction and decreasing during maintenance.

Should skilled volunteers be used for direct reduction activities, the associated cost of this alternative would rise to approximately $150,000 per year (or approximately $2,250,000 over 15 years), as detailed for the preferred alternative (see appendix D of this plan/EIS and “Chapter 2: Alternatives”). Among other things, these costs include the additional staff needed to help administer the skilled volunteer program, plus the fees associated with using wranglers to remove salvageable meat. Any assistance offered by the existing park staff would be considered part of regular duties, rather than project specific, and would not require additional project funding, but would take away from other responsibilities. Due to the funding increase needed, impacts would be long-term, adverse, and moderate to major.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and B, and would have short- and long-term, moderate adverse impacts to park operations and management. When combined with the impacts of alternative B, there would be long-term, moderate, adverse cumulative effects on park operations and management.

Conclusion. The gradual reduction and maintenance of the elk population at levels consistent with a lightly grazed system under alternative B would ease potential management issues associated with sustained overuse by a large elk population which would have a long-term, beneficial effect. However, annual direct reduction activities under alternative B would have long-term, moderate to major, adverse impacts, with the intensity being greater if park staff must oversee a skilled volunteer program annually. The average annual costs of this alternative are estimated to be approximately $100,000 per year (or approximately $1.5 million over 15 years), with costs higher during initial reduction. Should skilled volunteers be used for direct reduction activities, the associated administration costs have been estimated at $150,000 per year (or $2.25 million over 15 years), with much higher costs during initial reduction. Past, present, and reasonably foreseeable future actions, when combined with adverse impacts of alternative B would result in long-term, moderate adverse cumulative impacts.

Alternative C: Roundup and Euthanasia

The rapid reduction of the elk population in 1 year and maintenance at a level consistent with a lightly grazed system (i.e., between 100 and 400 elk) within the South Unit would require additional staff commitments and funding, but the smaller elk population would reduce potential impacts on the park ecosystem from sustained overuse by a large elk population and ease potential management issues (e.g., fence maintenance, bison/feral horse management), which would have a long-term, beneficial effect.

Planning and implementing the roundups, including herding via helicopter, working elk in the handling facility, loading elk into trucks for shipping to a commercial facility, as well as subsequent disease testing, would temporarily divert staff, and potentially some funds, from other management programs at the park. Considering the assumptions described in chapter 2, the potential for such impacts would be greatest in the first year, but would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 800 elk the first year to approximately 200 elk every 3 to 4 years thereafter). The associated impacts would be intermittent over the life of this plan, and would last only a matter of days when management actions are implemented. As with alternative B, research, monitoring, and increased education and interpretation activities would be conducted by existing staff within existing budgets.

The staff time needed to conduct roundups and euthanasia would require temporary shifts in priorities by most divisions during management actions, but would not require a substantial, permanent change in park management and operations, and would not be noticeable to visitors. Given the scope and frequency of management actions under this alternative, there would be long-term, minor to moderate, adverse impacts on park operations and management during initial reduction and periodic maintenance activities.

The cost of alternative C would vary depending on the number of elk to be rounded up and euthanized; the use of NPS staff versus authorized agents; cost of additional education and interpretation activities, the type of euthanasia method employed, data to be collected from the elk, and carcass processing or disposal requirements. As described in chapter 2, roundups were assumed to cost $155 per head, and CWD testing would be $35 to $50. Shipping was estimated at $1,000 per truckload and subsequent euthanasia and processing at $45 to $50 per head, and $0.35 to $0.49 per pound, respectively. Including these and the other costs identified in chapter 2, the average annual costs of this alternative are estimated to be approximately $85,000 to $103,000 per year (or approximately $1.3 million to $1.5 million over 15 years), with costs higher during initial reduction and decreasing during maintenance. Due to the necessary funding increase, impacts would be long-term, adverse and minor to moderate.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under alternatives A and C and would have short- and long-term, moderate adverse impacts to park operations and management. When combined with the impacts of alternative C, there would be long-term, moderate adverse cumulative effects on park operations and management.

Conclusion. The rapid reduction and maintenance of the elk population at levels consistent with a lightly grazed system under alternative C would ease potential management issues associated with sustained overuse by a large elk population which would have a long-term, beneficial effect. However, periodic management activities under alternative C would have long-term, minor to moderate, adverse impacts as a result of diverting staff time for implementation and oversight of management actions, including research, monitoring, and additional education and interpretation activities. The average annual costs of this alternative are estimated to be approximately $85,000 to $103,000 per year (or approximately $1.3 million to $1.5 million over 15 years) with costs higher during initial reduction and decreasing during maintenance. Past, present, and reasonably foreseeable future actions, when combined with those of alternative C would result in long-term, moderate adverse cumulative impacts.

Alternative D: Testing and Translocation

The gradual reduction (over at least 3 years) and annual maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) within the South Unit would require additional staff commitments and funding, but the smaller elk population would reduce potential impacts on the park ecosystem from sustained over use by a large elk population and ease potential management issues (e.g., fence maintenance, bison/feral horse management), which would have a long-term, beneficial effect.

Identifying and coordinating with willing recipients, planning and implementing the roundups (including herding via helicopter, working elk in the handling facility) for CWD testing and translocations and loading elk into trucks to be shipped would divert staff, and potentially some funds, from other management programs at the park. Considering the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from rounding up approximately 1,036 elk over the first 3 years to approximately 375 elk in year 10). In addition, these activities would only last a matter of days. As with alternative B, research, monitoring, and increased education and interpretation activities would be conducted by existing staff within existing budgets.

The staff time needed to conduct CWD testing and translocations would require temporary shifts in priorities by most divisions during management actions, but would not require a substantial, permanent change in park management and operations, and would not be noticeable to visitors. Given the scope and frequency of management actions under this alternative, there would be long-term, minor to moderate, adverse impacts on park operations and management during initial reduction and periodic maintenance activities.

The cost of implementing alternative D would vary depending on the number of elk rounded up and tested for CWD, subsequent carcass processing or disposal requirements, number of elk rounded up and translocated the use of NPS staff versus authorized agents, and the cost of additional education and interpretation activities. As described for alternative C, it was assumed that roundups would cost $ $155 per head, and CWD testing would be $35 to $50; however, these costs would be covered by the recipient and would not be the responsibility of the NPS. A refrigeration truck (estimated at $75,000) would be required to store carcasses until CWD test results are received. Because some costs associated with translocation, including trucking costs, special marking requirements, and veterinary screening requirements, may vary by recipient and would be their responsibility, these costs are not estimated.

Including these and the other assumptions identified in chapter 2, the average annual costs of this alternative are estimated to be approximately $43,600 per year (or approximately $654,000 over 15 years), with costs higher during initial reduction and decreasing during maintenance. Therefore, if translocations are used, a funding increase may not be required, and impacts would be long-term, negligible, and adverse.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and D and would have short-term and long-term, moderate adverse impacts to park operations and management. When combined with the impacts of alternative D, there would be long-term, moderate adverse cumulative effects on park operations and management.

Conclusion. The gradual reduction and maintenance of the elk population at levels consistent with a lightly grazed system under alternative D would ease potential management issues associated with sustained overuse by a large elk population which would have a long-term, beneficial effect. However, periodic management activities under alternative D would have long-term, minor to moderate, adverse impacts as a result of diverting staff time for implementation and oversight of management actions, including research, monitoring, and additional education and interpretation activities. The average annual costs of this alternative are estimated to be approximately $43,600 per year (or approximately $654,000 over 15 years). Therefore, this alternative would have negligible impacts on park management and operations. Past, present, and reasonably foreseeable future actions, when combined with impacts of alternative D would result in long-term, moderate adverse cumulative impacts.

Alternative E: Hunting Outside the Park

The gradual reduction (over 5 years) and annual maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) within the South Unit would have long-term beneficial effects because the smaller elk population would reduce potential impacts on the park ecosystem from sustained over use by a large elk population and ease potential management issues (e.g., fence maintenance, bison/feral horse management).

Identifying and coordinating with surrounding landowners and the state, and planning and implementing the dispersals (including herding via helicopter) would divert staff, and potentially some funds, from other management programs at the park. Dispersals would likely increase fence maintenance costs in the areas where elk are driven outside the park. Considering the assumptions described in chapter 2, the potential for such impacts would be greater during initial reduction, and would be minimized once maintenance activities begin and the scope of the effort is greatly reduced (from dispersing approximately 1,358 elk over the first 5 years to approximately 200 elk every 3 to 4 years thereafter). Implementing these actions would occur over a matter of days. As with alternative B, research, monitoring, and increased education and interpretation activities would be conducted by existing staff within existing budgets.

The staff time needed to conduct dispersals to increase hunting opportunities would mostly require temporary shifts in priorities by most divisions during management actions, but would not require a substantial, permanent change in park management and operations, and would not be noticeable to visitors. Given the scope and frequency of management actions under this alternative, there would be long-term, minor to moderate, adverse impacts on park operations and management during initial reduction and periodic maintenance activities.

The cost of implementing alternative E would vary depending on the number of elk that need to be dispersed; and the use of NPS staff and cost sharing with NDGF. It is assumed that additional education and interpretation activities would be covered by existing staff within existing budgets. As described in chapter 2, it was assumed that helicopter time would cost $17,000 per operation, and approximately seven to eight operations would be required over the life of the plan. Fence alterations for dispersing elk would cost approximately $6.90 per linear foot. Including these and the other assumptions identified in chapter 2, the average annual costs of this alternative are estimated to be approximately $50,000 per year (or approximately $750,000 over 15 years), with costs higher during initial reduction and decreasing during maintenance.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and E, and would have short- and long-term, moderate adverse impacts to park operations and management. When combined with the impacts of alternative E, there would be long-term, moderate adverse cumulative effects on park operations and management.

Conclusion. The gradual reduction and maintenance of the elk population at levels consistent with a lightly grazed system under alternative E would ease potential management issues associated with sustained overuse by a large elk population which would have a long-term, beneficial effect. However, periodic management activities under alternative E would have long-term, moderate, adverse impacts as a result of diverting staff time for implementation and oversight of management actions, including research, monitoring, and additional education and interpretation activities. The average annual costs of this alternative are estimated to be approximately $50,000 per year (or approximately $750,000 over 15 years), with costs higher during initial reduction and decreasing during maintenance. Past, present, and reasonably foreseeable future actions, when combined with impacts of alternative E would result in long-term, moderate adverse cumulative impacts.

Alternative F: Fertility Control (Maintenance Only)

Fertility control in free-ranging elk is currently experimental, and requires another alternative for initial reduction. If a fertility control agent could be developed that meets NPS criteria and proves effective at maintaining elk population levels (i.e., 100 to 400) consistent with a lightly grazed system in the park, it would result in because the smaller elk population would reduce potential impacts on the park ecosystem from sustained over use by a large elk population and ease potential management issues (e.g., fence maintenance, bison/feral horse management).

Planning and implementing the roundups, including herding via helicopter and working elk in the handling facility, as well as administering fertility agents would temporarily divert staff, and potentially some funds, from other management programs at the park. Considering the assumptions described in chapter 2, this would required rounding up at least 70 elk per year after initial reduction is complete, which could be completed in a matter of days at the most. These impacts would occur annually after initial reduction is complete, and should be completed in a matter of days when implemented As with alternative B, research, monitoring, and increased education and interpretation activities would be conducted by existing staff within existing budgets.

The staff time needed to implement fertility control, including additional monitoring for the effectiveness of fertility control, would require temporary shifts in priorities by most divisions during management actions, but would not require a substantial, permanent change in park management and operations. The effects would not be noticeable to visitors, but there would be long-term, minor to moderate, adverse impacts on park operations and management during annual maintenance activities.

The cost of alternative F would vary depending on the method used for initial reduction; the number of elk to be rounded up and treated; the cost of the fertility control agent; the effectiveness of the fertility control agent; the use of NPS staff versus authorized agents; and the cost of additional education and interpretation activities. As described in chapter 2, roundups were assumed to cost $75 to $150 per head, and fertility control agents would be $160 per dose. Including these and the other assumptions identified in chapter 2, the average annual costs of this alternative **for maintenance only** are estimated to be approximately $54,000 to $60,000 per year (or approximately $800,000 to $900,000 over 15 years) in addition to costs for initial reduction. Due to the necessary funding increase, impacts would be long-term, adverse and minor to major (depending on the alternative used for initial reduction).

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and F, and would have short- and long-term, moderate adverse impacts to park operations and management. When combined with the impacts of alternative F, there would be long-term, moderate adverse cumulative effects on park operations and management.

Conclusion. The gradual reduction and maintenance of the elk population at levels consistent with a lightly grazed system under alternative F would ease potential management issues associated with sustained overuse by a large elk population which would have a long-term, beneficial effect. However, annual management activities under alternative F would have long-term, minor to major (depending on the alternative used for initial reduction), adverse impacts as a result of diverting staff time for implementation and oversight of management actions, including research, monitoring, and additional education and interpretation activities. The average annual costs of this alternative **for maintenance only** are estimated to be approximately $54,000 to $60,000 per year (or approximately $800,000 to $900,000 over 15 years), in addition to the costs associated with the initial reduction method selected. Past, present, and reasonably foreseeable future actions, when combined with impacts of alternative F would result in long-term, moderate adverse cumulative impacts.

Preferred Alternative: Combined Techniques

The gradual reduction (over 3 to 5 years) and annual maintenance of the elk population consistent with a lightly grazed system (i.e., between 100 and 400 elk) within the South Unit would require additional staff commitments and funding, but the smaller elk population would reduce potential impacts on the park ecosystem from sustained overuse by a large elk population and ease potential management issues (e.g., fence maintenance, bison/feral horse management), which would have a long-term, beneficial effect.

Annual direct reduction activities under the preferred alternative would require additional staff time to accompany qualified federal employees or skilled volunteers during management actions. Arrangements would be needed to store salvageable meat until CWD test results are received, which would likely require a refrigeration truck. Time would be required to coordinate the details of donating the meat or disposing of CWD positive lots. These impacts would occur annually, but would be temporary for the duration of management actions, and would occur less frequently after initial reduction is complete and annual maintenance is implemented (removal of a maximum of 275 elk over several months each year for the first 5 years, versus 20 to 24 elk removed in a minimal period of time each year thereafter).

As part of this alternative, both elk population studies and vegetation monitoring would be conducted to document changes in elk grazing that may result from reduced elk numbers. This monitoring program would continue for at least 10 years. Monitoring would be similar to park efforts scheduled to continue under alternative A. This alternative would also involve increased educational and interpretive activities that would be handled by existing staff and within existing budgets.

The staff time needed to conduct direct reductions with firearms would require temporary shifts in priorities by most divisions during management actions. Although not necessarily noticeable to visitors, direct reduction with firearms on an annual basis would require a substantial change in park management and operations. As a result, there would be long-term, moderate to major, adverse impacts on park operations and management during initial reduction and annual maintenance activities.

If roundups and euthanasia/translocation are used in year 3, planning and implementing the roundups, including herding via helicopter, working elk in the handling facility, loading elk into trucks for shipping to a commercial facility, as well as subsequent disease testing, would temporarily divert staff, and potentially some funds, from other management programs at the park. The staff time needed to conduct roundups and euthanasia would require temporary shifts in priorities by most divisions during management actions, but would not require a substantial, permanent change in park management and operations, and would not be noticeable to visitors. Given the scope and frequency of management actions under this alternative, there would be short-term, minor to moderate, adverse impacts on park operations and management if roundups and euthanasia/translocation are used under the preferred alternative.

Besides staff time, the costs to the park would vary based on several factors, including the number of elk to be removed, removal methods, accessibility of the elk, training requirements, equipment availability, data to be collected from the elk, and meat processing or disposal requirements. Average estimated cost for direct reduction under the preferred alternative is approximately $104,000 per year. In addition, other costs would include $25 per head for testing CWD samples removed during handling of the carcass and preparing it for distribution or donation, as well as a refrigeration truck for storing meat until CWD test results are received. Including these and the other costs identified in chapter 2, the average annual costs of this alternative are estimated to be approximately $150,000 per year (or approximately $2.25 million over 15 years), with costs higher during initial reduction and decreasing during maintenance.

Although not necessarily noticeable to visitors, overseeing a skilled volunteer program for direct reduction with firearms on an annual basis would require a substantial change in park management and operations.

The cost of using a combination of techniques under the preferred alternative would vary depending on the number of elk to be rounded up and euthanized or translocated; cost of additional education and interpretation activities, the type of euthanasia method employed, data to be collected from the elk, and meat processing or disposal requirements. As described in chapter 2, the average annual costs of using combined techniques are estimated to be approximately $115,000 to $118,000 per year (or approximately $1.73 to 1.$77 million over 15 years), with costs higher during initial reduction and decreasing during maintenance. Due to the necessary funding increase under either scenario, impacts would be long-term, adverse and moderate to major.

Cumulative Impacts. The same past, present, and reasonably foreseeable future activities are expected under both alternatives A and the preferred alternative, and would have short- and long-term, moderate adverse impacts to park operations and management. When combined with the impacts of the preferred alternative, there would be long-term, moderate, adverse cumulative effects on park operations and management.

Conclusion. The gradual reduction and maintenance of the elk population at levels consistent with a lightly grazed system under the preferred alternative would ease potential management issues associated with sustained overuse by a large elk population which would have a long-term, beneficial effect. However, annual management activities associated with direct reduction with firearms would have long-term, moderate to major, adverse impacts as a result of diverting staff time for implementation and oversight of management actions, including research, monitoring, and additional education and interpretation activities. If used in year 3, roundup and euthanasia/translocation would have additional short-term, minor to moderate impacts. The average annual costs of this alternative are estimated to be approximately $115,000 to $150,000 per year (or approximately $1.73 million to $2.25 million over 15 years). Due to the necessary funding increase under either scenario, impacts would be long-term, adverse and moderate to major. Past, present, and reasonably foreseeable future actions, when combined with impacts of alternative F would result in long-term, moderate adverse cumulative impacts.

UNAVOIDABLE ADVERSE IMPACTS

The National Park Service is required to consider if the alternative actions would result in impacts that could not be fully mitigated or avoided (NEPA Section 101(c)(ii)).

Alternative A: No Action (Continue Existing Elk Management Program)

Under alternative A, there would be long-term, unavoidable adverse impacts to vegetation, the elk population, and wildlife habitat, due to the increase in the elk population over time and the associated damage to vegetation in elk use areas. In addition, there would be impacts to soils and water quality due to the removal of vegetation from elk browsing and grazing and subsequent erosion and sedimentation, and some unavoidable adverse impacts to those wildlife species that depend on ground cover and seedlings for their food and/or cover. There would also be long-term unavoidable adverse impacts on visitor use and experience, because of the effects on vegetation and the associated wildlife and scenery which park visitors enjoy. Unavoidable adverse impacts would continue on park management and operations, due to the demand on park staff related to continued research and resource management activities such as monitoring.

Alternative B: Direct Reduction with Firearms

Most of the unavoidable adverse impacts described for alternative A would continue, but would decrease, over the first 5 years until the population is reduced to and subsequently maintained between 100 and 400 elk over the life of the plan. After this time, potential impacts to vegetation, the elk population, wildlife, wildlife habitat, and soils and water quality would be greatly reduced. There may be some unavoidable adverse effects to these resources from noise and other disturbances during implementation of direct reduction with firearms. Visitors could also be disturbed by these actions. Providing educational and interpretive materials would help mitigate some adverse effects. If used, firearm noise suppressors could offset some of these impacts as well. Unavoidable adverse impacts to health and safety would also occur given the shooting that would occur and the risk of other injuries associated with this alternative. Impacts to park operations and management would also increase compared to alternative A due to periodic diversions of staff for activities associated with direct reduction using firearms.

Alternative C: Roundup and Euthanasia

Unavoidable adverse impacts for this alternative would be greatly reduced compared to the other alternatives, because the reduction in elk numbers would be complete within 1 year and potential impacts to vegetation, the elk population, wildlife, wildlife habitat, and soils and water quality would be greatly reduced. There may be some unavoidable adverse effects to these resources from noise and other disturbances during implementation of normal operations associated with roundups. Visitors could also be disturbed by these actions. Providing educational and interpretive materials would help mitigate some adverse effects. Unavoidable adverse impacts to park operations and management would increase compared to alternative A due to periodic diversions of staff for conducting roundups.

Alternative D: Testing and Translocation

Translocation under this alternative would depend on cooperation by outside parties to implement, which could delay management actions. Most of the unavoidable adverse impacts described for alternative A would continue but would decrease, as the population is reduced to and subsequently maintained between 100 and 400 elk over the life of the plan. After this time, potential impacts to vegetation, the elk population, wildlife, wildlife habitat, and soils and water quality would be greatly reduced. There may be some unavoidable adverse effects to these resources from noise and other disturbances during implementation of normal operations associated with roundups for translocation. Visitors could also be disturbed by these actions. Providing educational and interpretive materials would help mitigate some adverse effects. Unavoidable adverse impacts to park operations and management would increase compared to alternative A due to periodic diversions of staff for conducting roundups.

ALTERNATIVE E: HUNTING OUTSIDE THE PARK

Dispersal of elk to increase hunting opportunities and implementation of state actions would depend on cooperation by outside parties to implement, which could delay management actions. Most of the unavoidable adverse impacts described for alternative A would continue, but would decrease, as the population is reduced to and subsequently maintained between 100 and 400 elk over the life of the plan. After this time, potential impacts to vegetation, the elk population, wildlife, wildlife habitat, and soils and water quality would be greatly reduced. There may be some unavoidable adverse effects to these resources from noise and other disturbances during dispersals to increase hunting opportunities, but these would be similar to those normally associated with roundups conducted at the park. Visitors could also be disturbed by these actions. Providing educational and interpretive materials would help mitigate some adverse effects. Unavoidable adverse impacts to park operations and management would increase compared to alternative A due to periodic diversions of staff for conducting dispersal activities.

ALTERNATIVE F: FERTILITY CONTROL (MAINTENANCE ONLY)

This alternative is not currently an option because fertility control agents that meet NPS criteria are not currently available. It is possible that such an agent would be available during the life of this plan, but it would only be usable as a maintenance option in combination with one of the other alternatives used for initial reduction. Depending on the alternative used for initial reduction, it could delay management actions. Most of the unavoidable adverse impacts described for alternative A would continue but would decrease, as the population is reduced to and subsequently maintained between 100 and 400 elk over the life of the plan. After this time, potential impacts to vegetation, the elk population, wildlife, wildlife habitat, and soils and water quality would be greatly reduced. There may be some unavoidable adverse effects to these resources from noise and other disturbances (trampling) during implementation of roundups for fertility control, administering the fertility control agent, and the resulting infertile elk. Visitors could also be disturbed by these actions. Providing educational and interpretive materials would help mitigate some adverse effects. Unavoidable adverse impacts to park operations and management would increase compared to alternative A due to periodic diversions of staff for conducting roundups and implementing fertility control.

PREFERRED ALTERNATIVE: COMBINED TECHNIQUES

Most of the unavoidable adverse impacts described for alternative A would continue, but would decrease, over the first 3 to 5 years until the population is reduced to and subsequently maintained between 100 and 400 elk over the life of the plan. After this time, potential impacts to vegetation, the elk population, wildlife, wildlife habitat, and soils and water quality would be greatly reduced. There may be some unavoidable adverse effects to these resources from noise and other disturbances during implementation of direct reduction with firearms and, if used, roundups and euthanasia/translocation. Visitors could also be disturbed by these actions. Providing educational and interpretive materials would help mitigate some adverse effects. If used, firearm noise suppressors could offset some of these impacts as well. Unavoidable adverse impacts to health and safety would also occur given the shooting that would occur and the risk of other injuries associated with this alternative. Impacts to park operations and management would increase compared to alternative A due to periodic diversions of staff for activities associated with direct reduction using firearms and, if used, roundups and euthanasia/translocation.

SUSTAINABILITY AND LONG-TERM MANAGEMENT

In accordance with NEPA, and as further explained in NPS Director's Order 12: *Conservation Planning, Environmental Impact Analysis, and Decision-making,* consideration of long-term impacts and the effects of foreclosing future options should be included throughout any NEPA document. According to Director's Order 12, and as defined by the World Commission on Environment and Development, "sustainable development is that which meets the needs of the present without compromising the ability of future generations to meet their needs." For each alternative considered in a NEPA document, considerations of sustainability must demonstrate the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity. This is described below for each alternative. The NPS must consider if the effects of the alternatives involve tradeoffs of the long-term productivity and sustainability of park resources for the immediate short-term use of those resources. It must also consider if the effects of the alternatives are sustainable over the long term without causing adverse environmental effects for future generations (NEPA Section 102(c)(iv)).

ALTERNATIVE A: NO ACTION (CONTINUE EXISTING ELK MANAGEMENT PROGRAM)

Alternative A would trade long-term productivity for short-term use of park resources. The elk population would continue to grow over time and use the park's vegetation at the expense of the long-term productivity and sustainability of the vegetation and other affected wildlife in the park, as well as the park's cultural landscapes. Impairment of the vegetation, elk habitat, and some wildlife and wildlife habitat in elk use areas of the South Unit would likely occur over the long term if the population continues to grow and there is sustained, heavy use of plant communities.

ALTERNATIVE B: DIRECT REDUCTION WITH FIREARMS

There would be a short-term commitment of human resources and long-term impacts to the park's wildlife and visitors during annual elk removal actions. This alternative would ultimately result in the long-term productivity of the park's vegetation and habitat and a sustainable use of the resources in the park. No impairment of park resources would occur under alternative B but, for this alternative to be sustainable, it would require long-term management, including monitoring and adaptive management to protect park resources for future generations.

ALTERNATIVE C: ROUNDUP AND EUTHANASIA

There would be a short-term commitment of human resources and long-term impacts to the park's visitors and environment during periodic elk removal actions. But the rapid reduction in the elk population would quickly result in protection of long-term productivity of the park's vegetation and habitat and a sustainable use of the resources in the park. No impairment of park resources would occur under alternative C but, for this alternative to be sustainable, it would require long-term management, including monitoring and adaptive management to protect park resources for future generations.

ALTERNATIVE D: TESTING AND TRANSLOCATION

Translocation would depend on cooperation by outside parties to implement, which could delay management actions from being taken, resulting in a tradeoff of short-term uses of resources for long-term productivity that would be achieved as the population is reduced to and subsequently maintained between 100 and 400 elk over the life of the plan. There would be a short-term commitment of human resources during periodic management activities, which would have long-term impacts to the park's visitors and environment during removal actions. No impairment of park resources would occur for this alternative, but to be sustainable, it would require long-term management, including monitoring and adaptive management to protect park resources for future generations.

ALTERNATIVE E: HUNTING OUTSIDE THE PARK

Dispersal of elk to increase hunting opportunities and implementation of state actions would depend on cooperation by outside parties to implement, which could delay management actions from being taken, resulting in a tradeoff of short-term uses of resources for long-term productivity that would be achieved as the population is reduced to and subsequently maintained between 100 and 400 elk over the life of the plan. There would be a short-term commitment of human resources during periodic management activities, which would have long-term impacts to the park's visitors and environment during removal actions. No impairment of park resources would occur for this alternative, but to be sustainable, it would require long-term management, including monitoring and adaptive management to protect park resources for future generations.

ALTERNATIVE F: FERTILITY CONTROL (MAINTENANCE ONLY)

This alternative is not currently an option because fertility control agents that meet NPS criteria are not currently available. It is possible that such an agent would be available during the life of this plan, but it would only be usable as a maintenance option in combination with one of the other alternatives used for initial reduction. Depending on the alternative used for initial reduction, it could delay management actions, resulting in a tradeoff of short-term uses of resources for long-term productivity that would be achieved only after the population is reduced to and subsequently maintained between 100 and 400 elk over the life of the plan. There would be a short-term commitment of human resources during periodic management activities, which would have long-term impacts to the park's visitors and environment. Fertility control would require more focused resources because it is experimental in a free-ranging population and would require additional monitoring. No impairment of park resources would occur for this alternative, but to be sustainable, it would require long-term management, including monitoring and adaptive management to protect park resources for future generations.

PREFERRED ALTERNATIVE: COMBINED TECHNIQUES

There would be a short-term commitment of human resources and long-term impacts to the park's visitors and environment during periodic elk removal actions. But the reduction in the elk population would ultimately result in protection of long-term productivity of the park's vegetation and habitat and a sustainable use of the resources in the park. The duration of initial reduction (3 to 5 years) would result in a tradeoff of short-term uses of resources for long-term productivity that would be achieved as the population is reduced to and subsequently maintained between 100 and 400 elk over the life of the plan. There would be a short-term commitment of human resources during periodic management activities, which would have long-term impacts to the park's visitors and environment during removal actions. No impairment of park resources would occur under the preferred alternative but, for this alternative to be sustainable, it would require long-term management, including monitoring and adaptive management to protect park resources for future generations.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

The National Park Service must consider if the effects of the alternatives cannot be changed or are permanent (that is, the impacts are irreversible). The NPS must also consider if the impacts on park resources would mean that once gone, the resource could not be replaced; in other words, the resource could not be restored, replaced, or otherwise retrieved (NEPA Section 102(c)(v)).

ALTERNATIVE A: NO ACTION (CONTINUE EXISTING ELK MANAGEMENT PROGRAM)

Under alternative A, impacts to vegetation (particularly grasses and some shrubs and trees) from continued overuse by elk could result in irreversible impacts to grasslands and some woodlands if no actions are taken to reduce elk numbers. Exotic plants not palatable to elk would continue to exploit disturbances from overuse and trampling and animal species that rely on native ground vegetation might be displaced or subject to increased predation. Elk foraging at current population levels has not had obvious effects on vegetation, but it is unknown at what point that may happen. In addition, the elk population of the South Unit could suffer irretrievable adverse effects if no action is taken, as a result of habitat degradation, impacts to population health, and effects on movement, distribution, and energy expenditures.

ALTERNATIVE B: DIRECT REDUCTION WITH FIREARMS

Alternative B has the potential for some irreversible impacts during the 5 years of initial reduction activities. Some plant communities of the South Unit could be adversely affected by trampling and overuse by elk, which could also increase erosion and cause an irretrievable loss of soil. Under the hypothetical scenario described in chapter 2, the loss of approximately 1,558 to 1,598 elk would be an irretrievable commitment of individual animals. However, the plant communities, soils, wildlife, and wildlife/elk habitat would be protected in the long-term, and the smaller population would reduce the potential for density-dependent competition and disease transmission, as well as reduce potential impacts to overall population health.

ALTERNATIVE C: ROUNDUP AND EUTHANASIA

The potential for irreversible impacts would be greatly reduced under this alternative, because the rapid reduction and maintenance of the elk population between 100 and 400 animals would quickly result in protection of park resources. Under the hypothetical scenario described in chapter 2, the loss of approximately 1,400 to 1,600 elk would be an irretrievable commitment of individual animals. However, the plant communities, soils, wildlife, and wildlife/elk habitat would be protected in the long-term, and the smaller population would reduce the potential for density-dependent competition and disease transmission, as well as reduce potential impacts to overall population health.

ALTERNATIVE D: TESTING AND TRANSLOCATION

Translocation would create the potential for the same irreversible impacts as described for alternative B, although they would be less likely to occur as initial reduction would be completed within 3 years instead of 5 under the hypothetical scenario described in chapter 2. Under this scenario, the loss of at least 868 elk would be an irretrievable commitment of individual elk. However, the plant communities, soils, wildlife, and wildlife/elk habitat would be protected in the long-term, and the smaller population would reduce the potential for density-dependent competition and disease transmission, as well as reduce potential impacts to overall population health.

ALTERNATIVE E: HUNTING OUTSIDE THE PARK

Dispersal of elk to increase hunting opportunities would create the potential for the same irreversible impacts as described for alternative B. Under the hypothetical scenario described in chapter 2, the loss of approximately 1,758 to 1,958 elk would be an irretrievable commitment of individual elk. However, the plant communities, soils, wildlife, and wildlife/elk habitat would be protected in the long-term, and the smaller population would reduce the potential for density-dependent competition and disease transmission, as well as reduce potential impacts to overall population health.

ALTERNATIVE F: FERTILITY CONTROL (MAINTENANCE ONLY)

This alternative is not currently an option because fertility control agents that meet NPS criteria are not currently available. It is possible that such an agent would be available during the life of this plan, but it would only be usable as a maintenance option in combination with one of the other alternatives used for initial reduction. As a result, this alternative would create the potential for the same irreversible impacts as described for the other alternative alternatives during initial reduction. Under the hypothetical scenario described in chapter 2, the treatment of approximately 690 to 996 elk female elk with fertility control agents would be an irretrievable commitment of the reproductive capability of individual elk. However, the plant communities, soils, wildlife, and wildlife/elk habitat would be protected in the long-term, and the smaller population would reduce the potential for density-dependent competition and disease transmission, as well as reduce potential impacts to overall population health.

PREFERRED ALTERNATIVE: COMBINED TECHNIQUES

The preferred alternative has the potential for some irreversible impacts during the 5 years of initial reduction activities. Some plant communities of the South Unit could be adversely affected by trampling and overuse by elk, which could also increase erosion and cause an irretrievable loss of soil. Under the hypothetical scenario described in chapter 2, the loss of approximately 1,049 to 1,598 elk would be an irretrievable commitment of individual animals. However, the plant communities, soils, wildlife, and wildlife/elk habitat would be protected in the long-term, and the smaller population would reduce the potential for density-dependent competition and disease transmission, as well as reduce potential impacts to overall population health.

CONSULTATION AND COORDINATION

THEODORE ROOSEVELT NATIONAL PARK

CHAPTER 5: CONSULTATION AND COORDINATION

The intent of the *National Environmental Policy Act* is to encourage the participation of federal and state-involved agencies and affected citizens in the assessment procedure, as appropriate. This section describes the consultation that occurred during development of this plan/EIS, including consultation with scientific experts and other agencies. This chapter also includes a description of the public involvement process and a list of the recipients of the draft and final plan/EIS.

HISTORY OF PUBLIC INVOLVEMENT

The public involvement activities for this plan/EIS fulfill the requirements of the *National Environmental Policy Act* and NPS Director's Order 12 (NPS 2001a).

THE SCOPING PROCESS

The National Park Service divides the scoping process into two parts: internal scoping and external or public scoping. Internal scoping involved discussions among NPS personnel regarding the purpose of and need for management actions, issues, management alternatives, mitigation measures, the analysis boundary, appropriate level of documentation, available references and guidance, and other related topics.

Public scoping is the early involvement of the interested and affected public in the environmental analysis process. The public scoping process helps ensure that people have an opportunity to comment and contribute early in the decision-making process. For this planning document and impact statement, project information was distributed to individuals, agencies, and organizations early in the scoping process, and people were given opportunities to express concerns or views and to identify important issues or even other alternatives.

Taken together, internal and public scoping are essential elements of the NEPA planning process. The following sections describe the various ways scoping was conducted for this impact statement.

Internal Scoping

A two-day internal scoping meeting was held May 25 and 26, 2004 in Medora, North Dakota to discuss the development of an Elk Management Plan for Theodore Roosevelt National Park. During the two-day meeting, NPS employees identified the purpose of and need for action, management objectives, issues, and impact topics. Various roles and responsibilities for developing the elk management plan were also clarified. The results of the meetings were captured in a report now on file as part of the administrative record. Representatives from the NPS - Washington Office/Environmental Quality Division (EQD), NPS – Washington Office/Biological Resource Management Division (BRMD), NPS – Midwest Region, Theodore Roosevelt National Park (including a former employee), NDGF, USFS, U.S. Geological Survey (USGS), and Greystone Environmental Consultants, Inc.(Greystone) attended this meeting.

In addition, the park had coordinated with many technical experts prior to starting the planning process and established a Science Team to provide input to this plan, as described in "Chapter 1: Purpose of and Need for Action." Comprised of subject matter experts, the Science Team was chartered to advise and provide technical recommendations to the National Park Service on matters regarding scientific data and analysis. The team met periodically providing technical background information and research references for this plan. The team participants were limited to persons with scientific background in elk management, research, and range ecology; NPS staff; and others with background experience with the park or park ecosystems. The first of 12 Science Team meetings was held on March 1, 2005.

Public Scoping

Public Meetings and Comments

Public scoping efforts for this planning process focused on the means or processes to be used to include the public, the major interest groups, and local public entities. Based on past experience, park staff place a high priority on meeting the intent of public involvement in the NEPA process and giving the public an opportunity to comment on proposed actions.

The public scoping process began on August 31, 2004 with the publication of a Notice of Intent in the *Federal Register* (FR) (FR, Volume 69, Number 168). The NPS hosted five public scoping meetings throughout North Dakota in support of this effort. Public service announcements were provided to local television and radio news agencies and local newspapers, and an announcement was published in the FR (FR Vol. 69 No. 168; August 31, 2004) to notify the public of these meetings. Approximately 1,000 public scoping meeting brochures were also distributed by mail. These meetings were conducted during the weeks of November 29 and December 6, 2004.

Meetings were organized in an open-house format, allowing the public to browse informational posters, interact with park staff, and listen to a brief presentation at their own pace. Meetings were available to the public between 5:30 pm and 8:30 pm. A series of full-color display boards was presented to help illustrate the project background and potential environmental impacts, issues, concerns, and alternatives used at other parks facing similar management issues. These display boards provided an overview of the NEPA process, general project issues, elk biology, chronic wasting disease, and current management practices at the park. Park and contractors were located at the display boards to answer questions; facilitate discussions; and record thoughts, ideas, and concerns raised by the public.

Twice during each open house, the NPS offered brief slideshow presentations pertaining to elk history and status at the park as well as a summary of the NEPA process. During each meeting, the public was offered a variety of opportunities to provide feedback or submit questions, including flip charts, comment forms (and drop box), and pre-addressed comment forms for postal delivery. Participants were given information regarding NPS's web-based comment forum, Planning, Environment, and Public Comment (PEPC), and were encouraged to submit their comments electronically using this system. The addresses for submitting comments were printed on all news releases and the project newsletter for the benefit of people who could not attend the open houses, but still wanted to provide comments.

Meeting locations, meeting dates, and the number of public participants at each meeting are listed below:

Meeting Location	Date	Number of Participants
Dickinson, North Dakota	November 29, 2004	75
Minot, North Dakota	November 30, 2004	17
Fargo, North Dakota	December 1, 2004	39
Bismarck, North Dakota	December 2, 2004	103
Medora, North Dakota	December 6, 2004	78

A total of 304 people attended public meetings and provided NPS with 440 pieces of correspondence. An additional 242 pieces of correspondence were received by mail or electronically through PEPC and email.

A Content Analysis Process was used to compile and correlate similar public comments into a format useable by the decision-makers and the planning team. Content analysis assists the team in organizing, clarifying, and addressing technical information pursuant to NEPA regulations and in identifying the topics and issues to be evaluated and considered throughout the planning process.

The process included seven steps:

1. Entering correspondence that was not received directly into PEPC into the database;
2. Reviewing all correspondence;
3. Developing a coding structure;
4. Identifying and coding comments pulled from correspondence;
5. Analyzing the comments to identify issues and themes;
6. Creating concern statements; and
7. Preparing the Content Analysis Report.

A coding structure was developed to help sort comments into logical groups by topic and issue. The coding structure was derived from an analysis of the range of topics discussed during internal NPS scoping, past planning documents, NPS legal guidance, and the comments themselves. The coding structure was designed to capture all comments and content, rather than to restrict or exclude any content.

Analysis of the public comments involved the assignment of codes to statements made by the public in their letters, email messages, and written comment forms. Codes were assigned within the PEPC database for each individual comment in a correspondence. All comments were read and analyzed including those of a technical nature; opinions, feelings, and preferences of one element or one potential alternative over another; and comments of a personal or philosophical nature. All comments were considered, whether they were presented by several people saying the same thing or by a single person expressing a unique viewpoint. After reviewing and categorizing all of the comments within each correspondence, 1,646 comments were identified and coded appropriately.

A Comment Analysis Report was then prepared that summarized concern statements as well as the full text of all comments corresponding to the appropriate concern statement. All scoping comments were considered to be important as useful guidance and public input to the public scoping process. With regard to development of the draft plan/EIS, comments in favor of or against the proposed action or alternatives, those that only agree or disagree with NPS policy, and those that offer opinions or provide information not directly related to the issues or impact analysis were considered non-substantive comments. Non-substantive comments can provide background for a draft or final EIS but do not require a specific purpose.

Of the 1,646 comments received, 1,203 were related to the alternatives; 21 comments were concerned with the purpose and need of the plan; 15 comments were related to park operations; 56 comments recognized socioeconomics as a key component; 18 comments dealt with visitor experience; 15 comments were regarding vegetation and riparian areas; and 50 comments were related to wildlife and wildlife habitat. The remaining comments were of a general nature concerning consultation and coordination, hunting units, visitor conflict and safety, and water resources.

Public Notification

The Notice of Intent to publish an environmental impact statement was published in the *Federal Register* on August 31, 2004 (FR, Volume 69, Number 168).

A newsletter was mailed in the fall of 2004 to the project's preliminary mailing list of government agencies, organizations, businesses, and individuals. The newsletter announced the public scoping meetings, and provided background on elk management at the park. It also summarized the purpose of and need for an elk management plan and the plan objectives.

PUBLIC REVIEW OF THE DRAFT PLAN/EIS

A notice of availability for the draft plan/EIS was published in the Federal Register on December 15, 2008. Following the release of the draft plan/EIS, a 90-day public comment period was open between December 17, 2008, and March 19, 2009. This public comment period was announced through the park's website (www.nps.gov/thro); through mailings sent to interested parties, elected officials, and appropriate local and state agencies; and through press releases and newspapers. The draft plan/EIS was made available through several outlets, including the NPS PEPC website at http://parkplanning.nps.gov/, and available on CD or hardcopy by contacting the park Superintendent. After reviewing the draft plan/EIS, the public was encouraged to submit comments regarding the draft plan/EIS through the NPS PEPC website, emailing the park directly, faxing the park, or by postal mail sent directly to the park.

Six public meetings were held in February 2009 to present the plan, provide an opportunity to ask questions, and facilitate public involvement and community feedback on the draft plan/EIS for elk management at Theodore Roosevelt National Park as follows:

- February 23, 2009 from 5:00 pm to 8:30 pm at the Grand Dakota Lodge & Convention Center in Dickinson, North Dakota.
- February 24, 2009 from 5:00 pm to 8:30 pm at the Holiday Inn in Fargo, North Dakota.
- February 25, 2009 at the Canad Inn from 5:00 pm to 8:30 pm in Grand Forks, North Dakota.
- February 26, 2009 from 5:00 pm to 8:30 pm at the International Inn in Minot, North Dakota.
- February 27, 2009 from 5:00 pm to 8:30 pm at the Best Western Seven Seas Inn and Convention Center in Mandan, North Dakota.
- February 28, 2009 from 2:30 pm to 5:00 pm at the Medora Community Center in Medora, North Dakota.

These meetings were announced to the public and numerous media outlets on February 11, 2009 through a park press release and through PEPC. A total of 304 meeting attendees signed in during the six meetings. The meetings began with a brief open house format where attendees had the opportunity to ask questions and observe informational displays illustrating the study area, the purpose, need, and objectives of the plan, and summaries of the six proposed alternatives, as well as information on CWD, the history of elk management at the park, and the project timeline. The open house format was followed by a formal presentation by park staff, explaining the specifics of the plan and the proposed alternatives. The presentation was followed by another open house format that allowed the attendees to submit comments, and discuss issues with the project team in small groups. If the commenter did not want to make comments at the meetings, comment sheets were available at the sign-in table. Attendees could fill out the forms and submit them at the meeting or mail them to the park at any time during the public comment period. Those attending the meeting were also given a public meeting informational handout, which provided additional information about the NEPA process, commonly asked questions regarding the project, and additional opportunities for comment on the project, including directing comments to the NPS PEPC website at http://parkplanning.nps.gov/.

During the comment period for the draft plan/EIS, 390 pieces of correspondence were received including emails, hard copy letters via mail, comment sheets and flipchart comments submitted at the public meetings, and correspondences entered directly in the PEPC system. Letters received by email or through the postal mail, as well as the comments received from the public meetings, were entered into the PEPC system for analysis.

Once all the correspondences were entered into PEPC, each was read, and specific comments within each correspondence were identified. A total of 911 comments were derived from the correspondences received. During coding, comments were classified as substantive or non-substantive. A substantive comment is defined in the NPS *Director's Order 12* Handbook as one that does one or more of the following (NPS 2001a, Section 4.6A):

- Question, with a reasonable basis, the accuracy of information presented in the EIS;
- Question, with reasonable basis, the adequacy of the environmental analysis;
- Present reasonable alternatives other than those presented in the EIS; and/or
- Cause changes or revisions in the proposal.

As further stated in Director's Order 12, substantive comments "raise, debate, or question a point of fact or policy. Comments in favor of or against the proposed action or alternatives, or comments that only agree or disagree with NPS policy, are not considered substantive." Non-substantive comments offer opinions or provide information not directly related to the issues or impact analysis. Non-substantive comments were acknowledged and considered by the NPS, but did not require responses. Substantive comments were grouped into issues and "concern statements" prepared for responses. Members of the park team responded to the concern statements and these responses are addressed in "Attachment 2: Comment Response Report."

Copies of the final plan/EIS will be offered to each person or entity that received the draft plan/EIS. The electronic version of the final document will also be posted on the NPS PEPC website (http://parkplanning.nps.gov). Following the publication of a notice of availability of this final EIS in the Federal Register, a 30-day waiting period will begin before the Record of Decision documenting the reasoning and choosing of a final selected alternative is signed and implementation of that alternative can begin.

PUBLIC REVIEW OF THE PARK PREFERRED AND ENVIRONMENTALLY PREFERABLE ALTERNATIVES

Based on comments received from the public during the draft plan/EIS public comment period, the NPS identified a preferred alternative and an environmentally preferable alternative. The public was then given an opportunity to submit comments regarding these two alternatives during a 30-day comment period, from August 10, 2009, and September 9, 2009. During the comment period for the park preferred and environmentally preferable alternatives, 11,986 pieces of correspondence were received. Correspondences were received by one of the following methods: email, hard copy letter via mail, or entered directly into the Internet-based PEPC system. Letters received by email or through the postal mail were entered into the PEPC system for analysis. Of the 11,986 pieces of correspondences received, 11,132 were form letters.

Once all the correspondences were entered into PEPC, each was read, and specific comments within each correspondence were identified. A total of 46,435 comments were derived from the correspondences received. For this phase of the project, comments were also classified as substantive or non-substantive. Substantive comments were grouped into issues and "concern statements" prepared for responses. Members of the park team responded to the concern statements and these responses are addressed in "Attachment 2: Comment Response Report."

AGENCY CONSULTATION

U.S. DEPARTMENT OF AGRICULTURE – U.S. FOREST SERVICE

The U.S. Forest Service is a cooperating agency for this project and has participated in internal planning meetings, including the internal scoping meeting and alternatives development meeting.

U.S FISH AND WILDLIFE SERVICE

As described in the "Issues Dismissed from Further Consideration" section of chapter 1, no federally listed species or critical habitat occur in the project area. As a result, in accordance with Section 7 of the Endangered Species Act of 1973, the NPS has determined the project would have "no effect" on federally listed species, and consultation is not required. However, given the long-term nature of this plan, should any federally listed species be identified or newly designated (including critical habitat), the NPS would initiate consultation with the USFWS concerning any potential effects.

NORTH DAKOTA STATE HISTORIC PRESERVATION OFFICE

In accordance with Section 106 of the National Historic Preservation Act, consultation with the North Dakota State Historic Preservation Office concerning impacts to cultural resources will be initiated by the NPS, as needed.

NORTH DAKOTA AGENCIES

During development of this plan, representatives from the following state agencies were consulted:

- North Dakota Game and Fish Department
- North Dakota Natural Heritage Inventory Program
- North Dakota State Historic Preservation Office
- North Dakota Farm Bureau
- North Dakota Department of Transportation

The North Dakota Natural Heritage Inventory Program, managed by the North Dakota Parks & Recreation Department, was consulted for information used in this plan.

NORTH DAKOTA COUNTIES AND LOCAL AGENCIES

Representatives from McKenzie and Billings Counties were consulted and provided input on the alternatives during development of this plan. Additional opportunities for comment was afforded to representatives of McKenzie and Billings Counties during public review.

TRIBAL CONSULTATION

The appropriate level of Tribal government has been consulted during development of this plan/EIS. Representatives from the following Tribes were consulted:

- Oglala Lakota Tribal Council
- Cheyenne River Sioux Tribal Council
- Three Affiliated Tribes (Mandan, Hidatsa, and Arikara Nation)
- Lower Brule Sioux Tribal Council
- Spirit Lake Dakotah Nation
- Standing Rock Sioux Tribal Council

Some of these Tribes provided input on alternatives. Additional opportunities for comment were afforded to representatives from these Tribes during the public review period.

LIST OF RECIPIENTS OF THE PLAN / FINAL ENVIRONMENTAL IMPACT STATEMENT

This plan/EIS was sent to the following agencies, organizations, and businesses, as well as to other entities and individuals who requested a copy.

FEDERAL DEPARTMENTS AND AGENCIES

United States Animal and Plant Health Inspection Service (USAPHIS)

United States Army Corps of Engineers

United States Department of the Interior

National Park Service

Badlands National Park
Biological Resource Management Division
Midwest Regional Office
Ozark National Scenic Riverway
Rocky Mountain National Park
Wind Cave National Park

United States Bureau of Land Management, North Dakota Field Office

United States Fish & Wildlife Service

North Dakota Field Office United States Forest Service

Dakota Prairie Grasslands

United States Geological Survey

Northern Prairie Wildlife Research Center

United States House of Representatives

Congressman Earl Pomeroy

United States Senate

Senator Byron L. Dorgan
Senator Kent Conrad

NORTH DAKOTA AGENCIES

Dickinson State University

Mayville State University

Minot State University – Bottineau

North Dakota Deptartment of Agriculture

North Dakota Game & Fish Department

North Dakota House of Representatives

North Dakota Natural Resources Trust

North Dakota Parks & Recreation Department

North Dakota State Univerisity

Animal & Range Sciences Hultz Hall
Natural Resources Management Club

North Dakota Department of Commerce, Tourism Department

State Board of Animal Health

State Historical Society of North Dakota

Governor John Hoeven

University of North Dakota

COUNTY AND LOCAL AGENCIES

Billings County Commissioners

Dickinson Convention & Visitors Bureau

Dickinson Public Library

Golden Valley County Commissioners

McKenzie County Commissioners

McKenzie County Public Library

Roosevelt-Custer Regional Council

Stark County Commissioners

Slope County Commissioners

Watford City Area Chamber of Commerce

Native American Tribes

Cheyenne River Sioux Tribe (SD)

Crow Tribal Council (MT)

Lower Brule Sioux Tribal Council (SD)

Oglala Lakota Tribal Council (SD)

Spirit Lake Dakotah Nation (ND)

Standing Rock Sioux Tribal Council (ND)

Three Affiliated Tribes (Mandan, Hidatsa, and Arikara Nation) (ND)

Turtle Mountain Band of Chippewa Indians (ND)

Organizations and Businesses

Badland Conservation Alliance

Dakota Resource Council North Dakota Chapter

Humane Society of the United States

Little Missouri Grazing Association

McKenzie County Grazing Association

Medora Grazing Association

National Parks Conservation Association

North Dakota Chapter of the Wildlife Society

Rocky Mountain Elk Foundation – Missoula

Sierra Club

Theodore Roosevelt Medora Foundation

Theodore Roosevelt Nature and History Association

SCIENCE TEAM MEMBERS

Name	Title	Organization/Location
Mike Oehler	Wildlife Biologist	NPS/Theodore Roosevelt National Park
Dr. Glen Sargeant	Wildlife Research Biologist	U.S. Geological Survey
Dr. Jack Butler	Range Ecologist	U.S. Forest Service
Laurie Richardson	Botanist	NPS/Theodore Roosevelt National Park
Dr. Lynn Irby	Retired Professor of Ecology	Montana State University
Dr. Jenny Powers	Wildlife Veterinarian	NPS/BRMD
Bruce Stillings	Big Game Biologist	North Dakota Game and Fish Department
Dr. Josh Milspaugh	Professor of Quantitative Ecology	University of Missouri
Dan Licht	Regional Wildlife Biologist	NPS/Midwest Regional Office
Rod O’Sullivan	Former Environmental Protection Specialist	NPS/BRMD
Arden Warm	Wildlife Biologist	U.S. Forest Service

LIST OF PREPARERS AND CONSULTANTS

Name	Title
National Park Service	
Melissa Behrent	Environmental Protection Specialist, EQD
David Jacob	Project Manager, Environmental Protection Specialist
Bruce Kaye	Former Chief of Interpretation, Theodore Roosevelt National Park
Penny Knuckles	Former Chief of Resource Management, Theodore Roosevelt National Park
Dan Licht	Regional Wildlife Biologist (Midwest Region)
Michael Mayer	Former Environmental Protection Specialist, EQD
Valerie Naylor	Superintendent, Theodore Roosevelt National Park
Mike Oehler	Wildlife Biologist, Theodore Roosevelt National Park
Rod O'Sullivan	Former Environmental Protection Specialist, BRMD
Dr. Jenny Powers	Wildlife Veterinarian, BRMD
Laurie Richardson	Botanist, Theodore Roosevelt National Park
Tammy Whittington	Division Chief, EQD
William Whitworth	Chief of Resource Management, Theodore Roosevelt National Park
The Louis Berger Group	
Lucy Bambrey	Cultural Resource Specialist
Rebecca Byron	Environmental Scientist
Carol Efird	Senior Recreation/Land Use Planner
Amanda Goebel	Former Planner
Joel Gorder	Former Planner
Jeff Gutierrez	Environmental Planner
Dr. Lisa McDonald	Resource Economist
Dan Niosi	Project Manager, Environmental Scientist

Name	Title
Dana Otto	Quality Assurance/Quality Control Specialist
Brad Reed	Former Environmental Scientist
Josh Schnabel	Environmental Planner
Spence Smith	Scientist
Nancy Van Dyke	Senior Consultant
Doug Wetmore	Environmental Planner
The Final Word	
Juanita Barboa	Technical Editor
Matt Look	Graphic Designer
TQ NEPA	
Heidi West	Principal
Kathie Joyner	Senior Analyst

ACRONYMS, GLOSSARY, AND REFERENCES

THEODORE ROOSEVELT NATIONAL PARK

ACRONYMS

AUM	animal unit month
BRMD	Biological Resource Management Division
CCC	Civilian Conservation Corps
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (commonly known as Superfund)
CFR	Code of Federal Regulations
CVS	Certified Volunteer Sharpshooter
CWA	Clean Water Act
CWD	Chronic Wasting Disease
EIS	Environmental Impact Statement
EQD	Environmental Quality Division
EPA	U.S. Environmental Protection Agency
FDA	U.S. Food and Drug Administration
GnRH	gonadotropin releasing hormone
GPS	Global Positioning System
LCS	List of Classified Structures
MOU	Memorandum of Understanding
NDGF	North Dakota Game and Fish Department
NEPA	National Environmental Policy Act
NPS	National Park Service
NRHP	National Register of Historic Places
NVCS	National Vegetation Classification System
PEPC	Planning, Environment, and Public Comment
PL	Public Law

PZP	porcine zona pellucida
TSE	transmissible spongiform encephalopathy
USC	United States Code
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

GLOSSARY

Action Alternative—An alternative that proposes a different management action or actions to address the purpose, need, and objectives of the plan; one that proposes changes to the current management. Alternatives B, C, and D are the action alternatives in this planning process. See also: "No-Action Alternative."

Adaptive Management—The rigorous application of management, research, and monitoring to gain information and experience necessary to assess and modify management activities. A process that uses feedback from research and the period evaluation of management actions and the conditions they produce to either reinforce the viability of objectives, strategies, and actions prescribed in a plan or to modify strategies and actions in order to more effectively accomplish management objectives.

Adult—An elk older than two years of age.

Affected Environment—A description of the existing environment that may be affected by the proposed action (40 CFR 1502.15).

Agonist—An agent that combines with a receptor on a cell to produce a physiologic reaction.

Animal Unit Month—The amount of forage required by one mature cow of approximately 1,000 pounds and a calf, usually 6 months of age, or their equivalent, for a period of one month.

Biobullet—A single dose, biodegradable projectile comprised of an outer methylcellulose casing containing a solid, semi-solid, or liquid product (usually a vaccine or chemical contraceptive), propelled by a compressed-air gun.

Blight—Any of numerous plant diseases that result in sudden and conspicuous wilting and dying of affected parts, especially young growing tissues.

Break—Defined in literature for Theodore Roosevelt National Park as areas noticeably devoid of vegetation, or if vegetation does exist, the areas are situated on steep slopes.

Browse Line—A visible delineation at approximately six feet below which most or all vegetation has been uniformly browsed.

Brucellosis—A highly contagious bacterial disease of domestic and wild animals that is most readily transmitted through exposure to an aborted fetus or other birth materials and fluids, and causes stillbirths abortions, infertility, and decreased milk production.

Carnivore—An animal that eats a diet consisting solely or mostly of meat.

Carrying Capacity—The maximum number of organisms that can be supported in a given area or habitat.

Certified Volunteer Sharpshooter—Defined by North Dakota Game and Fish for this plan as a North Dakota resident that has participated in an approved hunter education course or is deemed legally eligible to obtain the necessary North Dakota licenses or permits to take or possess big game, and who participates in a specialized training course designed by the state.

Cervid—A member of the deer family, such as white-tailed deer, mule deer, elk, moose, and caribou.

Chronic Wasting Disease (CWD)—A slowly progressive, infectious, self-propagating neurological disease of captive and free-ranging deer, elk, and moose. CWD belongs to the transmissible spongiform encephalopathy (TSE) group of diseases and is characterized by accumulations of abnormal prion proteins in neural and lymphoid tissue.

Clinker—A reddish to purplish, layered, and brick-like mass of baked and fused clay, shale, and sandstone formed when lignite coal (see definition of “Lignite Coal”) burned, producing heat that baked the adjacent sediments.

Contragestive—A product that terminates pregnancy.

Contractor—For the purposes of this plan, a contractor is a fully insured business entity, nonprofit group, or other entity engaged in wildlife management activities that include the direct reduction with firearms. The contractor would possess all necessary permits.

Cumulative Impacts—Those impacts on the environment that result from the incremental effect of the action when added to the past, present, and reasonable foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

Elk Population—The group of elk living within the park that have common characteristics and interbreed among themselves.

Demographic—Referring to the intrinsic factors that contribute to a population’s growth or decline: birth, death, immigration, and emigration. The sex ratio of the breeding population and the age structure (the proportion of the population found in each age class) are also considered demographic factors because they contribute to birth and death rates.

Density-dependent—Refers to an influence on individuals that varies with the number of individuals per unit area in the population.

Depredation—Damage or loss.

Ecosystem—An ecological system; the interaction of living organisms and the nonliving environment producing an exchange of materials and energy between the living and nonliving.

Environment—The sum total of all biological, chemical, and physical factors to which organisms are exposed; the surroundings of a plant or animal.

Environmental Assessment (EA)—A concise public document, prepared in compliance with NEPA, that briefly discusses the purposes and need for an action, and provides sufficient evidence and analysis of impacts to determine whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).

Environmental Consequences—Environmental effects of project alternatives, including the proposed action, any adverse environmental effects which cannot be avoided, the relationship between short term uses of the human environment, and any irreversible or irretrievable commitments of resources which would be involved if the proposal should be implemented (40 CFR 1502.16).

Environmental Impact Statement (EIS)—A detailed written statement required by Section 102(2)(C) of the National Environmental Policy Act, analyzing the environmental impacts of a proposed action, adverse effects of the project that cannot be avoided, alternative courses of action, short term uses of the environment versus the maintenance and enhancement of long term productivity, and any irreversible and irretrievable commitment of resources (40 CFR 1508.11).

Ephemeral Streams—Surface waters that flow briefly only in direct response to precipitation in the immediate locality and whose channels are at all times above the water table.

Ethnographic Resource—Any site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it.

Euthanasia—Ending the life of an animal by humane means.

Eutrophication—A process whereby water bodies, such as lakes or slow-moving streams receive excess nutrients that stimulate excessive plant growth. When the plant material dies and decomposes, it reduces dissolved oxygen in the water and can cause other organisms to die. Nutrients can come from many sources, such as fertilizers applied to agricultural fields, golf courses, and suburban lawns; deposition of nitrogen from the atmosphere; erosion of soil containing nutrients; and sewage treatment plant discharges.

Exclosure—An area enclosed by a barrier, such as a fence, to protect vegetation and prevent browsing by animals.

Exotic Species—Any introduced plant, animal or protist species that is not native to the area and may be considered a nuisance; also called non-native or alien species.

Extirpated Species—A species that is no longer present in an area where it once lived.

Exsanguination—The action or process of draining blood.

Fertility Control—A method or methods used to limit the numbers of animals in a population by decreasing the reproductive success of the animals, such as contraception or sterilization.

Foliar Cover—The percent of ground surface covered by vegetation.

Foot and Mouth Disease—Eradicated from the U.S. since 1929, this is a severe, highly communicable disease of cattle and swine that can be transmitted to all cloven-hoofed animals, including elk, mule deer, and white-tailed deer. It is transmitted by animals, people, or materials that bring the virus into physical contact with susceptible animals and causes fever and blister-like lesions followed by loss of tissue on the tongue lips, mouth, and between the hooves.

Gramminoid—A grass or grass-like plant.

Habitat—The environment in which a plant or animal lives (includes vegetation, soil, water, and other factors).

Habitat Fragmentation—The breaking up of large, contiguous blocks of habitat into small, discontinuous areas that are surrounded by altered or disturbed lands.

Herbivore—An animal that eats a diet consisting primarily of plant material.

Home Range—The geographic area in which an animal normally lives.

Hypothesis—A tentative explanation for an observation or phenomenon that can be tested by further investigation.

Immunocontraception—The induction of contraception by injecting an animal with a compound that produces an immune response that precludes pregnancy.

Immunocontraceptive—A contraceptive agent that causes an animal to produce antibodies against some protein or peptide involved in reproduction. The antibodies hinder or prevent some aspect of the reproductive process.

Impairment—As used in NPS Management Policies, "impairment" means an adverse impact on one or more park resources or values that interferes with the integrity of the park's resources or values, or the opportunities that otherwise would exist for the enjoyment of them, by the present or a future generation. Impairment may occur from visitor activities, NPS activities in managing a park, or activities undertaken by concessioners, contractors, and others operating in a park. As used in this plan, the impairment of park resources and values has the same meaning as the phrase "derogation of the values and purposes for which these various areas have been established," as used in the General Authorities Act.

Intermittent Streams—Surface waters in contact with the groundwater table that flow at certain times of year (such as when groundwater table is high or when snow is melting).

Irretrievable—A term that applies to the loss of production, harvest, and consumptive or nonconsumptive use of natural resources. For example, recreation experiences are lost irretrievably when an area is closed to human use. The loss is irretrievable, but the action is not irreversible. Reopening the area would allow a resumption of the experience.

Irreversible—A term that describes the loss of future options. Applies primarily to the effects of use of nonrenewable resources, such as minerals or cultural resources, or to those factors, such as soil productivity that are renewable only over long periods of time.

Juvenile—An elk younger than 1 year old.

Leuprolide—A reproductive control agent that prevents secondary hormone secretion, which stops the formation of eggs and ovulation. Leuprolide is a GnRH agonist (see Appendix E for additional details).

Lignite Coal—A soft coal consisting of plant fragments deposited in Paleocene swamps that occurred in the area approximately 57 to 66 million years ago.

Metapopulation—A series of small, separate populations united together by some level of exchange of individuals between the populations.

Monitoring—A process of collecting information to evaluate if an objective and/or anticipated or assumed results of a management plan are being realized (effectiveness monitoring) or if implementation is proceeding as planned (implementation monitoring).

National Environmental Policy Act of 1969 (NEPA)—A law that requires all Federal agencies to examine the environmental impacts of their actions, incorporate environmental information, and utilize public participation in the planning and implementation of all actions. Federal agencies must integrate NEPA with other planning requirements and prepare appropriate NEPA documents to facilitate better environmental decision making. NEPA requires Federal agencies to review and comment on Federal agency environmental plans/documents when the agency has jurisdiction by law or special expertise with respect to any environmental impacts involved (42 U.S.C. 4321-4327) (40 CFR 1500-1508).

No-Action Alternative—The alternative in which baseline conditions and trends are projected into the future without any substantive changes in management (40 CFR 1502.14(d)). Alternative A is the no-action alternative in this planning process.

Off-label Use—The practice of prescribing drugs for a purpose outside the scope of the drug's approved label.

Opportunistic Surveillance—Taking diagnostic samples for CWD testing from elk found dead or harvested through other activities within a national park unit.

Palatability—The property of being acceptable to the taste or sufficiently agreeable in flavor to be eaten.

Population (or Species Population)—A group of individual plants or animals that have common characteristics and interbreed among themselves and not with other similar groups.

Point Bar—An accumulation of sediment deposited gradually on the inside of the bend in a river.

Prion—Protinaceous infectious particle; a microscopic particle similar to a virus but lacking nucleic acid, thought to be the infectious agent for certain degenerative diseases of the nervous system such as CWD.

Record of Decision (ROD)—A concise public record of decision prepared by a federal agency, pursuant to NEPA, that contains a statement of the decision, identification of all alternatives, a statement as to whether all practical means to avoid or minimize environmental harm from the alternative selected have been adopted (and if not, why they were not), and a summary of monitoring and enforcement where applicable for any mitigation (40 CFR 1505.2).

Recruitment—Number of organisms surviving and being added to a population at a certain point in time.

Repellents—chemical deterrents typically sprayed or brushed on vegetation that produce smells and tastes offensive to elk.

Rut—An annually recurring condition or period of sexual excitement and reproductive activity in elk; the breeding season.

Sacred Bundle—A wrapped package containing a varied collection of objects and representations of spiritual significance used by Native Americans for religious purposes. A package of this type may also be referred to as a medicine bag or medicine bundle.

Scoping—An early and open process for determining the extent and variety of issues to be addressed and for identifying the significant issues related to a proposed action (40 CFR 1501.7).

Seral—A phase in the sequential development of a climax community. The USFS defines seral stage as "the sequence of a plant community's successional stages to potential natural vegetation" (USDA Forest Service 2002).

Seeps—Surface waters with minimal flows and no defined channel or opening where discharge concentrates.

Sex Ratio—The proportion of males to females (or vice versa), in a population. A sex ratio of 50:50 would mean an equal number of males and females of an elk population.

Skilled Volunteers—For the purposes of this plan, a skilled volunteer would include individuals identified through an NPS-developed system which have a demonstrated level of firearm proficiency established by the park. Other skilled volunteers (e.g., veterinarians who volunteer to assist with CWD testing) would need to demonstrate appropriate proficiency depending on their proposed involvement. Those skilled volunteers that qualify for participation would become part of a pool of available personnel that may supplement elk management teams. In addition, all skilled volunteers would be directly supervised in the field by NPS personnel during any elk management actions.

Species Diversity—The variety of different species present in a given area; species diversity takes into account both species richness and the relative abundance of species.

Species Richness—The number of species present in a community.

Springs—A class of surface water characterized by well-defined flow paths that lend them to water capture and further development.

Subadult—An older than one year of age but younger than two years of age.

Targeted Surveillance—Lethal removal of elk that exhibit clinical signs of CWD, such as changes in behavior and body condition, and testing to determine if CWD is present.

Transect—A line along which sampling is performed.

Translocation—For this plan, defined as roundup and relocation of animals to willing recipients (see definition of "Willing Recipients") outside the park

Transmissible Spongiform Encephalopathies (TSEs)—A group of diseases characterized by accumulations of abnormal prion proteins in neural and lymphoid tissues, which cause distinctive lesions in the brain and result in death.

Tuberculosis—A chronic, progressive, density-dependent bacterial disease that can transmitted by the exchange of respiratory secretions between infected and uninfected animals, as well as ingestion of contaminated feed, or exposure to environmental contamination, and causes gradual debilitation, including emaciation and depression, difficulty breathing in severe cases, and in some instances, development of large blisters on the lymph nodes in the neck that may rupture and drain through the skin.

Turbidity—Visible undissolved solid material suspended in water.

Ungulate—A hoofed, typically herbivorous, animal; includes horses, cows, deer, elk, and bison.

Vaccine—A suspension of killed or attenuated microorganisms that, when introduced into the body, stimulates an immune response against that microorganism.

Willing Recipients—For this plan, willing recipients are defined as tribes, non-profit groups, or other agencies (state and federal) interested in receiving elk from translocation.

Withdrawal Period—The amount of time following treatment after which an elk would be considered drug free and fit for consumption.

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INDEX

APPENDIX A

THEODORE ROOSEVELT NATIONAL PARK

CHRONOLOGY OF THE REINTRODUCTION AND MANAGEMENT OF THEODORE ROOSEVELT NATIONAL PARK'S ELK POPULATION

1843: John James Audubon reflecting on a trip down the Little Missouri writes: "*We saw 3 elk swimming across it and the number of this fine species of deer that are about us now is almost inconceivable.*"

1888: Theodore Roosevelt writes about the decline of elk: "*This stately and splendid deer, the lordiest of its kind throughout the world, is now fast vanishing. In our own neighborhood it is already almost a thing of the past.*"

Late 1800s: Elk extirpated from the Badlands (Byran and Maser 1982).

April 25, 1947: Theodore Roosevelt National Park established.

December 20, 1982: Park officials at Wind Cave National Park study the effects of elk and bison grazing and trampling on park vegetation. Elk reduction is considered an option to try and preserve the prairie plant communities at Wind Cave National Park.

June 6, 1983: Theodore Roosevelt National Park Superintendent Harvey Wickware submits the idea of elk reintroduction to the North Dakota Game and Fish Department (NDGF).

August 1983: Park officials consider reintroducing elk into Theodore Roosevelt National Park in an effort to restore the historical Badlands ecosystem that Roosevelt and other visitors once wrote about.

August 16, 1983: First formal meeting between park and NDGF on possibility of elk reintroduction.

August 22, 1983: The elk reintroduction idea is presented to the United States Forest Service (USFS).

December 7, 1983: Superintendent met with Medora Grazing Association (MGA). MGA supported idea with some identified concerns.

October 11, 1983: The three involved agencies Theodore Roosevelt National Park, USFS, and NDGF meet informally to discuss the Elk reintroduction.

All three agree that a Memorandum of Understanding (MOU) should be written for this project to outline each agency's responsibilities.

January 6, 1984: Letter to NDGF formally inviting them to participate in the elk reintroduction process.

March 5, 1984: Acting Regional Director of the National Park Service (NPS) Rocky Mountain Region expresses his support for the elk reintroduction at Theodore Roosevelt National Park writing: "*Theodore Roosevelt already has a well-deserved reputation as a wildlife resource area. Your proposal to re-establish elk in the South Unit should add a major new segment to your resources management program.*"

August 13, 1984: Theodore Roosevelt National Park's Elk Management Plan and Environmental Assessment (EA) for the elk reintroduction released for Public Comment.

August 22 through September 17, 1984: Letters received from public and agencies both in support and against the. MGA letter of September 10, 1984 supported plan if there was no substantial damage to private lands from elk and if the NDGF agreed to compensate for damage that did occur.

September 5, 1984: Public Hearing on the EA is held in Medora, North Dakota at MGA's monthly meeting.

September 10, 1984: Chief Ranger met with MGA representative and NDGF to discuss compensation issue.

September 13, 1984: Public Hearing on the EA is held at Dickinson State University in Dickinson, North Dakota.

September 26, 1984: NDGF responded with letter to MGA regarding the reference about compensation for damage.

October 31, 1984: USFS Decision Notice signed by forest Supervisor.

December 21, 1984: Plans confirmed by the Superintendent of Wind Cave National Park for a transfer of surplus elk to Theodore Roosevelt National Park.

January 8, 1985: At Wind Cave National Park, elk are driven from Boland Ridge to the handling facility 3.5 miles away. Eighty-seven elk are trapped and park officials implement the testing/quarantine requirements needed for transport to North Dakota.

January 9, 1985: The Finding of No Significant Impact (FONSI) for the reintroduction project was issued by Theodore Roosevelt National Park and approved by the Regional Director.

January 21, 1985: It is confirmed by the Rocky Mountain Regional Director of NPS, Lorraine Mintzmeyer, that the elk reintroduction project will have no significant impact on the human environment. Press release on FONSI and plans for elk reintroduction.

January 28, 1985: Memorandum of Understanding (MOU) signed between NDGF, USFS, and Theodore Roosevelt National Park.

March 13, 1985: Forty-seven elk (eight males, 39 females) from the January roundup at Wind Cave National Park are released into South Unit of Theodore Roosevelt National Park at 3 PM. By 11 PM a large group of elk are seen gathered near Buck Hill.

June 1985: Montana State University begins a study in Theodore Roosevelt National Park of elk behavior, habitat use, and food habits.

September 28, 1987: Contact is established with the Rocky Mountain Elk Foundation (RMEF) by requesting information on elk for the park library.

October 7, 1987: RMEF responds with a complementary subscription to *Bugle* magazine and information on how the park can ask for funding for other elk and resource management projects.

September 1988: Population census indicates 148 elk.

September 1989: Population census indicates 176 elk.

October 1989: Jerry Westfall of Montana State University finishes study "Elk Movements, Habitat Use and Population Dynamics in Theodore Roosevelt National Park."

September 24, 1990: Regional letter to NDGF stating reintroduction a success, noting depredation problems outside park and the development of a regional elk management plan by the NDGF.

November 15, 1991: The elk herd continues to grow and many leave the park to forage. Complaints from nearby residents of damage to property spark the question from North Dakota State Representative Kenneth Thompson, "Is the Park Service liable for these damages?"

December 30, 1991: North Dakota Attorney General Nicholas Spaeth replies to Representative Thompson stating that because the elk are outside the park they are under the proprietorship of the state yet still considered wild and the state is not liable for damage done by the elk. He supports this by offering a judgment from *Metier v. Cooper Transport Co., Inc*., 378 N.W.2nd 907 (Iowa 1985): *"To hold the state liable for all the conduct of its wild animals in every situation would pose intractable problems, and intolerable risks to the ultimate ability of the state to administer its trust. The heritage of wildlife beauty and splendor the state seeks to preserve for future generations might well be lost."* Liability for damages is averted, but elk reduction is considered.

March 16, 1992: North Governor George Skinner proposes that Theodore Roosevelt National Park donate their surplus elk to replace the herd of Mitchell Charles which, at the time, was the only herd in North Dakota quarantined for brucellosis contamination.

August 1992: Money for the water well and distribution system is approved at the National level for the new wildlife handling facility at Theodore Roosevelt National Park to be completed by 1993.

January 11 through May 13, 1993: First elk reduction in park with 90 day quarantine.

> **January 11, 1993**: Theodore Roosevelt National Park begins roundup with intentions of transferring the animals to two zoos, the Sully's Hill National Game Preserve in North Dakota, and the Cheyenne River and Pine Ridge Reservations in South Dakota. Pre-roundup census estimated at 400 elk. Captured 278: 44 died, 176 shipped, and 51 returned to park. Cost of roundup: approximately $48,800. Post-roundup census estimated between 110 and 160 (130).
>
> **January 29, 1993**: Returned 51 elk back to park after testing negative for tuberculosis and brucellosis.
>
> **February 20, 1993**: A major effort is put forth to get the herd of Mitchell Charles replaced by Theodore Roosevelt National Park elk. Because the park had already stated they could not directly transfer the elk to Mr. Charles, the North Dakota Board of Animal Health, North Dakota Department of Agriculture, NDGF, North Dakota Elk Growers, North Dakota Stockmen's Association, and the Standing Rock Sioux Tribe of North Dakota devised a plan for a number of elk to be transferred to the Standing Rock Sioux Tribe. These elk could then be given to Mr. Charles in exchange for the meat from the herd that was infected.
>
> **February 24, 1993**: Ten elk were shipped to the Dakota Zoo, two to the Chahinkapa Zoo, three to Sully's Hill Game Preserve, and eight to the Prairie State Park.
>
> **May 5, 1993**: After the 90 day quarantine, 169 elk were left (44 having died during the whole roundup process). Forty-seven elk were sent to the Standing Rock Sioux Tribe, 51 were shipped to the Cheyenne River Reservation, and 55 to the Pine Ridge Reservation.

October 10, 1993: **"**Forage Allocation Model for Four Ungulate Species" submitted by Montana State University (Westfall et al. 1989). Elk population numbers set at approximately 360 to 400 using the model as a guide, and depending on numbers of bison and horses.

October 28, 1993: MOU renewed by three parties.

March 11, 1997: Helicopter census estimated at 226 plus**,** (42 bulls and 184 antlerless [cows and calves]).

March 11, 1997: MOU renewed by three parties.

July 28, 1997: NDGF meeting with ranchers on the upcoming August elk Depredation Hunt.

August 15–31, 1997: NDGF authorized the first hunting season for elk outside the park boundaries (a split season in one unit. The depredation hunt issued 36 sportsman permits and 17 landowner permits. Thirty-seven bulls were harvested.

February 11 and March 12, 1998: Two fixed-wing census efforts counted 160 and 120 elk, respectively. There was no snow on the ground for first flight. After a later snow, the second flight was flown. Census in fixed-wing aircraft did not appear to reflect true count.

February 18, 1998: NDGF meeting with ranchers concerning proposed 1998 depredation hunt.

July 10, 1998: RMEF approved park's request for funding a helicopter elk census in winter 1999.

August 1998: NDGF allows another short season for elk hunting outside the park. Forty sportsman and 18 land-owner licenses were issued for this elk unit. Three cows and 34 bulls harvested.

February 25, 1999: Fixed wind survey completed. Counted 273 elk (24 bulls, 237 cows and 12 calves) with 270 in park and 3 bulls outside the park.

March 1, 1999: Helicopter survey completed. Counted 417 elk (74 bulls, 257 cows and 86 calves) with 410 in park and 7 bulls outside the park. Both surveys funded by RMEF, Theodore Roosevelt National Park, NDGF, and USFS. Total cost was $15,185.

August 1999: NDGF establishes two hunting units. The first year there were 14 licenses issued in E3 (two landowner and 12 sportsman – all were "any elk" licenses). Season was from August 13 through August 29. Eight bulls were harvested. For unit E4, there were 58 licenses issued (18 landowner and 40 sportsman). Early season was August 13 through 19, and late was August 20 through 29. Twenty bulls and 16 cows were harvested.

January 18–28, 2000: Second elk reduction in park. The 2000 Roundup lasted 11 days. Initial effort took four days (18th-21st) to process 297 elk (one small calf was not processed). Tuberculosis was checked in 203 elk (21st-24th). On the 25th, 27th, and 28th, 198 elk were shipped: 144 to Kentucky, eight to Dakota Zoo, three to Roosevelt Zoo, three to Sully Hills, 40 to the Three Affiliated Tribes**.** A total of five deaths, four due to injury, and one from Johne's Disease. A total of 94 were released back into the park (50 with radio collars). Roundup was considered a success. Cost of roundup was approximately $40,000. Post roundup census was 200 elk.

2001–2003: NPS, RMEF and University of North Dakota (UND) formed a partnership to finance and implement a 3-year monitoring study (VHF collars) to track and monitor elk habitat and movements. UND dropped out of the project prior to its completion. The U.S. Geological Survey (USGS) Biological

Resources Division Northern Prairie Wildlife Research Center also was funded to implement a companion study to research the population ecology of the park herd and develop a survey protocol.

July 2002: Due to concerns about chronic wasting disease (CWD) a memo was issued by the NPS Director restricting movement of cervids (including elk) to or from NPS units without a 99% confidence that the prevalence of CWD was less than 1%.

January 2003: Roundup scheduled to remove approximately 250 elk from South Unit of Theodore Roosevelt National Park (reduce population to approximately 200) is cancelled. The memo described above effectively resulted in this cancellation.

May 25 and 26, 2004: NPS conducts an interagency internal scoping meeting to discuss development of an elk management plan for Theodore Roosevelt National Park. Participants included the NPS, NDGF, USFS, and USGS.

November 29 through December 6, 2004: NPS holds five public scoping meetings for the plan/EIS in Dickinson, Minot, Fargo, Bismarck, and Medora North Dakota. The meetings started a public comment period that ended on December 31, 2004. Comments were solicited to identify potential environmental impacts, issues, concerns, and alternatives.

March through November 2005: The science team for the project was convened and conducted 12 meetings, including conference calls. Smaller working groups have since met informally, primarily through conference calls, to address specific issues as well.

August 17 and 18, 2005: NPS conducts an interagency alternatives development meeting to discuss recommendations of the project science team; describe details of the alternatives; and evaluate how well each alternative meetings project objectives. Participants included the NPS, NDGF, USFS, and USGS.

April 25, 2006: The science team reconvenes in Rapid City, South Dakota to address the direction of the monitoring plan to be incorporated into the elk management program for Theodore Roosevelt.

October 24 through 26, 2006: NPS and USGS staff participate in a roundtable meeting, primarily to review the latest science team recommendations and to further detail the alternatives to be described in the plan.

January 17, 2007: A small science team working group participates in a conference call to further discuss direction of the monitoring plan for the elk management program.

February 17, 2007: The NPS cancels public meetings scheduled for February 21 and 22 due to the withdrawal of the NDGF as a cooperating agency. The intent of the meetings was to allow interested members of the public an opportunity to help refine the draft alternatives being developed for elk management.

August 20 and 21, 2007: NPS hosts an alternatives development roundtable meeting to finalize details of the alternatives to be considered in the plan/EIS, as well as those dismissed from detailed analysis.

December 15, 2008: A notice of availability for the *Draft Elk Management Plan / Environmental Impact Statement* was published in the Federal Register.

December 17, 2008 through March 19, 2009: Approximately 90-day public comment period for the draft plan/EIS, including six public meetings held throughout the state of North Dakota in February 2009.

Based on comments received from the public during the draft plan/EIS public comment period, the park identified a preferred alternative and an environmentally preferable alternative.

August 10, 2009 through September 9, 2009: The public was then given an opportunity to submit comments regarding the preferred alternative and an environmentally preferable alternative during a 30-day comment period.

A44

FS AGREEMENT #03-MU-110118-033

AGREEMENT No. G1540030001

MEMORANDUM OF UNDERSTANDING
AMONG
NATIONAL PARK SERVICE, THEODORE ROOSEVELT NATIONAL PARK
NORTH DAKOTA GAME AND FISH DEPARTMENT
AND
USDA, FOREST SERVICE, DAKOTA PRAIRIE NATIONAL GRASSLANDS

I. PURPOSE

The purpose of this Memorandum of Understanding (MOU) is to facilitate a cooperative effort among the National Park Service, herein referred to as NPS; the North Dakota Game and Fish Department, herein referred to as NDGF; and the U.S. Forest Service, herein referred to as USFS, to manage elk in and around the South Unit of Theodore Roosevelt National Park (THRO). The successful re-establishment of elk to these areas has provided the basis for the development of elk management programs by the NDGF, the NPS, and the USFS. Concern about the spread of chronic wasting disease (CWD) prompted the Director of the NPS to mandate that NPS restrict translocating deer or elk from areas where CWD is known to occur, or where there is inadequate documentation to confirm absence of the disease (i.e., prevalence<1% with a 99% confidence interval). The NPS has inadequate documentation on the prevalence of CWD in elk in THRO, therefore, until the Director's mandate is rescinded, this requirement must be satisfied before any translocation of live elk from THRO can occur.

The authority for NPS, NDGF, and the USFS to enter into this agreement is contained in the following:

North Dakota Century Code 20.11-02-04 Subsection 7
16 U.S.C. Sections 1 and 3
36 C.F.R. Part 10
36 C.F.R. 241.2

II. STATEMENT OF MUTUAL BENEFITS AND INTERESTS

Elk (*Cervus elaphus)* were common in the North Dakota badlands in historical times, and were extirpated in the late 1800s. National Park Service natural resource management policies encourage the restoration of native wildlife species when there is adequate habitat and the species does not pose a threat to park visitors, park resources, persons or property outside park boundaries. The NDGF has responsibilities for conserving wildlife and for providing recreational opportunities to the public, and will endeavor to maximize responsible use of natural resources within their jurisdictions. The USFS has responsibilities and interests in the management and conservation of wildlife. The parties agree that public wildlife needs to be conserved and managed to meet growing public demand. It is mutually beneficial for all parties to agree as follows:

III. NDGF AGREES TO AND WILL, TO THE EXTENT RESOURCES PERMIT:

A. Manage all elk for any period of time they are not on lands controlled by NPS, as directed by the statutes of the State of North Dakota.

B. Provide, when practical, wildlife management expertise to assist the NPS in collecting data to assess habitat utilization and elk demographics.

C. Provide the NPS and the USFS with the written results of any data generated by radio telemetry, range utilization analysis, census and mortality investigations.

D. Provide, where possible, controlled public harvest of surplus elk outside of THRO.

E. Provide reasonable mitigation measures to alleviate damage if significant elk depredation and/or damage occurs on private lands adjacent to THRO.

IV. THE NPS AGREES TO AND WILL, TO THE EXTENT RESOURCES PERMIT:

A. Manage elk consistent with NPS policies within the boundaries of THRO.

B. Continue to monitor and evaluate vegetation within THRO.

C. Conduct an aerial census of elk in THRO once per year and provide results to NDGF and USFS.

D. Provide reports on elk research conducted on elk in THRO to NDGF and USFS.

E. Notify NDGF of all incidents of elk mortality in which the cause of death is not obvious. NPS and NDGF biologists will determine the need to collect blood, tissue and organ samples for analyses. Laboratory results will be made available to NDGF and the USFS.

F. Allow NDGF and USFS access to the elk and the range they occupy within THRO under regulations governing NPS use and protection.

G. Periodically reduce the herd when the numbers of elk exceed the limits of established THRO objectives.

H. Attempt through herd reduction and fence maintenance to limit the egress of elk from THRO.

I. Provide data from elk research and technical assistance to NDGF and USFS to identify, substantiate, and mitigate confirmed depredation by elk on private lands in areas adjacent to the South Unit of the park

J. Make surplus elk available to NDGF, other Federal agencies, Indian Tribes, and to other states for wildlife management purposes,. Reasonable efforts will be made to ensure that public elk are not transferred to private ownership. Elk translocated within the State of North

Dakota will be certified healthy only by criteria determined and agreed to by the NDGF, NPS, and the North Dakota Board of Animal Health.

V. USFS AGREES TO AND WILL, TO THE EXTENT RESOURCES PERMIT:

A. Strive to achieve and maintain the desired future condition of Grasslands as defined in the Grassland's Plan, while taking into consideration the ecosystem capabilities and natural variability of the area.

VI. NPS (LEAD AGENCY) AND NDGF (COOPERATING AGENCY) AGREE TO BEGIN NEPA COMPLIANCE IN A JOINT EFFORT TO ADDRESS FUTURE REDUCTIONS OF THE PARK HERD. USFS WILL BE A COMMENTING AGENCY.

VII. IT IS MUTUALLY AGREED AND UNDERSTOOD BY AND AMONG THE SAID PARTIES THAT:

A. It is mutually agreed that the details of cooperative work shall be planned and executed jointly by the NPS, NDGF, and the USFS. All three parties to this agreement will meet once annually for the purpose of evaluating the program, evaluating annual accomplishments, and planning future activities.

B. The principal contacts for this instrument are:

North Dakota Game and Fish Department
Randy Kreil, Chief of Wildlife
North Dakota Game and Fish Department
100 North Bismarck Expressway
Bismarck, ND 58501-5095
PH (701) 221-6305, FAX (701) 221-6352

National Park Service
Michael Oehler, Wildlife Biologist
Theodore Roosevelt National Park
PO Box 7
Medora, ND 58645
PH (701) 623-4730 ext. 3567, FAX (701) 623-4840

U.S. Forest Service
Dan Svingen, Grasslands Biologist
U.S. Forest Service
Dakota Prairie Grasslands
Bismarck, ND 58501
PH (701) 250-4443

Changes in coordinators shall be approved by written modification of the MOU.

C. A party to this MOU may terminate their involvement with 30 day written notice to the other parties.

D. This instrument in no way restricts the NPS, NDGF, or USFS from participating in similar activities with other public or private agencies, organizations, and individuals.

E. This instrument is executed as of the last date shown below and expires upon completion of NEPA compliance by NPS and NDGF, at which time it will be subject to review, renewal, or expiration.

F. This instrument is neither a fiscal nor a funds obligation document. Any endeavor involving reimbursement or contribution of funds between the parties to this instrument will be handled in accordance with applicable laws, regulations, and procedures including those for Government procurement and printing. Such endeavors will be outlined in separate agreements that shall be made in writing by representatives of the parties and shall be independently authorized by appropriate statutory authority. This instrument does not provide such authority. Specifically, this instrument does not establish authority for noncompetitive award to the cooperator of any contract or other agreement. Any contract or agreement for training or other services must fully comply with all applicable requirements or competition.

G. Modifications within the scope of this instrument shall be made by the issuance of multilaterally executed modification prior to any changes being performed.

IN WITNESS WHEREOF, The parties hereto have executed this MOU as of the last written date below.

North Dakota Game and Fish Department

By Dean Hildebrand — Date June 19 03
Dean Hildebrand
Title: *Director*

National Park Service, Theodore Roosevelt National Park

By Valerie J. Naylor — Date July 2, 2003
Valerie Naylor
Title: *Superintendent*

USDA, Forest Service, Dakota Prairie Grasslands

By ______________________ Date 10/27/03

DAVID M. PIEPER

For

Title: Grasslands Supervisor

United States Department of Agriculture
Forest Service
Dakota Prairie Grasslands
240 W. Century Ave.
Bismarck, ND 58503

File Code: 1580
Date: June 25, 2003

Received
JUL 1 2003
Theodore Roosevelt National Park

Theodore Roosevelt National Park
Attn: Valerie Naylor, Superintendent
P.O. Box 7
Medora, ND 58645

Dear Ms. Naylor:

Enclosed you will find the Memorandum of Understanding between the National Park Service, North Dakota Game and Fish and USDA Forest Service regarding elk management programs in North Dakota.

I have signed this agreement, Dean Hildebrand, Commissioner of ND Game and Fish Department, has signed and I am forwarding it to you for your review and signature. If you concur with the agreement and sign, I would appreciate it if you would send a copy of the fully executed agreement to me for our records. I am enclosing a self-addressed envelope for your convenience in returning a copy to our office.

If you have any questions regarding this agreement that our office can help answer, please contact Dan Svingen at 701-250-4443.

Sincerely,

for
DAVID M. PIEPER
Grasslands Supervisor

Enclosures

Caring for the Land and Serving People

Printed on Recycled Paper

United States Department of the Interior

NATIONAL PARK SERVICE

Theodore Roosevelt National Park

Medora, North Dakota 58645

IN REPLY REFER TO:

A44

April 20, 2004

Dave Pieper
Grasslands Supervisor
U.S. Forest Service
Dakota Prairie Grasslands
240 W. Century Avenue
Bismarck, ND 58503

Dear Mr. Pieper:

As you know, the National Park Service is embarking on a major National Environmental Policy Act (NEPA) planning effort concerning the issue of elk population management in Theodore Roosevelt National Park. The North Dakota Game and Fish Department (NDGFD) is working with us as a Cooperating Agency on this effort.

Although the current Memorandum of Understanding among the National Park Service, U.S. Forest Service, and NDGFD for elk management in and around Theodore Roosevelt National Park states that the U.S. Forest Service will be a commenting agency, we invite the USFS to be a Cooperating Agency.

Council on Environmental Quality regulations state that "any other Federal agency which has special expertise with respect to any environmental issue… may be a cooperating agency upon request of the lead agency." Since the USFS has responsibilities and interests in the management and conservation of wildlife, and because much of the available elk habitat outside the park is on the Little Missouri National Grassland, it would be mutually beneficial to have the USFS participate as a Cooperating Agency. We invite you to do so.

Our internal scoping session for the NEPA effort is scheduled in Medora, North Dakota on May 25-26, 2004. In order to have a focused session, we would suggest that one or two USFS representatives attend. At the internal scoping meeting, we will further discuss roles and responsibilities of the agencies involved.

Please let us know as soon as possible in writing so that we will have an official document for the administrative record. In addition, please let us know who will be attending the internal scoping meeting from the USFS.

Thank you very much.

Sincerely,

Valerie J. Naylor

Valerie J. Naylor
Superintendent

United States Department of Agriculture
Forest Service
Dakota Prairie Grasslands
240 W. Century Ave.
Bismarck, ND 58503

File Code: 1950-4
Date: May 5, 2004

RECEIVED
MAY - 6 2004
Theodore Roosevelt National Park

Valerie J. Naylor, Superintendent
Theodore Roosevelt National Park
P. O. Box 7
Medora, ND 58645

Dear Valerie:

Thank you for the invitation for the Dakota Prairie Grasslands of the U.S. Forest Service to work with the National Park Service as a Cooperating Agency in the planning effort concerning the issue of elk management in Theodore Roosevelt National Park. I accept your offer and I am designating Arden Warm to serve as our representative in this National Environmental Policy Act process. Arden can be contacted at our Medora Ranger District Office in Dickinson, North Dakota. I have forwarded your letter with the initial internal scoping dates to Arden and will encourage his participation throughout the process.

Sincerely,

DAVID M. PIEPER
Grasslands Supervisor

cc: Arden Warm, Acting Medora District Ranger

Caring for the Land and Serving People

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APPENDIX B

THEODORE ROOSEVELT NATIONAL PARK

MONITORING METHODS FOR THE ELK POPULATION AND VEGETATION TRENDS

ELK POPULATION MONITORING METHODS

Park staff would continue to conduct aerial surveys for the purposes of estimating the elk population in the South Unit of Theodore Roosevelt National Park. During the first few years after elk were reintroduced, most of the population gathered seasonally in a few easily observable groups (Sullivan 1988). Numbers could be estimated via ground-based counts. At present densities, however, elk remain distributed in many groups that cannot be observed simultaneously, if at all, and group membership is presumably fluid (c.f., Eberhardt et al. 1998). As a result, efforts to count elk during the past decade have probably overlooked many groups and may have counted some elk more than once. Without methods for adjusting counts for these sources of bias, defensible estimates of population size cannot be obtained.

Undercounting of elk is often addressed through the use sightability curves (Samuel et al. 1987, Anderson et al. 1998, Cogan and Diefenbach 1998, Eberhardt et al. 1998) and mark-resight models (Eberhardt et al. 1998). Sightability curves predict probabilities of observing groups of elk, conditional on independent variables that may include, for example, group size, canopy closure, or snow cover. Observed numbers of groups are then divided by probabilities of observation to estimate total numbers of groups present during surveys. Mark-resight models assume marked and unmarked groups are equally likely to be seen during surveys; hence, the total number of elk groups can be estimated by dividing the number of groups seen by the proportion of marked groups seen. Multiplying the total number of marked groups by the mean group size produces an estimate of total population size.

Different landscapes and different types of aircraft require different sightability curves, and most existing curves have been developed for low-altitude helicopter surveys (Anderson et al. 1998). Unfortunately, helicopter surveys are not practical at Theodore Roosevelt National Park because only fixed-wing aircraft are reliably available from area vendors approved by the U.S. Department of Interior Aircraft Management Directorate. Moreover, most vendors of fixed-wing flight services are not certified for low-level flight (less than 500 feet above ground level). This has necessitated the development of correction factors specific to Theodore Roosevelt National Park. In the past, park staff are correcting for group size only, using correction factors derived from a pilot study conducted in 2001. During this study, staff used 66 sighting trials with marked groups of elk to estimate detection rates, conditional on group size (Sargeant and Oehler 2007). Therefore, elk counted during the survey are considered a minimum population, and each group observed is corrected based on its size (sightability for that size group during calibration trials).

Methodologies used in the past would continue to be employed. The logistical constraints described above would limit data collection for elk population monitoring to high altitude surveys (greater than 500 feet above ground level) conducted with a Cessna 172. The park would establish a series of east-west aerial survey transects spaced at 200 meter intervals across the entire South Unit. Over the course of approximately three days, the aircraft would traverse each transect in both directions (from east to west, and from west to east) traveling between 80 and100 miles per hour at 500 feet above ground level. Surveys are only flown when wind speeds are less than 25 miles per hour, and when conditions meet visual flight rules. By combining a dense search pattern with straight, level flight at relatively high altitude, the park would achieve satisfactory detection rates and uniform coverage of the park without compromising the safety of survey crews.

The survey crew would consist of a pilot and a single observer in the right front seat. A global positioning system unit connected to a laptop computer with geographic information system software would be used to monitor the location of the aircraft relative to transect lines during flights. Elk sightings would only be recorded by the observer, to allow the pilot to concentrate on flying and to monitor the computer navigation system used to keep the aircraft on course. This minimizes the number of personnel at risk during surveys.

Based on location data from 137 marked elk recorded since 2001, the majority of collared elk are within the boundaries of the South Unit between December and March. Therefore, elk surveys would be flown between February and March when elk are in the park, and ground conditions are conducive to observing elk from an aircraft (i.e., when trees have no leaves and there is snow cover).

MONITORING METHODS FOR VEGETATION TRENDS

As described in Chapter 2 “Alternatives,” it is the park’s intent to reestablish and maintain elk use areas in the South Unit to reflect lightly grazed conditions through elk management, as it had under previous strategies. In order to do so, vegetation would be monitored to determine the current ecological condition (seral stage) and trend, indicating the direction of change. In general, a plant community in a later seral stage would be reflective of a lightly grazed system, while communities in early seral stage would be reflective of heavier use.

The Needle-and-thread – Threadleaf Sedge Herbaceous (STCO-CAFI) plant association, as classified and mapped as part of the NPS-USGS Vegetation Mapping Program, would be monitored in elk use areas to determine the current seral stage. Principal diagnostic species that would be monitored in this association would be needle-and-thread, western wheatgrass, and blue grama.

The general technique for determining the current seral stage would be as follows:

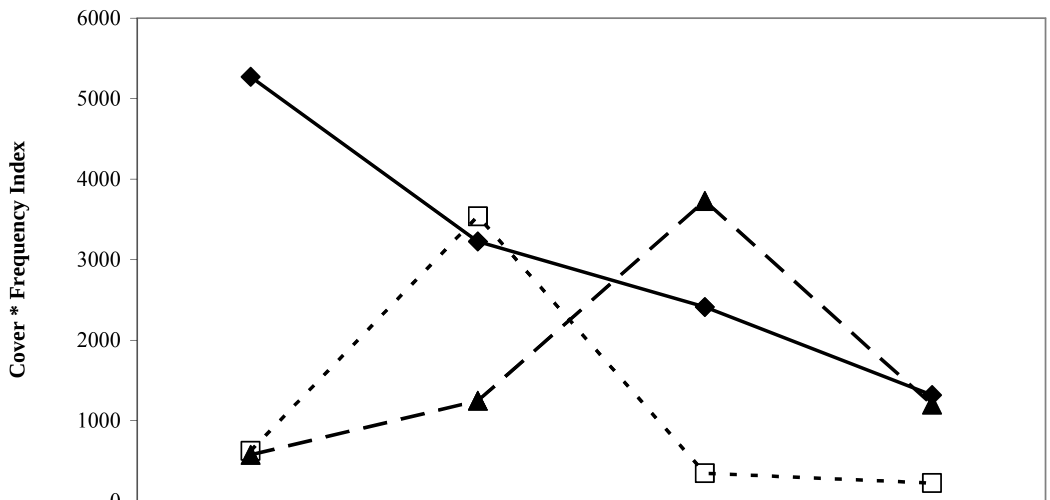
1. Two parallel, permanent 30 meter transects would be established approximately 20 meters apart in an area of at least 800 square meters. The location of the transects would be stratified according to elk location data (heavy, moderate, light, and no use). Specific site selection within each level of use would be conducted randomly.
2. Canopy cover would be recorded using six cover classes for the three major indicators species within a 20 by 50 centimeter quadrat placed at 1 meter intervals along each transect. Cover classes would also be assigned to litter, bare ground, and non-native plants.
3. The midpoint of each cover class would be used to calculate average foliar cover for the three species for each transect. Average cover and percent frequency for each transect would be multiplied, then averaged for the two transects to produce an index value. The index value will be located within seral stage probability tables for that association to determine seral stage (see example figure below).
4. Similarity indices using average percent foliar cover would be calculated for each level of use, and compared to historic (pre-1985) data when appropriate.

Shifts in the relative contribution of increaser/decreaser species within the association can be used in an assessment of grazing pressure of a particular site. For example, as shown in the figure on the following page, an early seral stage (heavily grazed system) is characterized by a relatively index value for western wheatgrass when compared to the slightly higher, and relatively equal, index values for needle-and-thread and blue grama. In contrast, a late seral stage (lightly grazed system) in this plant community is characterized by a much higher index value for needle-and-thread when compared to the lower, and relatively equal, index values for western wheatgrass and blue grama.

After current seral stage has been characterized, these species would be monitored for 10 years in the transects placed in areas of high and moderate elk use, and index values would be compared to data from areas of low and no elk use. In order to determine if the reduction in elk is leading toward a condition that reflects a lightly grazed system (later seral stage), these data would be coupled with information collected on the amount of bare ground and litter present; evidence of over-utilization of key plant species (plant vigor, hedging, browse lines, substantial use of low-preference plants, etc.); and the contribution of non-native plants, especially invasive species. A successful trend would be represented by shifts in the STCO/CAFI association in the high and moderate elk use areas (presumed to be in earlier seral stages) towards the conditions present in the areas of low and no elk use. Exclosures (small areas fenced to keep elk out) could also be used to monitor vegetation in areas of no elk use that would help interpret data.

General Seral Stage Classification Model

Needle-and-Thread Ecological Site



	Late	Late Intermediate	Early Intermediate	Early
Needle and Thread	5271	3226	2413	1319
Western Wheatgrass	626	3538	347	225
Blue Grama	577	1249	3730	1200

Seral Stage

REFERENCES

Anderson, C. R., Jr., D. S. Moody, B. L. Smith, F. G. Lindzey, and R. P. Lanka

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1984 Biases in aerial surveys of mule deer. Thorne Ecological Institute Technical Publication, 14:60-65.

Eberhardt, L. L., R. A. Garrott, P. J. White, P. J. Gogan

1998 Alternative approaches to aerial censusing of elk. Journal of Wildlife Management, 62:1046-1055.

Rabe, M. J., S. S. Rosenstock, and J. C. DeVos, Jr.

2002 Review of big-game survey methods used by wildlife agencies of the western United States. Wildlife Society Bulletin, 30:46-52.

Samuel M. D., E. O. Garton, M. W. Schlegel, and R. G. Carson

1987 Visibility Bias during Aerial Surveys of Elk in Northcentral Idaho. The Journal of Wildlife Management, 51:622-630.

Sargeant, G. A., and M. L.O. Oehler, Sr.

2007 Dynamics of newly established elk populations. Journal of Wildlife Management, 71:1141-1148.

APPENDIX C

THEODORE ROOSEVELT NATIONAL PARK

CHRONIC WASTING DISEASE

This appendix summarizes guidance provided by the National Park Service (NPS) in response to chronic wasting disease, and it outlines management options available to parks for implementation in the absence of a specific Chronic Wasting Disease (CWD) plan.

As of August 2007, chronic wasting disease has been diagnosed in two national parks — Rocky Mountain and Wind Cave. Several national park system units are at high risk because of their proximity to areas where CWD has been diagnosed in either captive or free-ranging cervids. In addition, there is a high likelihood that the disease would be detected in other areas of the country following spread of the disease and increases in surveillance for the disease. Therefore, chronic wasting disease has become an issue of national importance to wildlife managers and other interested public entities, as well as NPS managers.

NPS POLICY AND GUIDANCE

DIRECTOR'S CWD GUIDANCE MEMORANDUM (JULY 26, 2002)

The NPS director provided guidance to regions and parks on the NPS response to chronic wasting disease in a memorandum dated July 26, 2002. Even though the memo pre-dates current CWD distribution in the national park system, the guidance remains pertinent. The guidance addresses surveillance, management, and communication regarding the disease. It also strictly limits the translocation of deer and elk into or out of national park system units. Like any policy, deviation from the guidance memo would require a waiver approved by the director.

A NATIONAL PARK SERVICE MANAGER'S REFERENCE NOTEBOOK TO UNDERSTANDING CHRONIC WASTING DISEASE (VERSION 4: JULY, 2007)

This notebook serves as an informational reference that summarizes some of the most pertinent CWD literature, management options, and policies as they pertain to units of the national park system. It is not meant to be an all-inclusive review of current literature or management options. Chronic wasting disease is an emerging disease, and the knowledge base is continuing to expand. This document is updated as necessary to include information pertinent to the National Park Service.

ELK AND DEER MEAT FROM AREAS AFFECTED BY CHRONIC WASTING DISEASE: A GUIDE TO DONATION FOR HUMAN CONSUMPTION (JUNE, 2006)

This document provides an overview of the issues surrounding chronic wasting disease as it relates to public health, and includes NPS recommendations for the use of cervid meat for human consumption.

DESCRIPTION AND DISTRIBUTION

Chronic wasting disease is a slowly progressive, infectious, self propagating, neurological disease of captive and free-ranging mule deer (*Odocoileus hemionus*), white-tailed deer (*O. virginianus*), Rocky Mountain elk (*Cervus elaphus nelsoni*), and moose (*Alces alces*). The disease belongs to the transmissible spongiform encephalopathy (TSE) group of diseases (similar to scrapie and bovine spongiform encephalopathy).

Chronic wasting disease is the only TSE currently found in free-ranging animals. TSEs are characterized by accumulations of abnormal prion (proteinaceous infectious particle) proteins in neural and lymphoid tissues (Prusiner 1982, 1991, 1997).

There is evidence that human-associated movement of cervids has aided in the spread of the disease in captive, and likely free-ranging, deer and elk (Miller and Williams 2003; Salman 2003; Williams and Miller 2003). Localized artificial concentration of cervids in areas with few natural predators likely aids in disease transmission (Spraker et al. 1997; Samuel et al. 2003; Farnsworth et al. 2005). There is strong evidence to suggest that anthropogenic factors, such as land use, influence CWD prevalence (Farnsworth et al. 2005). Therefore, human influences are likely a substantial component of observed CWD distribution and prevalence.

As of February 2010, chronic wasting disease had been found in captive/farmed cervids in 10 states and 2 Canadian provinces and in free-ranging cervids in 12 states and 2 provinces. The historic area of CWD infection encompasses northeastern Colorado, southeastern Wyoming, and the southwest corner of the Nebraska panhandle (Williams and Miller 2002; Williams et al. 2002). However, with increased surveillance that has occurred since 2001, the disease has been found with increasing frequency in other geographically distinct areas (Joly et al. 2003).

CLINICAL SIGNS

The primary clinical signs of chronic wasting disease in deer and elk are changes in behavior and body condition (Williams et al. 2002). Signs of the disease are progressive. Initially only someone who is quite familiar with a particular animal or group of animals would notice a change in behavior. As the clinical disease progresses over the course of weeks to months, animals demonstrate increasingly abnormal behavior and additional clinical signs (Williams and Young 1992). Affected animals can lose their fear of humans, show repetitive movements, and/or appear depressed but quickly become alert if startled. Affected animals rapidly lose body condition, despite having an appetite (Williams et al. 2002b). In the end stages of the disease they become emaciated. Once an animal demonstrates clinical signs the disease is invariably fatal. There is no treatment or preventative vaccine for the disease.

DIAGNOSIS AND TESTING

Chronic wasting disease was initially diagnosed in deer and elk by testing a portion of the brain (histopathology techniques) (Williams and Young 1993). While this method is effective at diagnosing relatively advanced cases, it is not sensitive enough to detect early disease stages (Spraker et al. 1997; Peters et al. 2000). In contrast, immunohistochemistry (IHC) is a sensitive, specific, and reliable test that can be used to identify relatively early stages of chronic wasting disease. This technique can detect CWD prions in many tissues (brain, retropharyngeal lymph nodes, tonsils, rectal lymphoid tissue, etc.) (O'Rourke et al. 1998, Spraker et al. 2006).

In addition to immunohistochemistry, which takes several days to complete, new rapid tests also employ antibody technology to diagnose chronic wasting disease. Each has various advantages and disadvantages. Only certified laboratories can perform immunohistochemistry or the rapid CWD tests. No available test is 100% sensitive for chronic wasting disease, which means that a negative test result is not a guarantee of a disease-free animal.

TRANSMISSION

There is strong evidence that chronic wasting disease is infectious and is spread by direct lateral (animal to animal) or indirect (environment to animal) transmission (Miller et al. 2000; Miller and Williams

2003). Bodily secretions such as feces, urine, and saliva have all been suggested as possible means of transmitting the disease between animals and disseminating infectious prions into the environment (Williams et al. 2002b; Williams and Miller 2003). It has recently been demonstrated in captive laboratory animals that blood and saliva from infected deer can transmit the disease to naïve deer (Mathiason et al. 2006). Maternal transmission cannot be ruled out, but it does not play a large role in continuing the disease cycle in either deer or elk (Miller et al. 1998; Miller et al. 2000; Miller and Williams 2003; Miller and Wild 2004, Miller et al. 2006).

Like other infectious, contagious diseases, CWD transmission increases when animals are concentrated. High animal densities and environmental contamination are important factors in transmission among captive cervids. These factors may also play a role in transmission in free-ranging animals (Miller et al. 2004, Joly et al. 2006, Miller et al. 2006).

Management actions that increase mortality rates in diseased populations may retard disease transmission and reduce prevalence. Increasing mortality slows transmission by two mechanisms:

1. It reduces the average lifetime of infected individuals. Reduced lifespan, in turn, can compress the period of time when animals are infectious, thereby reducing the number of infections produced per infected individual.
2. The effect of reduced intervals of infectivity is amplified by reductions in population density.

Both of these mechanisms may decrease disease transmission. If these mechanisms cause the number of new infections produced per infected individual to fall below one, then the disease would be eliminated from the population (Tompkins et al. 2002).

DISPOSAL OF CWD INFECTED ORGANIC MATERIAL

Discarding known or suspect CWD-contaminated organic material, such as whole or partial carcasses, is likely to become an important issue for national park system units in the future. Each state, Environmental Protection Agency region, and refuse disposal area is likely to have different regulations and restrictions for disposal of potentially infected tissues. Currently there is no national standard for disposal. Because infected carcasses serve as a source of environmental contamination (Miller et al. 2004), and once prions bind to soil components their infectivity may be increased (Johnson et al. 2007), it is recommended that known and suspect CWD-positive animals be removed from the environment.

Given the type of infectious agent (prions), there are limited means of effective disposal. In most cases, however, off-site disposal of infected material is recommended in approved locations. The available options for each park would vary and would depend on the facilities present within a reasonable distance from the park. Disposal of animals that are confirmed to be infected should be disposed of in one of the following ways:

- *Alkaline Digestion or Incineration* — Alkaline digestion is a common disposal method used by veterinary diagnostic laboratories. This method uses sodium hydroxide or potassium hydroxide to catalyze the hydrolysis of biological material (protein, nucleic acids, carbohydrates, lipids, etc.) into an aqueous solution consisting of small peptides, amino acids, sugars, and soaps. Incineration is another disposal method used by veterinary diagnostic laboratories. This method burns the carcass at intense temperatures. Alkaline digestion and incineration are two of the most effective ways of destroying contaminated organic material. These are usually available at veterinary diagnostic laboratories or universities. Arrangements can often be made with laboratories to test and then dispose of animals.

- *Landfill* — The availability of this option varies by region, state, and local regulations. Therefore, local landfills must be contacted for more information regarding carcass disposal, to determine if they would accept CWD positive or negative carcasses or parts.

MANAGEMENT

Chronic wasting disease has occurred in a limited geographic area of northeastern Colorado and southeastern Wyoming for over 20 years. More recently, it has been detected in captive and free-ranging deer and elk in several relatively new locations, including Nebraska, South Dakota, New Mexico, Utah, new areas of Wyoming and Colorado, and east of the Mississippi River in Wisconsin, Illinois, West Virginia, New York, and Virginia.

The National Park Service does not currently have a single plan to manage chronic wasting disease in all parks. However, it has provided guidance to parks in how to monitor for and minimize the potential spread of the disease, as well as remove infected animals from specific areas. Generally, two levels of action have been identified, based on risk of transmission: (1) when chronic wasting disease is not known to occur within a 60-mile radius from the park; and (2) when the disease is known to occur within the park or within a 60-mile radius.

The chance of finding chronic wasting disease in a park is related to two factors: the risk of being exposed to the disease (the likelihood that the disease would be introduced into a given population), and the risk of the disease being amplified once a population of animals has been exposed. The first risk is important for national park system units where no CWD cases have been identified within 60 miles of their border. The second risk applies to units where chronic wasting disease is close to or within their borders, as well as in proactive planning efforts. By evaluating the risk of CWD exposure and amplification, managers can make better decisions regarding how to use their resources to identify the disease.

Actions available to identify chronic wasting disease are linked to the risk factors present in and around the park. When risk factors are moderate, surveillance for chronic wasting disease can be less intense (e.g., opportunistic) than when risk is high (NPS 2007). When the risk is higher, surveillance (e.g., opportunistic and targeted) should be increased. Other management actions that are in place for the host species may limit risk of exposure or transmission by maintaining appropriate population densities. Whether chronic wasting disease is within 60 miles of a unit or not, coordination with state wildlife and agriculture agencies on CWD activities is strongly encouraged.

OPPORTUNISTIC SURVEILLANCE

Opportunistic surveillance involves taking diagnostic samples for testing from cervids found dead or harvested through a management activity within a unit of the national park system. Cause of death may be culling, predation, disease, trauma (hit by car), or undetermined. Opportunistic surveillance has little, if any, negative impact on current populations. Unless elk or deer are culled, relatively small sample sizes may be available for opportunistic testing. Animals killed in collisions with vehicles may be a biased sample that could help detect chronic wasting disease. Research has indicated that CWD-infected mule deer may be more likely to be hit by vehicles than non-CWD infected deer (Krumm et al. 2005).

Opportunistic surveillance is an excellent way to begin surveying for presence of chronic wasting disease without changing management of the deer population. This is a good option for park units where chronic wasting disease is a moderate risk but where it has not yet been encountered within 60 miles of the park.

TARGETED SURVEILLANCE

Targeted surveillance entails lethal removal of elk and deer that exhibit clinical signs consistent with chronic wasting disease. Targeted surveillance has negligible negative effects on the entire population, removes a potential source of CWD infection, and is an efficient means of detecting new centers of infection (Miller et al. 2000). One limitation to targeted surveillance is that environmental contamination and direct transmission may occur before removal. Additionally, there is no available method to extrapolate disease prevalence when using targeted surveillance because actions are focused only on those individuals thought to be infected. Targeted surveillance is moderately labor intensive and requires educating NPS staff in recognition of clinical signs and training in identifying and removing appropriate samples for testing, as well as vigilance for continued observation and identification of potential CWD suspect animals. Training is available through the NPS Biological Resource Management Division. Targeted surveillance is recommended in all parks and is required in areas with moderate to high CWD risk (within 60 miles of known CWD occurrence) or in park units where chronic wasting disease has already been identified.

POPULATION REDUCTION

Population reduction involves randomly culling animals within a population in an attempt to reduce animal density, and thus decrease risk of transmission. In captive situations, where animal density is high, the prevalence of chronic wasting disease can be substantially elevated compared to that seen in free-ranging situations. Thus, it is hypothesized that increased animal density and increased animal-to-animal contact, as well as increased environmental contamination, may enhance the spread of chronic wasting disease. Therefore, decreasing animal densities may decrease the transmission and incidence of the disease. However, migration patterns and social behaviors may make this an ineffective strategy if instead of spreading out across the landscape, deer and elk stay in high-density herds in tight home ranges throughout much of the year (Williams et al. 2002b). Population reduction is an aggressive and invasive approach to mitigating the CWD threat. It has immediate and potentially long-term effects on local and regional populations of deer and the associated ecosystem. This may be an appropriate response if animals are above population objectives and/or the need to know CWD prevalence with a high degree of accuracy is vital.

COORDINATION

Regardless of which surveillance method is used, each park should cooperate with state wildlife and agriculture agencies in monitoring chronic wasting disease in park units, working within the park's management policies. Chronic wasting disease is not contained by political boundaries, thus coordination with other management agencies is important.

Additionally, as stated above, the NPS Biological Resource Management Division provides assistance to parks for staff training (e.g., sample collection, recognizing clinical signs of CWD) and testing (e.g., identifying qualified/approved labs or processing samples).

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APPENDIX D

THEODORE ROOSEVELT NATIONAL PARK

TABLE 1. COST BREAKDOWN FOR DIRECT REDUCTION WITH FIREARMS UNDER THE PREFERRED ALTERNATIVE--INITIAL REDUCTION
(assumes that initial reduction activities would last 13 weeks per year, and 25 skilled volunteers would be used per week)

ACTIVITY	ASSUMPTIONS	ANNUAL COSTS				
		Unit	Rate/hr	Base cost	Benefits @ 45%	Total cost
SELECTION PROCESS						
Communications (e.g., notifications)						
Mailings	500 letters @ $0.42per letter	500	$0.42	$210.00		$210.00
REDUCTION ACTIVITIES						
Implementation/Recovery Coordinator Oversees direct reduction teams in the field, identifying which animals are removed, ensuring field safety protocols are implemented, communicating with direct reduction coordinator and primary/secondary volunteer contact(s); Assume 3 NPS staff, one for each team	1 GS 9 Term Wildlife Biologist	2086	$19.92	$41,553.12	$18,698.90	$60,252.02
Meat Recovery	Estimated meat recovery fee of $250 paid to a professional wrangler for each elk recovered	230	$250.00	$57,500.00		$57,500.00
Wrangler Retainer Fee	Estimated retainer fee of $1,000 paid to a professional wrangler to ensure their services. Based on having 5 wranglers on standby.	5	$1,000.00	$5,000.00		$5,000.00
Direct Reduction Team Leaders Oversees direct reduction teams in the field, identifying which animals are removed, ensuring field safety protocols are implemented, communicating with direct reduction coordinator and primary/secondary volunteer contact(s); Assume 5 NPS staff, one for each team	5 GS 7 for 18 weeks each - 40 hours per week - 13 weeks actual reduction effort, with 4 weeks before and 1 week after (preparation and closeout)	3600	$16.28	$58,608.00	$4,483.51	$63,091.51
Direct Reduction Team Leaders - Overtime	10 hours per week for each Team Leader during actual reduction effort (13 weeks)	650	$24.42	$15,873.00	$1,214.28	$17,087.28

TABLE 1. COST BREAKDOWN FOR DIRECT REDUCTION WITH FIREARMS UNDER THE PREFERRED ALTERNATIVE--INITIAL REDUCTION

(assumes that initial reduction activities would last 13 weeks per year, and 25 skilled volunteers would be used per week)

ACTIVITY	ASSUMPTIONS	ANNUAL COSTS				
		Unit	Rate/hr	Base cost	Benefits @ 45%	Total cost
Primary Volunteer Contact/Radio Dispatcher Responsible for checking-in volunteers upon arrival at the park and assisting Direct Reduction Coordinator with miscellaneous requests.	1 GS 5 for 15 weeks - 40 hours per week during actual recution reduction efforts; 40 hours per week for one week before and after for preparation and closeout	600	$13.14	$7,884.00	$603.13	$8,487.13
Law enforcement rangers Additional staff required during direct reduction activities to ensure program conducted appropriately and to respond to potential emergencies.	2 GS 5 for 12 weeks - 40 hours per week per staff member during actual reduction efforts.	1040	$13.14	$13,665.60	$1,045.42	$14,711.02
Equipment/supplies						
Additional equipment needs, e.g. binoculars, radios, firearms/ammunition	Average of $11,750 per year (Initial year 1 cost would be $48,750, and $2,500 per year in years 2-5)			$11,750.00		$11,750.00
Fuel/Vehicle costs	Approximately $10,000 per year for the 1st 5 years			$10,000.00		$10,000.00
Annual Subtotal, Staffing Costs						$226,128.96
Annual Subtotal, Equipment and Supplies						$21,960.00
Annual Total						$248,088.96
Total Costs for 5-year initial reduction period (successful direct reduction with firearms program described in chapter 2)						$1,240,444.82
Total Costs for 2-year initial reduction period (unsuccessful direct reduction with firearms program)						$496,177.93

TABLE 2. COST BREAKDOWN FOR DIRECT REDUCTION WITH FIREARMS UNDER THE PREFERRED ALTERNATIVE—MAINTENANCE

(assumes that annual maintenance would last 4 weeks, 10 skilled volunteers would be used per week)

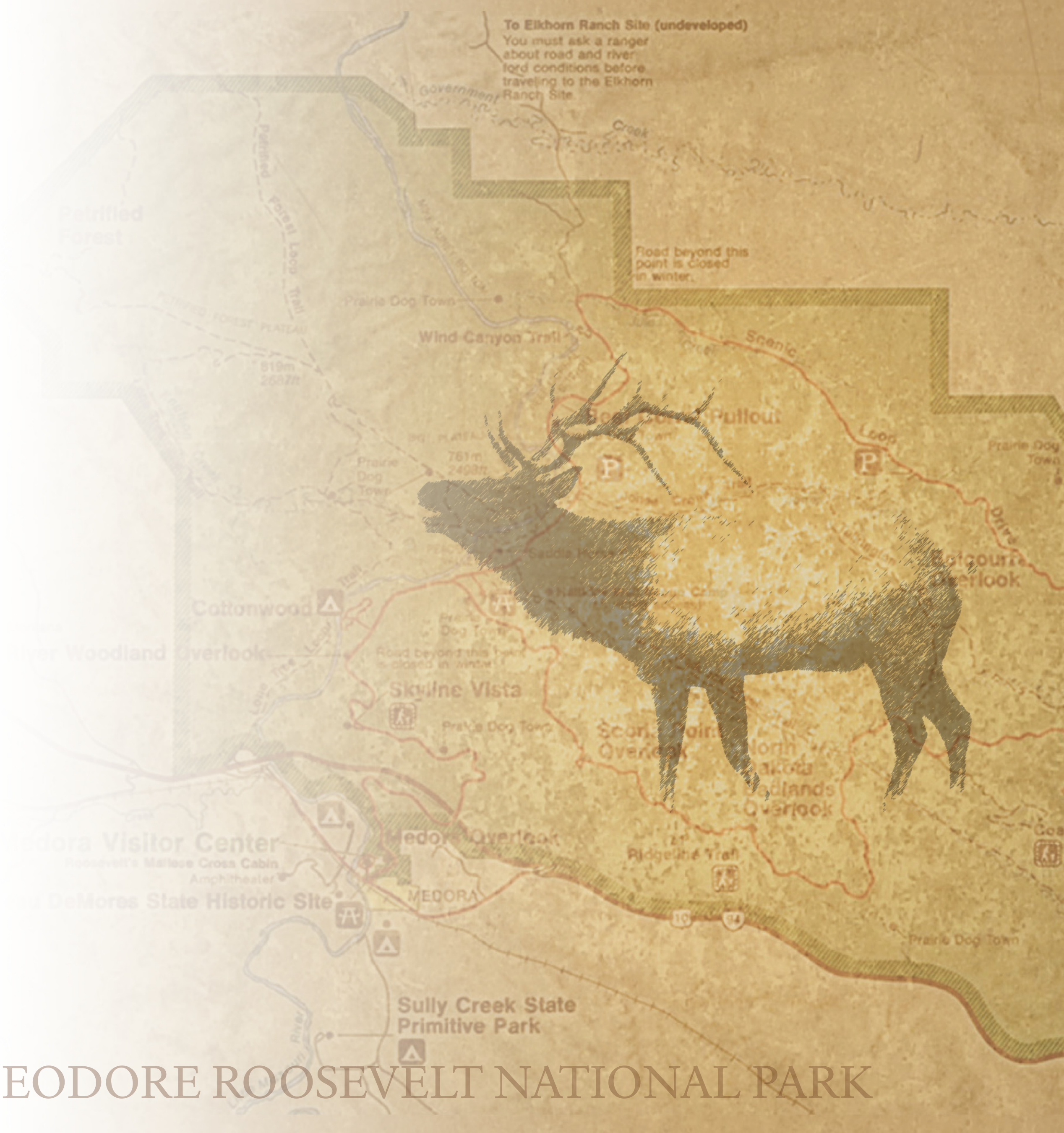
ACTIVITY	ASSUMPTIONS	ANNUAL COSTS				
		Unit	Rate/hr	Base cost	Benefits @ 45%	Total cost
SELECTION PROCESS						
Communications (e.g., notifications)						
Mailings	500 letters @ $0.42 per letter	500	$0.42	$210.00		$210.00
REDUCTION ACTIVITIES						
Direct Reduction Team Leaders Oversees direct reduction teams in the field, identifying which animals are removed, ensuring field safety protocols are implemented, communicating with direct reduction coordinator and primary/secondary volunteer contact(s); Assume 5 NPS staff, one for each team	2 GS 7 for 6 weeks each - 4 week reduction period 40 hours per week - 1 week before and 1 week after (preparation and closeout)	480	$16.28	$7,814.40	$597.80	$8,412.20
Direct Reduction Team Leaders - Overtime	10 hours per week for each Team Leader during actual reduction effort (4 weeks)	80	$24.42	$1,953.60	$149.45	$2,103.05
Meat Recovery	Estimated meat recovery fee of $250 paid to a professional wrangler for each elk recovered	25	$250.00	$6,250.00		$6,250.00
Wrangler Retainer Fee	Estimated retainer fee of $1,000 paid to a professional wrangler to ensure their services. Based on having 5 wranglers on standby.	2	$1,000.00	$2,000.00		$2,000.00
Primary Volunteer Contact/Radio Dispatcher Responsible for checking-in volunteers upon arrival at the park and assisting Direct Reduction Coordinator with miscellaneous requests.	1 GS 5 for 6 weeks - 40 hours per week during actual recution reduction efforts; 40 hours per week for one week before and after for preparation and closeout	240	$13.14	$3,153.60	$241.25	$3,394.85

TABLE 2. COST BREAKDOWN FOR DIRECT REDUCTION WITH FIREARMS UNDER THE PREFERRED ALTERNATIVE—MAINTENANCE

(assumes that annual maintenance would last 4 weeks, 10 skilled volunteers would be used per week)

ACTIVITY	ASSUMPTIONS	ANNUAL COSTS				
		Unit	Rate/hr	Base cost	Benefits @ 45%	Total cost
Law enforcement rangers Additional staff required during direct reduction activities to ensure program conducted appropriately and to respond to potential emergencies.	2 GS 5 for 4 weeks - 40 hours per week per staff member during actual reduction efforts.	320	$13.14	$4,204.80	$321.67	$4,526.47
Equipment/supplies						
Additional equipment needs, e.g. binoculars, radios, firearms/ammunition	$1,000 per year			$1,000.00		$1,000.00
Fuel/Vehicle costs	Approximately $2,000 per year/vehicle	2	$2,000.00	$4,000.00		$4,000.00
Annual Subtotal, Staffing Costs						$26,686.57
Annual Subtotal, Equipment and Supplies						$5,210.00
Annual Total						$31,896.57
Total for 10-year Maintenance Period (based on successful direct reduction with firearms program for initial reduction)						$318,965.70
Total for 12-year Maintenance Period (based on using a combination of techniques to complete initial reduction by year 3)						$382,758.84

APPENDIX E



THEODORE ROOSEVELT NATIONAL PARK

REVIEW OF ELK FERTILITY CONTROL

INTRODUCTION

Managing the overabundance of certain wildlife species has become a topic of public concern (Rutberg et al., 2004). Species such as Canada geese (*Branta canadensis*), coyotes (*Canis latrans*), white-tailed deer (*Odocoileus virginianus),* and elk *(Cervus elaphus nelsoni)* have become either locally or regionally overabundant throughout the United States (Fagerstone et al., 2002). In addition, traditional wildlife management techniques such as hunting and trapping are infeasible in many parks and suburban areas, forcing wildlife managers to seek alternative management methods.

The use of reproductive control in wildlife management has been assessed for the last several decades. Its use has gained more attention as the public has become more involved in wildlife management decisions. Interest in reproductive control, as an innovative alternative to traditional management methods, has led to the current state of the science (Baker et al., 2004). Often, the use of reproductive control is promoted in urban and suburban areas where traditional management tools, such as hunting, are publicly unacceptable or illegal due to firearm restrictions (Kilpatrick and Walter, 1997, Muller et al., 1997).

The following appendix describes the current state of reproductive control (2007) as it relates to ungulate (hoofed mammals) management with an emphasis on experimental studies in elk. In addition to describing the current technology available, it also covers population management challenges, regulatory issues, logistics, and consumption issues. It should be noted that since technology is changing rapidly in this field of research, this appendix is meant to be a description of the types of technology available and is not all-inclusive. At this time, fertility control agents have not been proven through science to effectively manage wildlife populations; however, ongoing research in other NPS units has indicated that use of such an agent for elk population maintenance at Theodore Roosevelt National Park could be feasible during the life of this plan.

CURRENT TECHNOLOGY

The area of wildlife contraception is constantly evolving as new technologies are developed and tested. For the sake of brevity, this appendix will only discuss reproductive control as it applies to female elk. There is a general understanding in herd based species, such as elk, that managing the female component of the population is more effective than managing the male component. Based on the polygamous breeding behavior of elk, suppressing male fertility would be ineffective if the overall goal is population management.

There are three basic categories of reproductive control technology: (1) immunocontraceptives (vaccines), (2) non-immunological methods (pharmaceuticals), and (3) physical or chemical sterilization.

IMMUNOCONTRACEPTIVES

It is suggested that immunocontraceptive vaccines offer significant promise for future wildlife management (Rutberg et al., 2004). Immunocontraceptive treatment involves injecting an animal with a vaccine that, "stimulates its immune system to produce antibodies against a protein (i.e., antigen) involved in reproduction" (Warren, 2000). In order to provide for sufficient antibody production, an adjuvant is combined with the vaccine. An adjuvant is a product that increases the intensity and duration of the immune system's reaction to the vaccine. There are two primary types of antigens used in fertility control vaccines tested in elk: porcine zona pellucida (PZP) and gonadotropin releasing hormone (GnRH).

PORCINE ZONA PELLUCIDA (PZP). The majority of immunocontraceptive research in wildlife has been conducted using PZP vaccines, and has been used experimentally in free-ranging Tule elk (Shideler et al., 2002) and captive as well as free-ranging Rocky Mountain elk (Garrott et al., 1998, Heilmann et al., 1998). Due to its mechanism of action, this type of vaccine is only effective in females. Until recently there were only two PZP vaccine products being developed- one is simply called PZP, and the other SpayVac™, however the company producing SpayVac™ has stated that it will no longer begin new research projects involving SpayVac™ in cervids. The other PZP vaccine has been used extensively in a variety of ungulates including white-tailed deer (Kirkpatrick et al., 1997; Turner et al., 1992, 1996; Walter et al., 2002a, 2002b), horses (Kirkpatrick et al., 1990, 1995, 1997; Turner et al., 1997, 2002), exotic species (Kirkpatrick et al., 1996a; Frank et al., 2005), and elk (Shideler et al., 2002; Garrot et al., 1998; Heilmann et al., 1998) in the course of investigating its effectiveness.

The currently available PZP vaccine formulation is effective for one year, though multi-year applications are also being studied. There are several limitations to the PZP based vaccines. First, at this time, PZP vaccines require annual boosters in order to maintain infertility, resulting in the need to mark treated animals and re-treat the same individuals each year. Second, regulatory agencies (e.g. the Food and Drug Administration and the Environmental Protection Agency) have not definitively determined whether vaccine components pose a human health risk. However, adjuvanted PZP does not appear to be a risk to non-target species if consumed orally (Barber and Fayrer-Hosken, 2000). Finally, the PZP based vaccines often cause abnormal out of season breeding behavior in treated populations (Fraker et al., 2002, Heilmann et al., 1998; McShea et al.,1997) as treatment with PZP causes repeated estrous cycling in females, which can result in late pregnancies and behavioral changes.

GONADOTROPIN RELEASING HORMONE (GNRH) VACCINES. GnRH is a small neuropeptide (a protein-like molecule made in the brain) that plays a necessary role in reproduction. It is naturally secreted by the hypothalamus (a region of the brain that regulates hormone production), which directs the pituitary gland to release hormones that control the proper functioning of reproductive organs (Hazum and Conn, 1998). In an attempt to interrupt this process, research has focused on eliminating the ability of GnRH to trigger the release of reproductive hormones. One solution that has been investigated is a vaccine that, when combined with an adjuvant, stimulates the production of antibodies to GnRH. These antibodies attach to GnRH in the hypothalamic region and prevent the hormone from binding to receptors in the pituitary gland, thus suppressing the secretion of downstream reproductive hormones.

GnRH vaccines have been used in a variety of wild and domestic ungulates as well as other wildlife species. One such GnRH vaccine being researched and developed is GonaCon™. In addition to developing an adjuvant with fewer unwanted side effects, researchers are also studying ways to develop a multi-year dose of the vaccine (USDA 2007). Potential benefits of this vaccine include the longer-lasting contraceptive effect and the lack of repeated estrous cycling. There are currently two ongoing studies investigating the safety and efficacy of GonaCon™ in elk (J. Powers personal communication, 2006). However, at this stage there are many uncertainties about this vaccine. First, like PZP vaccines, there is little information regarding the human and non-target species health risks. True health risks are likely to be negligible; however, more research is needed to confirm this hypothesis. Second, there is little information regarding vaccination of pregnant animals. Third, the vaccine can cause antibody development to not only the GnRH antigen but also a component of the adjuvant. This may cause difficulties if attempting to determine the Johne’s disease status of a population of treated elk. Finally, there is limited published data using this vaccine in free-ranging animals. More work is necessary to establish population and herd level effects.

NON-IMMUNOLOGICAL REPRODUCTIVE CONTROL METHODS

This group of reproductive control agents includes GnRH agonists, GnRH toxins, steroid hormones, and contragestives.

GNRH AGONISTS. GnRH agonists are similar in structure to GnRH and act by attaching to receptors in the pituitary gland. By attaching to the receptors, GnRH agonists reduce the number of binding sites available and thereby suppress the effect of natural GnRH. As a result of this suppression, reproductive hormones are not released (Aspden et al., 1996; D'Occhio et al., 1996). However, not all agonists have the same effects in all species. In fact, some can have an effect that is the opposite of what is intended. Therefore, it is important to fully understand the effects of a product on a given species. The GnRH agonists have been used experimentally in captive and free-ranging elk (Lincoln, 1987, Baker et al., 2002).

Leuprolide acetate: Leuprolide is one GnRH agonist that is being studied. Tests reveal that when it is administered as a controlled-release formulation it results in 100% pregnancy prevention in treated female elk (Baker et al., 2002; Baker et al., 2005; Conner et al. 2007). In addition, the treatment is reversible, and effects last only for a specific period of time (90-120 days; Baker et al., 2002; Trigg et al., 2001). This means that, should a female be treated in one year, before the breeding season, it will not be come pregnant in that year, but if the female is not re-treated the following year, then it has the same chances of becoming pregnant as an animal that was never treated. Treatment using leuprolide differs from GnRH vaccines in that it does not require an adjuvant; however, it does require a slow release implant that remains under the skin or in the muscle for the duration of treatment effectiveness and likely longer.

An added benefit to the use of leuprolide is that it requires only one treatment for the first year of contraception, whereas some immunocontraceptive vaccines require re-treating the same individual several times with additional doses to develop and maintain infertility. Additionally, leuprolide is not likely to pose a threat to the environment or non-target species (including humans; Baker et al., 2004). In contrast with some of the immunocontraceptive vaccines, leuprolide does not appear to have negative physiological side effects, and short term behavioral effects are minimal.

GNRH TOXINS. GnRH toxins consist of a cellular toxin that is combined with a GnRH analog. The toxin is carried to the receptors in the pituitary gland and is internalized. Once absorbed, the toxin disrupts cellular function and can lead to cellular death. When this occurs the production of reproductive hormones is affected. This process has been studied in female mule deer (Baker et al., 1999), and the technology is still being developed. This contraceptive method has not been explored in elk.

STEROID HORMONES. The field of wildlife contraception began with research examining the manipulation of reproductive steroid hormones. Treatments using steroids can include administering high doses of naturally occurring hormones, such as estrogens or progesterone. However, the treatment usually entails the application of synthetic hormones, such as norgestomet, levangesterol, and melangestrol acetate. Most products that are available are used in domestic animal or zoological veterinary medicine, and have not been used widely in free-ranging wildlife. Some issues related to using steroids include: difficulties in treating large numbers of animals for extended periods of time, negative side effects experienced by the treated animals, and concerns over the consumption of treated animals by non-target species, including humans. Therefore reproductive steroids are not recommended for use in free-ranging wildlife.

CONTRAGESTIVES. Contragestives are products that terminate pregnancy. Progesterone is the primary gestational hormone for maintaining pregnancy in mammals. Many contragestives act by preventing progesterone production or blocking its effect, thereby affecting pregnancy. The primary contragestive that has been researched for use in domestic animals and wild ungulates is Prostaglandin $F_{2\alpha}$ analogue (Becker and Katz, 1994; DeNicola et al., 1997; Waddell et al., 2001). $PGF_{2\alpha}$ has been used successfully to disrupt pregnancy in captive elk (Bates et al., 1982; J. Powers personal communication, 2006). Lutalyse® is a commercially available form of Prostaglandin $F_{2\alpha}$ analogue. Unlike many of the other alternatives, there are no issues related to consumption of the meat when it has previously treated with this product. Difficulties with contragestives include: timing of administration, percent efficacy, potential to re-breed if breeding season is not finished, and the potential for aborted fetuses on the landscape.

STERILIZATION. Sterilization can be either a surgical or chemical treatment process. Surgical sterilization is an intensive and invasive procedure that requires a veterinarian and is common in managing domestic animal fertility. Physical sterilization has not been used for population management in free-ranging elk populations. Chemical sterilization using sclerosing agents to initiate scar tissue development and physical damage to the reproductive tract is typically performed on males as a contraceptive measure. Both types of sterilization are generally permanent.

REGULATORY ISSUES

The application of reproductive control agents in free-ranging wildlife is fairly new and is currently (August 2007) regulated by both the United States Food and Drug Administration (FDA) and the Environmental Protection Agency (EPA). None of the agents discussed here are currently licensed or labeled for use as reproductive control agents in elk. However, some can be used in a research setting under an Investigational New Animal Drug (INAD) exemption through FDA, as an experimental application of a pesticide through EPA, or in either a management application or experimental setting with veterinary prescription if the drug is approved for use in other species (Extralabel drug use – ELDU).

INAD exemptions and experimental use permits are granted by the FDA or the EPA respectively for the purpose of allowing research to facilitate the gathering of information pertaining to the agent prior to granting full approval for its use. Some of the agents discussed above, specifically several of the pharmaceuticals, have FDA approval for therapeutic use in humans (e.g., leuprolide) or other non-wildlife species (e.g. prostaglandin $F_{2\alpha}$). As a safety precaution, each approved agent is labeled indicating how it is to be used. To use the drug in a manner other than that indicated on the label, a licensed veterinarian must prescribe the agent and it must be used in accordance with the Animal Medicinal Drug Use Clarification Act of 1994. The prescribing veterinarian is accountable for prescribing and labeling a product when it is to be used in an extra-label manner. However, the owner (in this case, the NPS unit manager) is responsible for using the agent in the prescribed manner. In addition, the veterinarian must establish a meat residue withdrawal period - the time it takes for the animal to fully metabolize and clear the drug from its tissue - for any animals that may enter the human food chain. A treated animal may not be killed and enter the human food chain before the meat residue withdrawal period is over. Treated animals need to be marked to prevent this from occurring.

POPULATION MANAGEMENT CHALLENGES

Managing local populations of wildlife using reproductive control can be difficult. The level of difficulty relates to the number of animals that need to be treated, their behavior (i.e., solitary, herd, diurnal, nocturnal, habituation, etc.), the topography of the habitat in which they are found, as well as treatment protocol logistics. In order for reproductive control agents to effectively reduce population size, treatment with an agent must decrease the reproductive rate to less than the mortality rate. In many protected environments, where human alteration of the landscape and a lack of a full suite of large predators, mortality rates are generally very low. Regarding elk in and around Theodore Roosevelt National Park, the average survival rates – with hunting – for females and males are 96% and 52%, respectively

(Sargeant and Oehler, 2004). Additionally, a significant amount of population data is necessary to successfully monitor the effects of long-term population changes due to the use of contraceptives (Rudolph et al. 2000, Hobbs et al., 2000, Porter et al., 2004).

Reproductive control agents generally decrease population levels slowly, and over time, may not result in a sustained reduction of population growth. Modeling conducted by the science team for this plan/EIS showed treating 75% of the female elk population in the park annually resulted in a brief suspension of population growth. However, within the first five years, the population resumed growing at a rate of 6.5% annually. Even when the model was run assuming 90% of female elk are treated annually, the initial reduction in population growth was not sustained, and the population resumed growing at 1.5% within the first 10 years. Hobbs et al. described a model that suggests white-tailed deer density will remain constant if 90% of the initial females are treated with a long term reproductive control agent. Subsequently, 90% of female fawns would require treatment. This would stabilize the population if the average mortality rate is 10 percent. However, this result does not hold for short-duration agents (1 year duration). In this case, the 90% of reproductively mature females would require treatment each year in order to maintain constant herd numbers (Hobbs et. al., 2000). Reproductive control techniques are best suited to localized populations where the number of breeding females to be treated is small (e.g., less than 100 animals) and managers are trying to maintain the population between 30% and 70% of carrying capacity (Rudolph et al., 2000).

ADMINISTERING THE TREATMENT

There are two basic approaches to administering reproductive control agents: capture and treat and remotely treat. Capture and treat requires physically and/or chemically restraining the animal and using a syringe or other delivery device to treat the animal. One benefit of this approach is that it allows for marking the elk which facilitates subsequent treatments. This method also is helpful in collecting valuable biological data, and it provides notice of meat residue withdrawal times. Depending on the method of capturing the animal (round-up versus ground darting versus net gunning or darting from a helicopter), this approach may be more time intensive and can be more expensive than using a remote delivery system, especially as treated animals tend to be more difficult to recapture. In addition, capture-related mortality may also be a concern.

A remote delivery system uses an adapted firearm (i.e., dart gun) and some form of projectile that contains the reproductive control agent. These projectiles can be darts or another form of delivery system (e.g., biobullet) that can be used at a distance without needing to capture the animal first. One shortcoming of remote treatment is that it does not allow for permanently marking the treated animals. In addition, previously treated animals can be more difficult to re-treat.

POTENTIAL IMPACTS TO ELK BEHAVIOR AND HEALTH

There have been few studies designed to intensively assess the effects of reproductive control on elk behavior and health. For many agents, additional research is needed to fully understand the behavioral, social, and physiological consequences of reproductive control. However, some research has been conducted on the effects of reproductive control on deer, and although the effects are unknown for elk, they may be similar. Because each group of reproductive control agents operates differently, studies show that the effects to the individual elk or population could vary widely. Porcine zona pellucida (PZP) immunocontraceptive agents have been documented to cause the continued cycling of females, which can extend the breeding season or rut (Fraker et al., 2002; Heilmann et al., 1998; McShea et al., 1997). This may lead to an extended period for herding behaviors in males. In addition, if the female gets pregnant later in the year, there are changes to fawning dates and survival rates, as they are born later in the season, similar to what has been seen in white-tailed deer (DeNicola et al., 1997). Other immunocontraceptives such as the gonadotropin releasing hormone (GnRH) vaccine, when applied in male deer, have resulted in depressed antler development and lack of interest in breeding (Killian et al, 2005). When this vaccine is applied to female deer, they display decreased estrous behavior during the breeding season (Miller et al., 2000). If enough females in the population are treated, it may result in a disruption to natural male/female social as well as reproductive interactions. An ongoing study is investigating the effects of GnRH vaccination on reproductive behavior in captive female elk (J. Powers personal communication, 2006).

The group of reproductive control agents categorized as non-immunocontraceptive methods can also have varying effects on behavior and health. For example, GnRH agonists have not been documented as causing behavioral changes when applied to female elk (Baker et al., 2002). GnRH agonists have had variable behavioral effects when applied to male elk (Lincoln, 1987). Contragestives pose a different kind of problem depending on when the treatment is applied. If applied too early in the breeding season, then the female could potentially breed again later in the year extending the rut and resulting fawn-related health issues such as those described for some immunocontraceptive agents above. If applied too late in the season contragestives can result in health implications for the female, as described for deer (DeNicola et al., 1997).

Depending on the method of sterilization this procedure may have behavioral effects on both male and female elk. If gonads are removed, the source of several important reproductive hormones will be removed. This may change elk social interactions. If gonads are not removed, females will continue to ovulate and show behavioral signs of estrus and consequently may extend the breeding season similar to the phenomenon seen with PZP immunocontraception.

As described above, any effect that could extend the rut has the potential for secondary effects to the individual elk. Increased attempts to breed, especially if unwelcomed, can result in increased aggression and movements. This can be problematic in areas with high vehicle use, as there could be increases in elk/vehicle collisions or other negative interactions with the public. However, as stated above, the effects of reproductive control agents still need more research in order to better understand the variations in elk behavior and health.

POTENTIAL IMPACTS TO CONSUMPTION

As described above, some of the reproductive control agents can result in issues related to human consumption of meat. These issues can be avoided by: 1) using an agent that does not pose any risk to humans, 2) marking treated animals and providing meat residue withdrawal times (if established), 3) providing educational materials to the local public that may consume hunted animals in the general area of treated animals, and 4) increasing research efforts to determine true human consumption risks.

TABLE E-1. A SUMMARY OF THE PERCEIVED ADVANTAGES AND DISADVANTAGES OF DIFFERENT REPRODUCTIVE CONTROL AGENTS FOR ELK

Reproductive Control Agent	Mechanism	Advantages	Disadvantages
PZP Vaccine	Immunization – antibodies directed at the ovum (egg).	• No hormonal residues. • Effective for at least 1 year. • Antibodies not harmful to humans. • Apply any time of year. • No apparent adverse health effects. • Generally reversible. • Currently available for use as an INAD (may change in the future).	• Requires booster vaccinations. • Only useful in females. • Females continue to cycle out of natural breeding season. • Not 100% effective. • Animals must be permanently marked. • No meat residue withdrawal time established.
GnRH Vaccine	Immunization – antibodies directed at a protein hormone that is needed for reproduction.	• Same as above plus: • Stops hormonal cycling. • Applicable to both males and females. • Is likely to be EPA approved for use as a pesticide in 2007-2008.	• May remove primary and secondary sexual characteristics. • May affect behaviors. • Currently animals must be permanently marked. • Incompletely tested in free-ranging populations. • No meat residue withdrawal time established.
GnRH Agonists **Leuprolide** **Buserelin**	Overwhelming GnRH receptors on anterior pituitary suppressing release of reproductive hormones.	• No hormonal meat residues. • No affect on reproductive behaviors. • FDA approved for therapeutic use in humans. • Slow-release formula available. • Remote delivery possible.	• Annual treatment prior to breeding season. • Meat residue withdrawal period not well established.
GnRH Toxin	Linking a GnRH analog to a cellular toxin which targets and kills GnRH receptors preventing release of reproductive hormones.	• May cause permanent sterility.	• More research is needed before using this product in elk.
Steroid Hormones **Progestins** **Estrogens**	Controlling the reproductive cycle by administering steroid hormones or their analogues.	• Variable efficacy. • Variable duration.	• Some formulations can accumulate in tissues and may pose a health risk to scavengers or humans. • Some steroids can be harmful to the target species. • Animals must be marked. • Administered by slow release implants or repeated feeding.
Contragestion **$PGF_{2\alpha}$**	Pre-term pregnancy termination.	• Administered by biobullet or hand injection. • FDA approved for use in domestic large animals. • No meat withdrawal period in domestic cattle.	• Administered when the animal is pregnant. • Re-breeding may occur if given early. • Increased health complications if given late.

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APPENDIX F

THEODORE ROOSEVELT NATIONAL PARK

NATIVE PLANT SPECIES OF THEODORE ROOSEVELT NATIONAL PARK

Common Name	Scientific Name
Common twinpod	*Physaria didymocarpa* var. *didymocarpa*
Painted milkvetch	*Astragalus ceramicus* var. *filifolius*
Missouri milkvetch	*Astragalus missouriensis*
Box elder	*Acer negundo*
Soapweed	*Yucca glauca*
Narrowleaf water plantain	*Alisma gramineum*
American water plantain	*Alisma subcordatum*
Northern water plantain	*Alisma triviale*
Arum-leaf arrowhead	*Sagittaria cuneata*
Broadleaf arrowhead	*Sagittaria latifolia*
Fragrant sumac	*Rhus aromatica*
Skunkbrush sumac	*Rhus trilobata*
Poison ivy	*Toxicodendron rydbergii*
Water hemlock	*Cicuta maculata*
Plains spring parsley	*Cymopterus acaulis*
Carrot-leaf desert-parsley	*Lomatium foeniculaceum*
Biscuit root	*Lomatium orientale*
Wild parsley	*Musineon divaricatum*
Aniseroot	*Osmorhiza longistylis*
Snakeroot	*Sanicula marilandica*
Spreading dogbane	*Apocynum androsaemifolium*
Indian hemp	*Apocynum cannabinum*

Common Name	Scientific Name
Wild sarsaparilla	*Aralia nudicaulis*
Sidecluster milkweed	*Asclepias lanuginosa*
Plains milkweed	*Asclepias pumila*
Showy milkweed	*Asclepias speciosa*
Whorled milkweed	*Asclepias verticillata*
Green milkweed	*Asclepias viridiflora*
Western yarrow	*Achillea millefolium*
Prairie dandelion	*Agoseris glauca*
Common ragweed	*Ambrosia artemisiifolia*
Western ragweed	*Ambrosia psilostachya*
Giant ragweed	*Ambrosia trifida*
Howell's pussytoes	*Antennaria howellii* ssp. *neodioica*
Littleleaf pussytoes	*Antennaria microphylla*
Field pussytoes	*Antennaria neglecta*
Parlin's pussytoes	*Antennaria parlinii*
Small-leaf pussytoes	*Antennaria parvifolia*
Woman's tobacco	*Antennaria plantaginifolia*
Rosy pussytoes	*Antennaria rosea*
Arnica	*Arnica fulgens*
Field sagewort	*Artemisia campestris*
Silver sagebrush	*Artemisia cana*
Green sagebrush/ false tarragon	*Artemisia dracunculus*
Fringed sage	*Artemisia frigida*
Long-leaved sage	*Artemisia longifolia*
Cudweed sagewort	*Artemisia ludoviciana*

Common Name	Scientific Name
Mountain big sagebrush	*Artemisia tridentata*
Nodding beggarstick	*Bidens cernua*
Bur beggartick	*Bidens frondosa*
Nodding beggarstick	*Bidens vulgata*
False boneset	*Brickellia eupatorioides*
Flodman's thistle	*Cirsium flodmanii*
Wavy-leaf thistle	*Cirsium undulatum*
Horseweed	*Conyza canadensis*
Spreading fleabane	*Conyza ramosissima*
Hawk's beard	*Crepis occidentalis*
Hawk's beard	*Crepis runcinata*
Fetid marigold	*Dyssodia papposa*
Purple cone flower	*Echinacea angustifolia*
Rubber rabbitbrush	*Ericameria nauseosa* var. *glabrata*
Rubber rabbitbush	*Ericameria nauseosa* var. *nauseosa*
Rough fleabane	*Erigeron asper*
Hoary fleabane	*Erigeron canus*
Smooth fleabane	*Erigeron glabellus*
Low-meadow fleabane	*Erigeron lonchophyllus*
Philadelphia daisy	*Erigeron philadelphicus*
Low fleabane	*Erigeron pumilus*
Prairie fleabane	*Erigeron strigosus*
Three-nerve fleabane	*Erigeron subtrinervis*
Blanketflower	*Gaillardia aristata*

Common Name	Scientific Name
Curlycup gumweed	*Grindelia squarrosa*
Broom snakeweed	*Gutierrezia sarothrae*
Common sunflower	*Helianthus annuus*
Maximilian sunflower	*Helianthus maximiliani*
Stiff sunflower	*Helianthus pauciflorus*
Plains sunflower	*Helianthus petiolaris*
Hairy goldaster	*Heterotheca villosa*
Finleaf hymenoppas	*Hymenopappus filifolius*
Chalk Hill hymenopappus	*Hymenopappus tenuifolius*
Pingue rubberweed	*Hymenoxys richardsonii*
Poverty weed	*Iva axillaris*
Marsh elder	*Iva xanthifolia*
Wild lettuce	*Lactuca ludoviciana*
Blue lettuce	*Lactuca tatarica* var. *pulchella*
Dotted gay feather	*Liatris punctata*
Rush skeleton plant	*Lygodesmia juncea*
Hoary aster	*Machaeranthera canescens*
Goldenweed	*Machaeranthera grindelioides*
Cutleaf goldenweed	*Machaeranthera pinnatifida* var. *pinnatifida*
Prairie false dandelion	*Nothocalais cuspidata*
Prairie goldenrod	*Oligoneuron album*
Stiff goldenrod	*Oligoneuron rigidum*
Woolly groundsel	*Packera cana*
Prairie grounsel	*Packera plattensis*
Plains bahia	*Picradeniopsis oppositifolia*

Common Name	Scientific Name
Lanceleaf goldenweed	*Pyrrocoma lanceolata* var*. lanceolata*
Prairie coneflower	*Ratibida columnifera*
Green prairie coneflower	*Ratibida tagetes*
Blackeyed susan	*Rudbeckia hirta*
Ragwort	*Senecio integerrimus*
Canada goldenrod	*Solidago canadensis*
Giant goldenrod	*Solidago gigantea*
Missouri goldenrod	*Solidago missouriensis*
Soft goldenrod	*Solidago mollis*
Gray goldenrod	*Solidago nemoralis*
Thrift mock goldenweed	*Stenotus armerioides* var*. armerioides*
Wire lettuce	*Stephanomeria runcinata*
White heath aster	*Symphyotrichum ericoides*
White prairie aster	*Symphyotrichum falcatum* var*. falcatum*
Smooth blue aster	*Symphyotrichum laeve*
White panicle aster	*Symphyotrichum lanceolatum* var*. lanceolatum*
Aromatic aster	*Symphyotrichum oblongifolium*
Stemless hymenoxys	*Tetraneuris acaulis*
Stemless townsendia	*Townsendia exscapa*
Cockleburr	*Xanthium strumarium*
Mountain birch	*Betula occidentalis*
Paper birch	*Betula papyrifera*
Beaked hazelnut	*Corylus cornuta*
Butte candle	*Cryptantha celosioides*

Common Name	Scientific Name
Nodding stickseed	*Hackelia deflexa*
Many flower stickseed	*Hackelia floribunda*
Stickseed	*Lappula occidentalis*
Hoary puccoon	*Lithospermum canescens*
Narrowleaf puccoon	*Lithospermum incisum*
Prairie bluebells	*Mertensia lanceolata*
False gromwell	*Onosmodium molle* ssp*. occidentale*
Hairy rockcress	*Arabis hirsuta*
Rockcress	*Arabis holboellii*
Spreadingpod rockcress	*Arabis X divaricarpa*
Western tansymustard	*Descurainia pinnata*
Yellow whitlowort	*Draba nemorosa*
White whitlowort	*Draba reptans*
Western wallflower	*Erysimum asperum*
Smallflower wallflower	*Erysimum inconspicuum*
Pepperweed	*Lepidium densiflorum*
Pepperweed	*Lepidium virginicum*
Alpine bladderpod	*Lesquerella alpina*
Bladderpod	*Lesquerella arenosa*
Foothill bladderpod	*Lesquerella ludoviciana*
Mustard twinpod	*Physaria brassicoides*
Yellowrocket	*Rorippa palustris*
Prince's plume	*Stanleya pinnata*
Missouri foxtail cactus	*Escobaria missouriensis* var*. missouriensis*
Pincushion cacti	*Escobaria vivipara*

Common Name	Scientific Name
	var. *vivipara*
Brittle prickly pear	*Opuntia fragilis*
Twistspine pricklypear	*Opuntia macrorhiza*
Plains prickly pear	*Opuntia polyacantha*
Water starwort	*Callitriche hermaphroditica*
Little pod flax	*Campanula rotundifolia*
Looking glass	*Triodanis leptocarpa*
Common hops	*Humulus lupulus*
Rocky mtn bee plant	*Cleome serrulata*
Clammy weed	*Polanisia dodecandra*
Common snowberry	*Symphoricarpos albus*
Buckbrush	*Symphoricarpos occidentalis*
Nannyberry	*Viburnum lentago*
Prairie chickweed	*Cerastium arvense*
Shortstalk chickweed	*Cerastium brachypodum*
Nodding chickweed	*Cerastium nutans*
Grove-sandwort	*Moehringia lateriflora*
Creeping nailwort	*Paronychia sessiliflora*
Sleepy catchfly	*Silene antirrhina*
Bittersweet	*Celastrus scandens*
Silverscale saltbush	*Atriplex argentea*
Four-wing saltbush	*Atriplex canescens*
Shadscale saltbush	*Atriplex confertifolia*
Nuttall's saltbush	*Atriplex nuttallii*
Saline saltbush	*Atriplex subspicata*
Pitseed goosefoot	*Chenopodium berlandieri*

Common Name	Scientific Name
Arid goosefoot	*Chenopodium desiccatum*
Fremont's goosefoot	*Chenopodium fremontii*
Smooth goosefoot	*Chenopodium leptophyllum*
Desert goosefoot	*Chenopodium pratericola*
Giant seed goosefoot	*Chenopodium simplex*
Standley's goosefoot	*Chenopodium standleyanum*
Smooth goosefoot	*Chenopodium subglabrum*
Suckley's saltbush	*Endolepis dioica*
Winterfat	*Krascheninnikovia lanata*
Poverty weed	*Monolepis nuttalliana*
Red swampfire	*Salicornia rubra*
Greasewood	*Sarcobatus vermiculatus*
Seepweed	*Suaeda calceoliformis*
Alkali seepweed	*Suaeda moquinii*
Bracted spiderwort	*Tradescantia bracteata*
Prairie spiderwort	*Tradescantia occidentalis* var. *occidentalis*
False bindweed	*Calystegia macounii*
Hedge bindweed	*Calystegia sepium*
Redosier dogwood	*Cornus sericea*
Ditch stonecrop	*Penthorum sedoides*
Common juniper	*Juniperus communis*
Creeping juniper	*Juniperus horizontalis*
Rocky mountain juniper	*Juniperus scopulorum*
Dodder	*Cuscuta gronovii*
Dodder	*Cuscuta pentagona*

Common Name	Scientific Name
Wheat sedge	*Carex atherodes*
Shortbeak sedge	*Carex brevior*
Crested sedge	*Carex cristatella*
Needleleaf sedge	*Carex duriuscula*
Bristleleaf sedge	*Carex eburnea*
Emory's sedge	*Carex emoryi*
Threadleaf sedge	*Carex filifolia*
Heavy sedge	*Carex gravida*
Deer sedge	*Carex hallii*
Sun sedge	*Carex inops* ssp. *heliophila*
Smoothcone sedge	*Carex laeviconica*
Woolly sedge	*Carex pellita*
Penn sedge	*Carex pensylvanica*
Rocky mtn sedge	*Carex saximontana*
Sprengel sedge	*Carex sprengelii*
Upright sedge	*Carex stricta*
Torrey's sedge	*Carex torreyi*
Fox sedge	*Carex vulpinoidea*
Needle spikerush	*Eleocharis acicularis*
Flatstem spikerush	*Eleocharis compressa*
Bald spike-rush	*Eleocharis erythropoda*
Hardstem bulrush	*Schoenoplectus acutus* var. *acutus*
Three square	*Schoenoplectus americanus*
River bulrush	*Schoenoplectus fluviatilis*
Cosmopolitan bulrush	*Schoenoplectus maritimus*

Common Name	Scientific Name
Three square	*Schoenoplectus pungens* var. *pungens*
Softstem bulrush	*Schoenoplectus tabernaemontani*
Torrey's bulrush	*Schoenoplectus torreyi*
Green bulrush	*Scirpus atrovirens*
Brittle bladder fern	*Cystopteris fragilis*
Cliff fern	*Woodsia oregana*
Silverberry	*Elaeagnus commutata*
Silver buffaloberry	*Shepherdia argentea*
Field horsetail	*Equisetum arvense*
Scouring horsetail	*Equisetum hyemale*
Smooth horsetail	*Equisetum laevigatum*
Bear berry	*Arctostaphylos uva-ursi*
Geyer's sandmat	*Chamaesyce geyeri*
Ribseed sandmat	*Chamaesyce glyptosperma*
Spotted sandmat	*Chamaesyce maculata*
Prairie sandmat	*Chamaesyce missurica*
Matted sandmat	*Chamaesyce serpens*
Thyme-leaved sandmat	*Chamaesyce serpyllifolia*
Horned spurge	*Euphorbia brachycera*
Warty spurge	*Euphorbia spathulata*
Leadplant	*Amorpha canescens*
Purple milkvetch	*Astragalus agrestis*
Two grooved milkvetch	*Astragalus bisulcatus*
Ground plum	*Astragalus crassicarpus*

Common Name	Scientific Name
Pliant milkvetch	*Astragalus flexuosus*
Plains milkvetch	*Astragalus gilviflorus*
Prairie milkvetch	*Astragalus laxmannii* var. *robustior*
Lotus milkvetch	*Astragalus lotiflorus*
Narrowleaf milkvetch	*Astragalus pectinatus*
Woollypod milkvetch	*Astragalus purshii*
Cream milkvetch	*Astragalus racemosus*
Tufted milkvetch	*Astragalus spatulatus*
Loose flower milkvetch	*Astragalus tenellus*
White prairie clover	*Dalea candida*
Nine-anther prairie clover	*Dalea enneandra*
Purple prairie clover	*Dalea purpurea*
Wild licorice	*Glycyrrhiza lepidota*
Sweet broom	*Hedysarum boreale*
American bird's foot trefoil	*Lotus unifoliolatus*
Silvery lupine	*Lupinus argenteus*
Low lupine	*Lupinus pusillus*
Field locoweed	*Oxytropis campestris*
Lambert crazyweed	*Oxytropis lambertii*
Yellow-flower locoweed	*Oxytropis monticola*
White locoweed	*Oxytropis sericea*
Silverleaf scurfpea	*Pediomelum argophyllum*
Indian breadroot	*Pediomelum esculentum*
Lemon scurfpea	*Psoralidium lanceolatum*

Common Name	Scientific Name
Slimflower scurfpea	*Psoralidium tenuiflorum*
Goldenpea	*Thermopsis rhombifolia*
American vetch	*Vicia americana*
Bur oak	*Quercus macrocarpa*
Northern gentian	*Gentiana affinis*
Annual gentian	*Gentianella amarella*
Bicknell's cranesbill	*Geranium bicknellii*
Arolina cranesbill	*Geranium carolinianum*
Black current	*Ribes americanum*
Golden current	*Ribes aureum* var. *villosum*
Missouri gooseberry	*Ribes missouriense*
Canadian gooseberry	*Ribes oxyacanthoides*
American watermilfoil	*Myriophyllum sibiricum*
Silverleaf phacelia	*Phacelia hastata*
Blue-eyed grass	*Sisyrinchium angustifolium*
Mountain blue-eyed grass	*Sisyrinchium montanum*
Arctic rush	*Juncus arcticus*
Baltic rush	*Juncus balticus*
Toad rush	*Juncus bufonius*
Bog rush	*Juncus effusus*
Inland rush	*Juncus interior*
Knotted rush	*Juncus nodosus*
Torrey's rush	*Juncus torreyi*
Arrowgrass	*Triglochin maritimum*
Blue giant hyssop	*Agastache foeniculum*
False pennyroyal	*Hedeoma drummondii*

Common Name	Scientific Name
False pennyroyal	*Hedeoma hispida*
American bugleweed	*Lycopus americanus*
Rough bugleweed	*Lycopus asper*
Field mint	*Mentha arvensis*
Wild bergamot	*Monarda bradburiana*
Wild bergamot	*Monarda fistulosa*
Lanceleaved sage	*Salvia reflexa*
American germander	*Teucrium canadense*
White wild onion	*Allium textile*
Sego lily	*Calochortus nuttallii*
Fairy bells	*Disporum trachycarpum*
Leopard lily	*Fritillaria atropurpurea*
Yellow bell	*Fritillaria pudica*
Wood lily	*Lilium philadelphicum*
False solomon's seal	*Maianthemum racemosum*
Starry false solomon's seal	*Maianthemum stellatum*
Smooth solomon's seal	*Polygonatum biflorum*
Death camus	*Zigadenus venenosus*
Blue flax	*Linum lewisii*
Stiff flax	*Linum rigidum*
Tenpetal blazingstar	*Mentzelia decapetala*
Bushy blazingstar	*Mentzelia dispersa*
Purple ammannia	*Ammannia coccinea*
Scarlet globemallow	*Sphaeralcea coccinea*
Sand verbena	*Abronia fragrans*

Common Name	Scientific Name
White four o'clock	*Mirabilis albida*
Hairy four o'clock	*Mirabilis hirsuta*
Narrow-leaf 4-o'clock	*Mirabilis linearis*
Heart-leaf 4-o'clock	*Mirabilis nyctaginea*
Sandpuffs	*Tripterocalyx micranthus*
Green ash	*Fraxinus pennsylvanica*
Cutleaf primrose	*Calylophus serrulatus*
Autumn willowherb	*Epilobium brachycarpum*
Fringed willowherb	*Epilobium ciliatum*
Scarlet gaura	*Gaura coccinea*
White-stem evening-primrose	*Oenothera albicaulis*
Common evening primrose	*Oenothera biennis*
Gumbo lily	*Oenothera caespitosa*
Cut-leaved evening primrose	*Oenothera laciniata*
Pale evening primrose	*Oenothera latifolia*
Gumbo lily	*Oenothera nuttallii*
Hairy evening primrose	*Oenothera villosa*
Clustered broomrape	*Orobanche fasciculata*
Broom-rape	*Orobanche ludoviciana*
Yellow wood sorrel	*Oxalis stricta*
Ponderosa pine	*Pinus ponderosa*
Indianwheat	*Plantago elongata*
Broadleaf plantain	*Plantago major*
Woolly plantain	*Plantago patagonica*

Common Name	Scientific Name
Indian ricegrass	*Achnatherum hymenoides*
Ticklegrass	*Agrostis scabra*
Shortawn foxtail	*Alopecurus aequalis*
Big bluestem	*Andropogon gerardii*
Sand bluestem	*Andropogon hallii*
Red threeawn	*Aristida purpurea*
American sloughgrass	*Beckmannia syzigachne*
Sideoats grama	*Bouteloua curtipendula*
Blue grama	*Bouteloua gracilis*
Hairy grama	*Bouteloua hirsuta*
Fringed brome	*Bromus ciliatus*
Buffalo grass	*Buchloe dactyloides*
Plains reedgrass	*Calamagrostis montanensis*
Reedgrass`	*Calamagrostis stricta*
Prairie sandreed	*Calamovilfa longifolia*
Drooping woodreed	*Cinna latifolia*
Poverty oatgrass	*Danthonia spicata*
Tapered rosette grass	*Dichanthelium acuminatum*
Scribner dichanthelium	*Dichanthelium oligosanthes* var. *scribnerianum*
Fall panicum	*Dichanthelium wilcoxianum*
Saltgrass	*Distichlis spicata*
Rough barnyard grass	*Echinochloa muricata*
Canada wildrye	*Elymus canadensis*
Bottlebrush squirreltail	*Elymus elymoides* ssp. *elymoides*
Streambank wheatgrass	*Elymus lanceolatus* ssp. *lanceolatus*

Common Name	Scientific Name
Wildrye	*Elymus trachycaulus* ssp. *trachycaulus*
Hairy wildrye	*Elymus villosus*
Virginia wildrye	*Elymus virginicus*
Sheep fescue	*Festuca saximontana* var. *saximontana*
American mannagrass	*Glyceria grandis*
Fowl mannagrass	*Glyceria striata*
Needle-and-thread	*Hesperostipa comata*
Porcupine grass	*Hesperostipa spartea*
Foxtail barley	*Hordeum jubatum*
Little barley	*Hordeum pusillum*
Junegrass	*Koeleria macrantha*
False buffalograss	*Monroa squarrosa*
Scratchgrass	*Muhlenbergia asperifolia*
Plains muhly	*Muhlenbergia cuspidata*
Wirestem muhly	*Muhlenbergia mexicana*
Marsh muhly	*Muhlenbergia racemosa*
Mat muhly	*Muhlenbergia richardsonis*
Green needlegrass	*Nassella viridula*
Rough-leaved ricegrass	*Oryzopsis asperifolia*
Witchgrass	*Panicum capillare*
Switchgrass	*Panicum virgatum*
Western wheatgrass	*Pascopyrum smithii*
Common reed	*Phragmites australis*
Littleseed ricegrass	*Piptatherum micranthum*
Plains bluegrass	*Poa arida*

Common Name	Scientific Name
Cusick's bluegrass	*Poa cusickii*
Inland bluegrass	*Poa nemoralis* ssp. *interior*
Fowl bluegrass	*Poa palustris*
Sandberg bluegrass	*Poa secunda*
Bluebunch wheatgrass	*Pseudoroegneria spicata* ssp. *spicata*
Alkali grass	*Puccinellia nuttalliana*
Tumble grass	*Schedonnardus paniculatus*
False melic	*Schizachne purpurascens*
Little bluestem	*Schizachyrium scoparium*
Common rivergrass	*Scolochloa festucacea*
Alkali cordgrass	*Spartina gracilis*
Prairie cordgrass	*Spartina pectinata*
Prairie wedgegrass	*Sphenopholis obtusata*
Alkali grass	*Sporobolus airoides*
Sand dropseed	*Sporobolus cryptandrus*
Sixweeks fescue	*Vulpia octoflora*
Agrohordeum	*xElyhordeum macounii*
Collomia	*Collomia linearis*
Ballhead gilia	*Ipomopsis congesta*
Needle-leaf pincushion-plant	*Navarretia intertexta* ssp. *propinqua*
Hood's phlox	*Phlox hoodii*
White milkwort	*Polygala alba*
Senega snakeroot	*Polygala senega*
Whorled milkwort	*Polygala verticillata*
Yellow eriogonum	*Eriogonum flavum*

Common Name	Scientific Name
Few-flower wild buckwheat	*Eriogonum pauciflorum*
Water knotweed	*Polygonum achoreum*
Water knotweed	*Polygonum amphibium*
Knotweed	*Polygonum douglasii*
Erect knotweed	*Polygonum erectum*
Pale smartweed	*Polygonum lapathifolium*
Pennsylvania smartweed	*Polygonum pensylvanicum*
Lady's thumb	*Polygonum persicaria*
Western dock	*Rumex aquaticus* var. *fenestratus*
Willow dock	*Rumex salicifolius* var. *mexicanus*
Wild begonia	*Rumex venosus*
Western polypody	*Polypodium hesperium*
Baby pondweed	*Potamogeton pusillus*
Clasping leaf pondweed	*Potamogeton richardsonii*
Sago pondweed	*Stuckenia pectinatus*
Rock jasmine	*Androsace occidentalis*
Sea milkwort	*Glaux maritima*
Fringed loosestrife	*Lysimachia ciliata*
Baneberry	*Actaea rubra*
Canada anemone	*Anemone canadensis*
Candle anemone	*Anemone cylindrica*
	Anemone patens
Tall thimbleweed	*Anemone virginiana*
Red columbine	*Aquilegia canadensis*

Common Name	Scientific Name
Western virgin's bower	*Clematis ligusticifolia*
Virgin's bower	*Clematis virginiana*
Little larkspur	*Delphinium bicolor*
Pasque flower	*Pulsatilla patens*
Early wood buttercup	*Ranunculus abortivus*
Alkali buttercup	*Ranunculus cymbalaria*
Sagebrush buttercup	*Ranunculus glaberrimus*
Long-beak water-crowfoot	*Ranunculus longirostris*
Macoun's buttercup	*Ranunculus macounii*
Labrador buttercup	*Ranunculus rhomboideus*
Cursed buttercup	*Ranunculus sceleratus*
Purple meadow rue	*Thalictrum dasycarpum*
Veiny meadow rue	*Thalictrum venulosum*
Woodland grooveburr	*Agrimonia striata*
Saskatoon serviceberry	*Amelanchier alnifolia*
Silverweed	*Argentina anserina*
Little ground rose	*Chamaerhodos erecta*
Fineberry hawthorn	*Crataegus chrysocarpa*
Shrubby cinquefoil	*Dasiphora floribunda*
Woodland strawberry	*Fragaria vesca*
Wild strawberry	*Fragaria virginiana*
Yellow avens	*Geum aleppicum*
White avens	*Geum canadense*
Prairie smoke	*Geum triflorum*
Tall cinquefoil	*Potentilla arguta*

Common Name	Scientific Name
Elegant cinquefoil	*Potentilla concinna*
Woolly cinquefoil	*Potentilla hippiana*
Norwegian cinquefoil	*Potentilla norvegica*
Bushy cinquefoil	*Potentilla paradoxa*
Pennsylvania cinquefoil	*Potentilla pensylvanica*
Wild plum	*Prunus americana*
Pin cherry	*Prunus pensylvanica*
Sand cherry	*Prunus pumila* var. *besseyi*
Chokecherry	*Prunus virginiana*
Prairie rose	*Rosa arkansana*
Wood's rose	*Rosa woodsii*
Red raspberry	*Rubus idaeus*
Catchweed bedstraw	*Galium aparine*
Northern bedstraw	*Galium boreale*
Balsam poplar	*Populus balsamifera*
Plains cottonwood	*Populus deltoides*
Quaking aspen	*Populus tremuloides*
Lanceleaf cottonwood	*Populus X acuminata*
Peachleaf willow	*Salix amygdaloides*
Bebb's willow	*Salix bebbiana*
Diamond willow	*Salix eriocephala*
Narrowleaf willow	*Salix exigua*
Prairie willow	*Salix humilis*
Sandbar willow	*Salix interior*
Shining willow	*Salix lucida*
Yellow willow	*Salix lutea*

Common Name	Scientific Name
Toadflax	*Comandra umbellata*
Alumroot	*Heuchera richardsonii*
Indian paintbrush	*Castilleja sessiliflora*
Clammy hedge-hyssop	*Gratiola neglecta*
Oldfield toadflax	*Nuttallanthus canadensis*
Owl clover	*Orthocarpus luteus*
White penstemon	*Penstemon albidus*
Narrowleaf penstemon	*Penstemon angustifolius*
Fuzzytongue penstemon	*Penstemon eriantherus*
Narrow leaf beardtongue	*Penstemon gracilis*
Waxleaf penstemon	*Penstemon nitidus*
Small clubmoss	*Selaginella densa*
Smooth carrion flower	*Smilax herbacea*
Blue ridge carrion flower	*Smilax lasioneura*
Clammy groundcherry	*Physalis heterophylla*
Virginiana groundcherry	*Physalis virginiana*
Common twinpod	*Physaria didymocarpa*
Buffalobur nightshade	*Solanum rostratum*
Cutleaf nightshade	*Solanum triflorum*
Broad-fruit bur-reed	*Sparganium eurycarpum*
Broadleaf cattail	*Typha latifolia*
American elm	*Ulmus americana*
Pennsylvania pellitory	*Parietaria pensylvanica*

Common Name	Scientific Name
Stinging nettle	*Urtica dioica*
Prostrate vervain	*Verbena bracteata*
Western vervain	*Verbena lasiostachys*
Hoary vervain	*Verbena stricta*
Blue violet	*Viola adunca*
Canadian white violet	*Viola canadensis*
Northern bog violet	*Viola nephrophylla*
Nuttall's violet	*Viola nuttallii*
Prairie violet	*Viola pedatifida*
Virginia creeper	*Parthenocissus quinquefolia*
Woodbine	*Parthenocissus vitacea*
Riverbank grape	*Vitis riparia*
Winter grape	*Vitis vulpina*
Horned pondweed	*Zannichellia palustris*

Source: NPS 2007a

Exotic Plant Species of Theodore Roosevelt National Park

Common Name	Scientific Name
Prostrate pigweed	*Amaranthus albus*
Rough pigweed	*Amaranthus retroflexus*
Poison hemlock	*Conium maculatum*
Russian knapweed	*Acroptilon repens*
Burdock	*Arctium minus*
Absinth wormwood	*Artemisia absinthium*
Biennial wormwood	*Artemisia biennis*
Plumeless thistle	*Carduus acanthoides*
Musk thistle	*Carduus nutans*
Spotted knapweed	*Centaurea biebersteinii*
Canada thistle	*Cirsium arvense*
Bull thistle	*Cirsium vulgare*
Prickly lettuce	*Lactuca serriola*
Sow thistle	*Sonchus arvensis*
Dandelion	*Taraxacum officinale*
Goats beard	*Tragopogon dubius*
Golden crownbeard	*Verbesina encelioides*
German madwort	*Asperugo procumbens*
Gypsyflower	*Cynoglossum officinale*
European stickseed	*Lappula squarrosa*
Alyssum	*Alyssum desertorum*
India mustard	*Brassica juncea*
Littlepod false flax	*Camelina microcarpa*
Shepherd's purse	*Capsella bursa-pastoris*
Blue mustard	*Chorispora tenella*
Hare's-ear-mustard	*Conringia orientalis*
Flixweed	*Descurainia sophia*
Wormseed wallflower	*Erysimum cheiranthoides*
Clasping pepperweed	*Lepidium perfoliatum*
Radish	*Raphanus sativus*
Tumbling mustard	*Sisymbrium altissimum*
Small tumbleweed mustard	*Sisymbrium loeselii*
Field pennycress	*Thlaspi arvense*
Tartarian honeysuckle	*Lonicera tatarica*
Smooth catchfly	*Silene cserei*
Bladder campion	*Silene latifolia* ssp. *alba*
Burningbush	*Bassia scoparia*
Lambsquarters	*Chenopodium album*
Oak-leaved goosefoot	*Chenopodium glaucum*
Russian thistle	*Salsola kali*
Prickly russian thistle	*Salsola tragus*
Field bindweed, creeping jenny	*Convolvulus arvensis*
Russian olive	*Elaeagnus angustifolia*
Urban spurge	*Euphorbia agraria*
Leafy spurge	*Euphorbia esula*
Black medic	*Medicago lupulina*
Alfalfa	*Medicago sativa*
White sweetclover	*Melilotus alba*
Yellow sweetclover	*Melilotus officinalis*
Red clover	*Trifolium pratense*

Common Name	Scientific Name
White clover	*Trifolium repens*
Common vetch	*Vicia sativa*
Catnip	*Nepeta cataria*
Asparagus	*Asparagus officinalis*
Blue flax	*Linum perenne*
Small fruited mallow	*Malva parviflora*
Common mallow	*Malva rotundifolia*
Crested wheatgrass	*Agropyron cristatum*
Desert wheatgrass	*Agropyron desertorum*
Smooth brome	*Bromus inermis*
Japanese brome	*Bromus japonicus*
Cheat grass	*Bromus tectorum*
Orchard grass	*Dactylis glomerata*
Barnyard grass	*Echinochloa crus-galli*
Bearded wheatgrass	*Elymus caninus*
Quackgrass	*Elymus repens*
Stinkgrass	*Eragrostis cilianensis*
Meadow fescue	*Lolium pratense*
Pearl millet	*Pennisetum glaucum*
Bulbous blue grass	*Poa bulbosa*
Canada bluegrass	*Poa compressa*
Kentucky bluegrass	*Poa pratensis*
Green bristlegrass	*Setaria viridis*
Intermediate wheatgrass	*Thinopyrum intermedium*
Common knotweed	*Polygonum arenastrum*
Prostrate knotweed	*Polygonum aviculare*

Common Name	Scientific Name
Climbing knotweed	*Polygonum convolvulus*
Curly dock	*Rumex crispus*
Narrow-leaf dock	*Rumex stenophyllus*
Common purslane	*Portulaca oleracea*
Annual buttercup	*Ceratocephala testiculata*
Dalmatian toadflax	*Linaria dalmatica*
Butter and eggs	*Linaria vulgaris*
Purslane speedwell	*Veronica peregrina*
Black henbane	*Hyoscyamus niger*
Hoe nightshade	*Solanum sarrachoides*
Saltcedar	*Tamarix ramosissima*
Narrowleaf cattail	*Typha angustifolia*
Siberian elm	*Ulmus pumila*

Source: NPS 2007a

NOXIOUS WEEDS OF NORTH DAKOTA

Common Name	Scientific Name
Russian knapweed	*Acroptilon repens*
Absinth wormwood	*Artemisia absinthium*
Musk thistle	*Carduus nutans*
Diffuse knapweed	*Centaurea diffusa*
Yellow starthistle	*Centaurea solstitialis*
Spotted knapweed	*Centaurea stoebe ssp. Micranthos*
Canada thistle	*Cirsium arvense*
Field bindweed	*Convolvulus arvensis*
Leafy spurge	*Euphorbia esula*
Dalmatian toadflax	*Linaria dalmatica ssp. Dalmatica*
Spotted knapweed	*Centaurea stoebe ssp. Micranthos*
Purple loosestrife	*Lythrum salicaria*
purple loosestrife	*Lythrum vigatum*
Saltcedar	*Tamarix chinensis*
Saltcedar	*Tamarix parviflora*
Saltcedar	*Tamarix ramosissima*

Source: USDA-NRCS 2007

APPENDIX G

THEODORE ROOSEVELT NATIONAL PARK

MINIMUM REQUIREMENTS DECISION GUIDE

Theodore Roosevelt National Park Elk Management Plan/EIS

". . . except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act..."

– the Wilderness Act, 1964

Please refer to the accompanying MRDG *Instructions* for filling out this guide.
The spaces in the worksheets will expand as necessary as you enter your response.

Step 1: Determine if any administrative action is necessary.

Description: Briefly describe the situation that may prompt action.

Implementation of the elk management plan/environmental impact statement (Plan/EIS) would necessitate activities in the wilderness portion of Theodore Roosevelt National Park. The purpose of this plan/EIS is to develop and implement an elk management strategy compatible with the long term protection and preservation of park resources. As a result of past and current actions within and beyond the park, several conditions have led to the increase of the park elk population to the approximately 900-1000 that occur in the South Unit today. This includes the absence of effective elk predators; public hunting outside the park which does not appear to control population size within the park; high reproductive, survival, and population growth rates; lack of elk mortality such as winter kill; and the inability of the park to translocate elk without testing to show that the NPS is 99% confident that chronic wasting disease (CWD) is present in less than 1% of the population. These conditions are expected to continue and the population is projected to increase for the foreseeable future.

Large populations of elk could, over the long term, affect plant communities and other resources as a result of sustained, heavy grazing. Large elk populations could affect other herbivores by competing for forage. Other considerations include land use and users outside the park, including livestock grazing, hunting, and agriculture; visitors to the park; and the ability of the park to effectively manage resources.

A. Describe Options Outside of Wilderness

Is action necessary within wilderness?

Yes: ☒ **No:** ☐

Explain: Elk are a highly mobile species that are not prevented from entering or leaving park wilderness. Restricting elk reduction activities to locations outside wilderness but within the park would likely create a refuge for elk, further increasing pressure on wilderness vegetative resources. The North Dakota Game and Fish Department (NDGF) has increased the number of elk tags in units adjacent to the park the past several years, resulting in increased take but in numbers ineffective in controlling the population within the park. To prevent the degradation of vegetation as a result of sustained, high elk densities, reduction activities would be required within park wilderness.

B. Describe Valid Existing Rights or Special Provisions of Wilderness Legislation

Is action necessary to satisfy valid existing rights or a special provision in wilderness legislation (the Wilderness Act of 1964 or subsequent wilderness laws) that allows consideration of the Section 4(c) prohibited uses? Cite law and section.

Yes: ☐ **No:** ☒ **Not Applicable:** ☐

Explain: There are no provisions in the Wilderness Act of 1964 or subsequent wilderness legislation that specifically allows for the control of unnaturally high elk populations or consideration of the uses prohibited in Section 4(c) for active management of otherwise problematic wildlife and plant species. There is a reference to fire related activities in Section 4(d)(1) which states "In addition, such measure may be taken as may be necessary in the control of fire, insects, and diseases, subject to such conditions as the Secretary deems desirable." This language allows for consideration of fire as a management tool, provided fire related actions are the minimum necessary. The preferred alternative does not include the use of fire in wilderness.

C. Describe Requirements of Other Legislation

Is action necessary to meet the requirements of other laws?

Yes: ☒ **No:** ☐ **Not Applicable:** ☐

Explain: As an administrative unit of the National Park System, Theodore Roosevelt National Park is managed in conformity with the National Park Service Organic Act (39 Stat. 535, codified at 16 U.S.C. sections 1 through 4), which prohibits the NPS from allowing impairment of park resources and values. Because high elk population numbers could likely have the potential to impair park resources or values, the National Park Service (NPS) has authority to remove or otherwise redistribute elk and to employ allowable measures to protect vegetation and other park resources and values.

D. Describe Other Guidance

Is action necessary to conform to direction contained in agency policy, unit and wilderness management plans, species recovery plans, or agreements with tribal, state and local governments or other federal agencies?

Yes: ☒ **No:** ☐ **Not Applicable:** ☐

Explain: Theodore Roosevelt National Park has a responsibility to control the elk population as outlined in formal agreements with the U.S. Forest Service (USFS) and NDGF, and strives to be responsive to elk management concerns of area land owners and other land managers.

Reducing elk numbers within the park would conform to NPS policies regarding wilderness preservation and management in addition to general guidance on animal and plant management. These policies allow for active management of biological or physical processes to restore them to and maintain the closest approximation of a natural condition possible.

Section 4.4.2 of NPS Management Policies (2006) states that "[w]henever possible, natural processes will be relied upon to maintain native plant and animal species and influence natural fluctuations in populations of these species. The NPS may intervene to manage populations or individuals of native wildlife species only when such intervention will not cause unacceptable impacts to the populations of the species or to other components and processes of the ecosystems that support them." The policy restricts management to times when certain conditions exist. One such condition is when "a population occurs in an unnaturally high or low concentration as a result of human influences (such as loss of seasonal habitat, the extirpation of predators, the creation of highly productive habitat through agriculture or urban landscapes) and it is not possible to mitigate the effects of the human influences." The elk population at Theodore Roosevelt National Park has the potential to quickly reach unnaturally high levels due to the absence of effective predation and the presence of the high quality habitat found in the park and surrounding agricultural areas. This could lead to resource degradation that would require restoration. Thus, active management of elk to avoid these effects is consistent with guiding policies.

Section 6.3.7 of the NPS Reference Manual #41 – Wilderness Preservation and Management (RM-41) recognizes that wilderness is a composite resource with interrelated parts. "Without spectacular natural resources, especially indigenous and endemic species, a wilderness experience might not be possible. Natural resources are critical, defining elements of the wilderness resource, but need to be managed within the context of the whole. Natural resource management in wilderness will include and be guided by a coordinated program of scientific inventory, monitoring, and research."

National Park Service RM-41 further states that "The principle of non-degradation will be applied to wilderness management, and each wilderness area's condition will be measured and assessed against its own unimpaired standard. Natural processes will be allowed, in so far as possible, to shape and control wilderness ecosystems. Management should seek to sustain natural distribution, numbers, population, composition, and interaction of indigenous species. Management intervention should only be undertaken to the extent necessary to correct past mistakes, the impacts of human use, and the influences originating outside wilderness boundaries. Management actions, including restoration of extirpated native species, altered natural fire regimes, controlling invasive alien species, endangered species management, and the protection of air and water quality, should be attempted only when the knowledge and tools exist to accomplish clearly articulated goals."

E. Wilderness Character

Does taking administrative action preserve or impair wilderness character, as described by the qualities listed below?

- "Untrammeled" – Wilderness is essentially unhindered and free from modern human control or manipulation.
- "Undeveloped" – Wilderness retains its primeval character and has minimal evidence of modern human occupation or modification.
- "Natural" – Wilderness ecological systems are substantially free from the effects of modern civilization.
- "Outstanding opportunities for solitude or a primitive and unconfined type of recreation" – Wilderness provides opportunities for people to experience natural sights and sounds, solitude, freedom, risk, and the physical and emotional challenges of self-discovery and self reliance.

Note: Wilderness quality definitions closely follow USDA General Technical Report RMRS-GTR-217WWW, *Applying the Concept of Wilderness Character to National Forest Planning, Monitoring, and Management*.

Untrammeled: **Preserve:** ☒ **Impair:** ☐ **Not Applicable:** ☐

Explain: Elk population reduction would not leave the wilderness unhindered and free from human control or manipulation but would result in elk densities consistent with those expected in an untrammeled, historic condition. Evidence of human manipulation while reduction activities are ongoing would manifest itself as government employees and volunteers participating in reduction activities. Such activities would be transient in nature and, over the long-term, reduction of the elk population and densities to the levels recommended in the EIS would restore the untrammeled nature of the wilderness character by reducing evidence of human manipulation (e.g., elk population at unnaturally high levels).

Undeveloped: **Preserve:** ☐ **Impair:** ☐ **Not Applicable:** ☒

Explain: Elk reduction activities are not expected to result in any permanent developments or evidence of human modification of wilderness resources.

Natural: **Preserve:** ☒ **Impair:** ☐ **Not Applicable:** ☐

Explain: Actions to reduce the elk population to appropriate management levels are expected to maintain natural conditions and prevent the degradation of the wilderness vegetative community. Elk within the park are extremely difficult to approach and do not appear to have habituated to visitor presence since their reintroduction in 1985. Visitors often are able to view elk only from a great distance or by travelling off established roads (on foot) and consider any elk they do observe as “wild” in every sense. Proposed reduction activities are expected to reduce the likelihood elk within the park will habituate to the presence of humans.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation:

Preserve: ☒ **Impair:** ☐ **Not Applicable:** ☐

Explain: Elk reduction activities, most notably the occasional discharge of a firearm or a helicopter during a roundup, would result in short-term disturbance of wilderness solitude. This transient type of disturbance would be limited to wilderness in the park’s South Unit. Reduction activities and any associated noise would be spatially dispersed within wilderness and limited to the late fall to mid-winter months when visitation to wilderness is minimal. Over the long term, once the elk population decreases to the desired maintenance level, firearm use is expected to significantly decline, resulting in normal or near normal wilderness conditions during most years. Reduction activities involving firearm use, regardless of being short or long term, are not expected to occur every day. Thus, opportunities for solitude and unconfined recreation are expected even during the peak of reduction activity. The large expanse of wilderness in the park’s North Unit is available year round and provides park visitors outstanding opportunities for solitude and primitive and unconfined recreation.

Other unique components that reflect the character of this wilderness:

Preserve: ☐ **Impair:** ☐ **Not Applicable:** ☒

Explain:

F. Describe Effects to the Public Purposes of Wilderness

Is action necessary to support one or more of the public purposes for wilderness (as stated in Section 4(b) of the Wilderness Act) of recreation, scenic, scientific, education, conservation, and historical use?

Preserve: ☒ **Impair:** ☐ **Not Applicable:** ☐

Explain: Significant reduction of the elk population is consistent with the parks science-based forage allocation model, with elk numbers present before human settlement of the region, and with recreation, scenic, education, conservation, and historical use for wilderness. Management of the elk herd will assist with conservation of park resources and is in line with historic use in the park’s wilderness. Failing to reduce the population significantly could result in impacts to grassland vegetation that would require restoration, which is inconsistent with direction in Section 4.1 of the NPS *Management Policies 2006* which state that the NPS will manage the components and processes of park ecosystems for natural conditions to prevent resource degradation, and any subsequent need for restoration.

The impacts of a high elk population, if left unchecked, could ultimately lead to the impairment of grassland vegetation in the South Unit, as well as impacts to the elk themselves, other wildlife and wildlife habitat, and surrounding lands. The potential impairment that could occur without management of the elk population is prohibited by the Organic Act of 1916*.* As defined by Section 1.4.4 of the NPS *Management Policies 2006*, this is the cornerstone of the Organic Act of 1916, and ensures that park resources and values will continue to exist in a condition that will allow the American public to have present and future opportunities to experience park resources and values. Ensuring the park's vegetation is not degraded protects scenic and recreational opportunities which visitors come to the park to enjoy.

Step 1 Decision: Is any administrative action necessary in wilderness?

Yes: ☒ **No:** ☐ **More information needed:** ☐

Explain: The presence of high quality habitat found in the park and surrounding agricultural areas creates a high potential for the elk numbers to reach unnaturally high levels. The NPS is concerned that an unchecked elk population at the South Unit will eventually create adverse resource impacts that are not consistent with *NPS Management Policies 2006*.

There is also a need to consider the land use and users outside the park, including livestock grazing, hunting, and agriculture. The park has a responsibility to actively manage the elk population as outlined in agreements with the U.S. Forest Service and North Dakota Game and Fish Department, and it is necessary to reevaluate objectives and management options addressing the 2002 Director's Guidance Memorandum on CWD.

Given the absence of effective population controls (e.g., predation, hunting outside the park) and concerns over Chronic Wasting Disease (CWD), the NPS believes it is necessary to significantly reduce elk numbers to protect park resources, address public and agency concerns, and maintain consistency with NPS policy. Considering the mobility of elk and known distribution patterns, reduction activities are expected to occur in park wilderness so therefore administrative action is necessary.

If action is necessary, proceed to Step 2 to determine the minimum activity.

Step 2: Determine the minimum activity.

Please refer to the accompanying MRDG *Instructions* for an explanation of the effects criteria displayed below.

Description of Alternative

Describe what methods and techniques will be used, when the activity will take place, where the activity will take place, what mitigation measures are necessary, and the general effects to the wilderness resource and character.

Preferred Alternative: Combination of Techniques

Description:

Extensive public and agency comment received by the park during two separate, formal public reviews of the draft EIS and draft preferred/environmentally preferred alternative was considered in developing the park's (final) preferred alternative, which consists of a suite of techniques contained in alternatives B (direct reduction with firearms), C (roundup and euthanasia), and D (roundup and translocation).

Direct Reduction with Firearms - Direct reduction with firearms would involve the use of teams that would assist with all related field activities (shooting, field dressing, data collection, CWD testing, carcass handling/transport) and subsequent management actions (carcass handling after removal from the field, data collection, shipping).

Five teams comprised of a single team leader and up to four skilled volunteers would be involved with direct reduction activities. Team leaders would be temporary or permanent NPS (or other government) employees that meet the same qualifications as the team members. They would also be familiar with badlands terrain and park operations and would have additional training in first aid, radio operations, volunteer supervision, use of firearms, CWD testing, and other procedures developed for the elk reduction program.

The five team leaders would conduct a pilot effort employing all of the same protocols that would be used during future reduction efforts (e.g., locating and shooting elk, collecting biological samples, recovering and storage of meat and other products, and processing other data collected while in the field) for the purposes of training, evaluating, and modifying field protocols to ensure that reduction teams are properly equipped and as efficient as possible.

Teams would generally access an area on foot. Because of the difficulty reduction teams may have efficiently locating elk, the monitoring effort outlined in alternative A would be implemented prior to the reduction effort. Real-time GPS collars would be deployed on a sample of female elk, and team leaders would check locations of collared animals on a daily basis. This information would be used to guide each team’s efforts for that day. Each team would be outfitted with a GPS datalogger (available from the park) that would track the movements of the team for future analyses. This level of monitoring would greatly increase the efficiency of the reduction effort, and provide the NPS with an objective basis for why the alternative succeeded or failed (response of elk to teams, effort of teams. etc.).

Using these data, teams would locate and take groups of elk to facilitate reduction activities, although individual elk located opportunistically would also be considered for removal. Teams would take advantage of opportunities to take a number of elk at any given time, depending on the situation. Team leaders would ensure that only cow elk were taken but may or may not indicate a specific animal or animals, depending on the conditions. Team leaders would determine how many animals would be taken at a given time, but the team would work together to determine other specifics, such as the best approach and which person would do the shooting. Team members would use only non-lead bullets, and elk injured during the operation would be put down as quickly as possible.

Qualified team members would be responsible for taking CWD samples. Every effort would be made to remove all carcasses from the field, although a small number could be left because of the difficulty to retrieve them given terrain, weather, etc. The locations of these carcasses would be marked using GPS, and if any samples from these carcasses test positive for CWD, park staff would retrieve them to the extent possible and dispose of them appropriately.

All carcasses, except for the small number that could be left in the field (due to terrain, weather, etc.), would be transported to a storage facility in the park. To enhance the efficiency of reduction operations, teams would be supplemented by experienced wranglers familiar with pack horses/mules, as well as preparing and packing game in rough terrain, who would remove carcasses from the field and transport them to the storage facility. This would allow the team leaders and skilled volunteers to focus their efforts on the location and reduction (shooting) of elk, and minimize time spent processing and transporting carcasses.

Additional personnel would be available at the storage facility for subsequent management activities, such as loading carcasses into refrigeration trucks for temporary storage, collecting data, and shipping carcasses for distribution or donations. These carcasses would be held, processed, and donated in accordance with guidance from the NPS Office of Public Health. As long as there are not positive CWD tests, meat would be donated to state agencies, American Indian tribes, approved charities, or other organizations in accordance with General Services.

Roundup and Euthanasia - If roundup and euthanasia are used under the preferred alternative, these actions would be implemented as described for alternative C. Roundups would be conducted and elk would be herded to the park's capture and handling facility. Live elk would be transported from this location to a commercial processing facility, where they would be euthanized, tested for CWD, and processed for distribution, donation, or disposal, as appropriate. If this is not an available option, elk would be euthanized at the park handling facility by qualified NPS employees and authorized agents skilled in specific euthanasia techniques.

Testing and Translocation - If testing and translocation are used, these actions (roundup and relocation of animals to willing recipients outside the park) would be implemented as described for alternative D. All applicable state and federal permits required to implement this alternative would be obtained. This option would involve multiple roundups—at least one for testing a sample number of elk to establish the prevalence of CWD, and subsequent roundups for the actual translocation of animals. However, several circumstances could hinder implementation of this option, including the presence of CWD, the availability of willing recipients, and management considerations for the park.

Timing and Magnitude of Actions - The suite of techniques available would be used for both the initial herd reduction and annual maintenance phases and permit a greater degree of flexibility in determine the appropriate action (adaptive management) and respective timeframe. The number of elk removed under the initial reduction would be equal to the number of elk over the target population goal. Based on reduction via firearms as the primary management tool, over 1000 elk would need to be taken to meet the initial reduction phase goal of 200. Any mortality attributed to hunting outside the park would be considered when determining if annual reduction goals and/or population targets have been met. Depending on the techniques used and success in the field, the initial reduction phase could take several months per year (up to five years) to complete.

Once initial the reduction goal is met, the number of elk removed under a maintenance reduction would be only that required to keep population growth from exceeding the target population level. Since elk population growth rate is variable and hunter success in the state sponsored season varies each year, the number of elk reduced in the park would vary as well. Maintenance actions would focus on the removal of adult female elk. Given a maximum post-initial reduction elk population of 200, approximately 20-30 elk are expected to be removed each year under a maintenance phase.

Reduction activities within wilderness would likely occur during the late fall and early winter to overlap the state sponsored hunting season outside the park and to minimize impacts to visitors within the park. Visitor impacts would be minimized as overall park visitation is lowest from November through March, with only a small portion of those expected to visit wilderness sites. The NPS would determine if safety concerns warrant temporary closure of specific areas of the park during elk management activities. The public would be appropriately notified of these closures. Overlapping in-park and outside park reduction efforts is desirable because in-park reduction could encourage some elk to leave the park that normally would not, (possibly) enhancing hunter success outside the park. Elk movement data would be collected concurrently with federal and state reduction efforts, permitting adjustment of activities as needed in order to maximize overall program success.

Effects:

Wilderness Character

Park wilderness area is one location where elk activity is relatively high and it is likely some management actions would be conducted in this area. Although firearms are used routinely outside of the park during hunting season, their sporadic use in the wilderness area of the South Unit would create additional noise intrusion on solitude. The presence of direct reduction teams would also contribute to the impact. Noise impacts would dissipate with distance from the activity, and would also occur less frequently after initial reduction is complete and annual maintenance is implemented. If used, firearm noise suppressors could offset some of these impacts. Management actions timed to coincide with periods of low visitation, coupled with closures, would minimize the number of wilderness users that would be affected. Once management actions are complete, wilderness resources would recover. As a result, there would long-term, negligible to moderate adverse impacts from the use of firearms and the presence of people during annual elk reduction actions. The intensity of impacts would depend on the distance from the activity. The human intervention associated with elk management, although not prohibited in wilderness areas, could also be considered “unnatural” and could contribute to these impacts by affecting the wilderness values of some users.

Should the use of firearms fail to meet annual elk reduction goals, the use of a helicopter would be considered, however there would be no helicopter landings in wilderness. Helicopters, and the disturbances associated with the herding and driving of elk would have impacts consistent with normal (past) operations at the park. Aircraft noise would create intrusions on solitude, and the associated human intervention could be viewed as “unnatural.” However, these impacts would be short term and intermittent over the life of this plan as initial reduction and maintenance phase reduction could be completed in one week or less. Management actions would be carried out in fall and winter during periods of low visitation and coupled with closures would reduce the number of wilderness users that would be affected. Once management actions are complete, wilderness resources would recover.

Ground-disturbing activities associated with routine research and monitoring could affect vegetation in wilderness areas, but the impacts would not be discernable. Use of fixed-wing aircraft during elk population surveys would have temporary (for the duration of the activity), short-term, negligible to major adverse impacts on the solitude of the wilderness area. Monitoring aircraft are expected to maintain a minimum altitude of 500 feet above ground level while herding aircraft (if used) could fly at lower elevation. Excluding emergency situations, aircraft are not expected to land within wilderness. The intensity of the impacts would depend on the distance from the activity.

The gradual reduction (over five years) and maintenance of the elk population would result in the loss of native elk that may have adverse effects on the natural character of the wilderness area; however, despite the number of elk removed over the life of this plan under this alternative, maintaining a healthy population between 100 and 400 would ensure elk remain as a ***natural*** component of the wilderness ecosystem. A significantly reduced elk population eliminates the potential for sustained, heavy use of the vegetation a supports the ***untrammeled*** character of the wilderness area experienced today. The ***undeveloped*** nature of park wilderness will also continue as reduction activities under the preferred alternative are not expected to result in temporary or permanent roads, fences or other structures, or aircraft landing sites. Elk reduction activities in South Unit wilderness involving firearm and/or aircraft use are not expected to occur seven days a week even during the peak season of reduction activity. Moreover, a large expanse of wilderness exists in the North Unit is available year round, providing park visitors ***outstanding opportunities for solitude and primitive and unconfined recreation***. Therefore, reducing and maintaining the elk population at proposed levels would have long-term beneficial effects on wilderness character.

Other unique components that reflect the character of park wilderness

Heritage and Cultural Resources – Elk are an historic component of the North Dakota landscape and highly valued by state residents and American Indian groups. Reduction of elk numbers to acceptable levels will positively benefit numerous people through donation of elk meat and hides and will not result in their loss from park habitats. There could also be a benefit in that firearm reduction could minimize the liklihood that elk in the park will become habituated to visitor presence, assuring highly valued photographic opportunities for “wild” elk in addition to decreasing the potential for future elk-human conflict.

Maintaining Contrast and Traditional Skills - Elk reduction actions would not leave any permanent markings which would present a contrast to the surrounding area. The presence of volunteers and park staff engaged in reduction activities may create a temporary contrast, but this would be short term and would not have permanent impacts to the wilderness.

Special Provisions - None identified

Economic and Time Constraints – Oversight, logistics, and coordination of a volunteer-based program are substantial and will result in increased elk reduction costs, particularly during the initial reduction phase when a large number of elk must be removed. Retrieval of elk carcasses from wilderness sites is expected to be an extremely challenging aspect of program management due to limited transportation options, steep terrain, adverse weather, inadequate physical conditioning of some volunteers, and relative remoteness of park wilderness. Carcass removal via backpack would require relatively modest capital expenditures but unquestionably is the least efficient method. Depending upon location and weather, team members hauling elk quarters could spend an entire day transporting a single elk to the storage facility. Supplementing or replacing the backpack method, a second approach utilizes dedicated carcass extraction crews (with mules and/or pack horses) that could dramatically improve reduction team efficiency by allowing team members to focus on locating and shooting elk rather than packing elk. Extraction crews would increase program costs further (at least in the short term) but would result in increased program efficiency (# elk removed/day), a reduction in the time required to reach management objectives, and a corresponding decrease to wilderness resource impacts and values.

Additional Wilderness-specific Comparison Criteria – None identified

Safety of Visitors, Personnel, and Contractors - Risk to humans, animals and plants cannot and should not be removed from wilderness as this concept reaches the core of what defines wilderness. However, it is appropriate to mitigate some risks to humans, particularly those that are introduced to the wilderness lanscape by man himself. Human-introduced risk and safety issues associated with this alternative includes aircraft use and the use of firearms by volunteers and park staff during reduction actions.

Reduction activities involving firearm use would likely occur during the late fall and early winter to overlap the state sponsored hunting season outside the park. Late fall and winter reduction activities will minimize impacts to visitors within the park as annual visitation is lowest from Novermber through March, with only a small portion of those expected to visit wilderness sites. The NPS will monitor wilderness visitation to the extent possible and determine if safety concerns warrant temporary closure of specific areas of the park during elk management activities. The public would be appropriately notified of these closures.

Inherent risk to aircraft pilots and passengers conducting low elevation, annual population surveys and (potentially) herding/driving flights will occur under this alternative. Reduction teams will be subjected to walking over muddy and/or loose soil and steep terrain, deep snow, and sub zero temperatures. Additionally, team members could be expected to carry approximately 60-75 lbs of elk meat via backpack. Use of footware and clothing appropriate to weather conditions and adherence to safety protocols can mitigate, but not eliminate, identified many safety concerns. Physical exertion, fatigue, and other safety issues associated with backpacking heavy loads under field conditions may be lessoned through the use of (professional) carcasss extraction teams. Reduction teams and other staff will be required to follow work safety procedures for management actions when developed.

Safety Criterion

If safety issues override impacts to wilderness character or other criteria, provide documentation that the use of motorized equipment or other prohibited uses is necessary because to do otherwise would cause increased risks to workers or visitors that cannot be satisfactorily mitigated through training, use of personal protective equipment (PPE), or other requirements to alleviate the safety risk. (This documentation can take the form of agency accident-rate data tracking occurrences and severity; a project-specific job hazard analysis; research literature; or other specific agency guidelines.)

Documentation: Not applicable

Step 2 Decision: What is the Minimum Activity?

Please refer to the accompanying MRDG *Instructions* before describing the selected alternative and describing the rationale for selection.

Selected alternative: Preferred Alternative: Combination of Techniques

Rationale for selecting this alternative (including documentation of safety criterion, if appropriate):

This alternative allows the National Park Service to meet management objectives with the minimum use of motorized equipment. Overall, this alternative reduces to a great degree impacts on opportunities for solitude and visitor recreation within wilderness. Following the close of the public comment period on the draft EIS followed by a second comment period on the agency's preferred/environmentally preferred alternative, comments were compiled and distributed internally for review. An interdisciplinary team, including senior park and NPS managers, considered the public comments with respect to cost efficiency, how effectively the alternatives would meet the stated objectives of the plan, and the environmental benefits and adverse impacts for each alternative. Collectively, these factors were evaluated to arrive at the park's preferred alternative, which consists of a suite of techniques contained in alternatives B (direct reduction with firearms by federal employees and skilled volunteers), C (roundup and euthanasia), and D (roundup and translocation). Methods and techniques under these alternatives would be used for both an initial herd reduction phase and a maintenance phase under the preferred alternative.

Monitoring and reporting requirements:

Given acceptable weather conditions, the elk population within the park will be estimated via fixed wing aircraft annually should reduction goals utilizing firearms (exclusively) be deemed inadequate, the use of helicopters to herd and drive elk through wilderness could occur. Regardless of aircraft used, landing within wilderness is NOT anticipated.

In keeping with past practice, NPS data regarding reduction success and elk movements will continue to be shared with North Dakota Game and Fish staff and the US Forest Service. Bull and cow elk have, and will continue to be, outfitted with collars that permit location data to be collected several times daily. Similarly, each reduction team would be outfitted with a GPS datalogger that would track the movements of the team while in the field. Integrating these monitoring efforts could greatly increase the efficiency of the reduction effort, and provide the NPS with an objective basis for modifying protocols (adaptive management) and determining factors contributing to program success or failure (response of elk to teams, effort of teams. etc.).

Vegetation monitoring within wilderness is important to address several management issues and would occur on a subset of established monitoring plots each year between spring and late summer. Initiating a sound monitoring program within wilderness is currently being considered and could provide insight into reduction impacts in addition to potential mitigation measures. Vegetation plots are not discernable to the park visitor or employee and monitoring is quick and non-invasive.

Check any Wilderness Act Section 4(c) uses approved in this alternative:

- ☐ mechanical transport
- ☐ motorized equipment
- ☐ motor vehicles
- ☐ motorboats
- ☐ landing of aircraft
- ☐ temporary road
- ☐ structure or installation

Record and report any authorizations of Wilderness Act Section 4(c) uses according to agency procedures.

APPROVALS

Recommended:

Tom Cox — 2-28-10
Chief Ranger — Date
Theodore Roosevelt National Park

[signature] — 2-28-2010
Chief of Resource Management — Date
Theodore Roosevelt National Park

Approved:

Valerie J. Naylor — 2-28-2010
Superintendent — Date
Theodore Roosevelt National Park

ATTACHMENT 1

THEODORE ROOSEVELT NATIONAL PARK

RECOMMENDATIONS FOR MANAGEMENT OF ELK AT THEODORE ROOSEVELT NATIONAL PARK

ELK MANAGEMENT PLAN/ENVIRONMENTAL IMPACT STATEMENT, THEODORE ROOSEVELT NATIONAL PARK (THRO), NORTH DAKOTA

FINAL RECOMMENDATIONS OF THE SCIENTIFIC ADVISORY TEAM, 30 AUGUST 2007

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EXECUTIVE SUMMARY

In this document, the Science Team provides recommendations for park managers to consider relative to management goals for elk in the South Unit of Theodore Roosevelt National Park. Specifically, we provide background information and recommendations on the following topics related to elk and vegetation management at the park: 1) considerations for population estimation and determining population objectives; 2) recommended maximum population size; 3) recommended minimum population size (considering genetics and population viability); 4) implications for management of population dynamics; and 5) our recommendations for monitoring to determine the success of management strategies.

As the park progressed through the early stages of the Environmental Impact Statement (EIS) process (internal and public scoping, development of alternatives, etc.), it became readily apparent to the Science Team that there were several reoccurring science-related questions and concerns frequently raised by NPS staff, cooperating agencies, and the general public. For that reason, we developed very specific "white papers" to address those reoccurring issues, and have attached them as appendices to this document. These papers serve(d) several critical functions, and in particular: 1) they serve as repository for our collective conclusions; 2) they provided a mechanism for a review and collective approval by the Science Team; 3) they provide an administrative record of our conclusions; and 4) they are the foundation for our recommendations. In an additional appendix we present park managers with various treatment scenarios to consider relative to their management goals for this elk population.

Briefly, the Science Team recommends that Theodore Roosevelt National Park continues to manage its ungulates at or below historical population levels. Given the unpredictable nature of precipitation in this region (hence forage production) and uncertainty inherent in the estimation of population size, forage production, and effects of herbivory on park vegetation, we believe that this conservative approach will continue to protect the range from overuse, and ensure that plant communities in the park continues to contribute to the diversity of the broader regional landscape. If ungulate populations are maintained at levels greater than historical objectives, then impacts of elk and other herbivores on plant communities should be the primary concern for park managers, and thus, extensive monitoring of vegetation will be critical. If on the other hand, ungulate populations are maintained at or below historical levels, as recommended by the Science Team, then monitoring of the ungulate population should become the primary concern.

TABLE OF CONTENTS

POPULATION OBJECTIVES AND POPULATION ESTIMATION

Population estimates for elk at THRO require aerial surveys; however, a proportion of elk are not seen during surveys. Estimates must thus be based on numbers of elk seen and on correction factors that compensate for uncertainties in elk detection. Because correction factors are estimates and proportions of elk seen during surveys are random variables, overestimates and underestimates of population size are inevitable. As a result, impacts of population manipulations cannot be predicted with certainty *a priori*. The following hypothetical example helps to illustrate that point:

Consider a post-removal population target of 200 elk and a pre-removal population estimate of 1,000 ± 250 elk. Assume the population estimate is based on the observation of 500 elk and an estimated detection rate of 50%. Removing 800 elk would result in a projected population size of 200 ± 250 elk. In such a case, the treatment could jeopardize the future of the elk population, and yet could not predictably be expected to reduce the population below the maximum desired population level.

For reasons that are evident from the preceding example, the Science Team has reached 3 conclusions:

1) Expressing population goals in terms of minimum numbers, rather than estimated numbers, would reduce the risk that uncertainty accompanying population estimates will lead to greater-than-desired reductions. Detection rates for elk surveys can be taken into account when minimum numbers are specified.
2) If the population is surveyed at least once annually so population estimates can be updated and projections can be calibrated, the risk of failing to accomplish population objectives will be greatly reduced.
3) Refining estimates of detection rates could substantially reduce uncertainty regarding elk numbers and management decisions.

MAXIMUM POPULATION SIZE AND CONSIDERATIONS FOR PREVENTING UNDESIRABLE IMPACTS TO PLANT COMMUNITIES

Plant communities exist in a state of dynamic equilibrium characterized by natural fluctuations in composition, which can be caused by such factors as grazing, drought, or fire acting singly and in combination. When influences on community composition change—for example, when the intensity of grazing or frequency of fire increases—communities can be driven from one state to another.

Transitions from late-successional states to earlier states can occur very rapidly, especially when disturbance factors interact: in contrast, restoration to desired conditions may require sweeping changes in management and a much longer period of time because of the need to accommodate the range of natural variation in environmental conditions typical of the region. Consequently, monitoring that includes both an evaluation of current ecological condition (seral stage) and trend, indicating the direction of change from a desired future condition (DFC), are extremely important. Unfortunately, the park does not have a current vegetation management plan for the park from which to identify DFCs for park vegetation. Given the rate at which the elk population in the park is growing, and the undesirable consequences it will have for plant communities in the park, the Science Team recommends that the park should not delay active management of the elk population until a vegetation plan is completed.

If we consider the park's management of elk and other ungulates since elk were reintroduced in 1985, and our conclusion that there has been no overt degradation of the range when managed at historical levels, we believe it is reasonable to conclude that past management has succeeded in achieving the objective of protecting vegetation from overuse. We acknowledge that although more or less ungulates (i.e., elk, bison, and feral horses) might have been maintained in the park during any given year—depending on precipitation and subsequent forage production—the conservative science-based approach adopted by the park was a responsible strategy for maintaining long-term health of the plant community, and viability of ungulate populations.

Therefore, after extensive discussion (Appendix B; Principles of Ecological Modeling with Implications for Elk Management at Theodore Roosevelt National Park), the Science Team concurred with the use of the forage allocation model developed by Westfall et al. (1993) to establish an upper population limit of approximately 400 elk. This limit, however, should not be misconstrued as a population objective. The Science Team does not anticipate adverse consequences for park vegetation or other wildlife if considerations other than forage production and effects of elk on plant succession lead to population objectives substantially below the upper limit. Science Team perspectives on relations between this upper limit and management objectives are summarized in Appendix C (The Concept of Carrying Capacity: Implications for Elk Management at Theodore Roosevelt National Park, North Dakota).

MINIMUM POPULATION SIZE

POPULATION VIABILITY

Elk at THRO have demonstrated rates of reproduction and survival that are among the highest recorded for any population (Sargeant and Oehler 2007). As a result, the Science Team believes the population could be reduced to <100 individuals without substantial risk to population persistence. The greatest risk to population viability at low numbers would likely result from uncertainty inherent in population estimates, which could lead to errors in the implementation of management prescriptions. Using minimum elk numbers, rather than population estimates, to track population status could help alleviate this risk.

POPULATION GENETICS

Although elk are presently abundant and widely distributed in North America, the species was extirpated from much of its historic range by 1900. Most restored populations, including the population at THRO, originated with stock that can ultimately be traced to Yellowstone National Park. Indeed, Hicks et al. (2007) recently reported that the genetic diversity of elk at THRO does not differ significantly from that of the Yellowstone population. Because elk derived from the same parent population are distributed throughout North America and some metapopulations number in the tens-of-thousands, the Science Team does not believe the THRO population contributes in a meaningful way to the conservation of genetic material.

The Science Team also considered the potential for deleterious effects resulting from inbreeding, but concluded that risks are minimal because the THRO population is not genetically isolated from other populations in the region. For example, tag returns from hunter-killed elk and movement records for elk marked with radio collars have documented the exchange of individuals from THRO with metapopulations inhabiting the Killdeer Mountains of North Dakota and Missouri Breaks of Montana. Moreover, the Science Team expects regional elk populations to gradually expand in numbers and distribution, leading to more frequent contacts with elk from THRO, as land management priorities and public tolerance evolve.

Hicks, J. F, J. L. Rachlow, O. E. Rhodes, Jr., C. L. Williams, and L. P. Waits. 2007. Reintroduction and genetic structure: Rocky Mountain elk in Yellowstone and the western states. Journal of Mammalogy 88(1): 129-138.

IMPLICATIONS OF MANAGEMENT FOR POPULATION DYNAMICS

Regardless of the method used, effects of elk management are manifested through changes in survival and recruitment. The Science Team used a deterministic population model to: 1) gain insights about potential consequences of changes in survival and recruitment rates; and 2) evaluate and refine preliminary conclusions reached via discussions. Simulations and Science Team conclusions are summarized in Appendix D.

MONITORING

A monitoring plan essentially describes a set course of action to observe and document how a management action is affecting a particular resource. The information gained through monitoring allows decision-makers to better understand whether or not the federal actions chosen provide the route best suited to mitigate any and all negative effects on the environment. Code of Federal Regulations section 1505.2 requires that after an EIS is finished pursuant with NEPA, a Record of Decision (ROD) must “state whether all practicable means to avoid or minimize environmental harm from the alternative selected have been adopted, and if not, why they were not. A monitoring and enforcement program shall be adopted and summarized where applicable for any mitigation.” Therefore a monitoring plan must be developed as part of the NEPA process.

Further, under Section (1500.2)(c), agencies are required to “integrate the requirements of NEPA with other planning and environmental review procedures required by law or by agency practice so that all such procedures run concurrently rather than consecutively” (NEPA Overview and NPS Mandates pg 78). With this statute in mind, the Department of the Interior (DOI) also requires the National Park Service (NPS) to include “adaptive management” as an agency function. Adaptive management is a systematic approach for improving resource management by learning from management outcomes (Adaptive Management Guide pg. 1). This learning is based on taking an action, monitoring the effects of that action, and allowing the information gained in monitoring to inform subsequent management decisions and make adjustments as needed. The achievements and failures of certain actions in the management plan cannot be properly evaluated if the resources being managed are not monitored. Further, “an adaptive approach involves exploring alternative ways to meet management objectives” and “monitoring to learn about the impacts of management actions”, which essentially describes how NEPA is to be implemented at the practical level (Adaptive Management pg 1).

Also, a monitoring plan would help ensure compliance with the National Parks Omnibus Management Act of 1998 (NPOMA). Under Section 201, NPOMA states, “the purpose of this title…” is “to ensure appropriate documentation of resource conditions in the National Park System”. Monitoring for the Elk Management Plan would provide a useful tool for documentation of resource conditions. With the high level of variability in the affects of adjusting/managing the elk population on the grassland habitat, a monitoring plan is necessary to ensure proper management.

In the instance of the Elk Management Plan at Theodore Roosevelt National Park, a monitoring plan would not only benefit the park goals, but it provides the information necessary to meet the requirements of adaptive management and NEPA. It would supply data to ensure the chosen plan develops, meets expectations, and whether the plan needs adjustment or should continue as implemented.

Recognizing the previous requirements of NEPA and other NPS policies for monitoring, the Science Team envisioned two possible monitoring strategies that could be implemented by the park, depending on their final decision. First, if it is decided that ungulate populations should be maintained at levels greater than historical objectives, then the impacts of elk and other herbivores on plant communities should be the primary concern for park managers, and thus, extensive monitoring of vegetation would be critical. If on the other hand, ungulate populations are maintained at or below historical levels, as recommended by the Science Team, then monitoring of the ungulate populations becomes the primary concern, and extensive monitoring of vegetation at these conservative numbers would not be necessary.

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Westfall, J. A. Jr., L. R. Irby, and J. E. Norland. 1993. A forage allocation model for four ungulate species in Theodore Roosevelt National Park. Montana State University, Bozeman, Montana, USA.

APPENDIX A - JUSTIFICATION FOR PARK-BASED MANAGEMENT GOALS

The prevailing legal authority and guidance for management of natural resources on National Park Service lands is the National Park Service Organic Act of 1916. The Organic Act states that the NPS:

> *"shall promote and regulate the use of the Federal areas known as national parks, monuments, and reservations hereinafter specified… by such means and measures as conform to the fundamental purpose of the said parks, monuments, and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."*

The "fundamental purpose" for a park is typically codified in the park's enabling legislation. Theodore Roosevelt National Memorial Park was established in 1947 as a memorial to its namesake. However, the legislation does not call for management of conditions present at the time of Roosevelt's residence at the site nor does the legislation prescribe other detailed management goals. Therefore, in the absence of clear guidance in the Organic Act or the park's enabling legislation, the next level of natural resource guidance for the park is the National Park Service Management Policies (National Park Service 2000).

NPS Management Policies state that parks will manage their lands for "natural conditions" (unless otherwise directed by enabling legislation or statute). Natural conditions are defined by the policies as "*the condition of resources that would occur in the absence of human dominance over the landscape*" (4.0).

The policies further state that the NPS:

> *"will try to maintain all the components and processes of naturally evolving park ecosystems, including the natural abundance, diversity, and genetic and ecological integrity of the plant and animal species native to those ecosystems. Just as all components of a natural system will be recognized as important, natural change will also be recognized as an integral part of the functioning of natural systems"* (4.1).

NPS policies do not dictate what the natural conditions are for a specific park unit, but rather, leave it up for the individual parks to determine. The policies do recognize that complete restoration of "natural conditions" may be unattainable and that human intervention may be necessary under certain circumstances (4.1). Parks are directed to prepare long-range management strategies that clearly identify the "desired future conditions" for a park using the "best available science" (4.1.1.).

NPS Management Policies also acknowledge that park units are parts of much larger ecosystems, and that parks can contribute to the conservation of regional biodiversity. Conversely, many parks cannot meet their natural resource preservation goals without the assistance and collaboration of neighboring landowners and resources. Therefore, the NPS Management Policies state that the agency:

> *"will pursue opportunities to improve natural resource management within parks and across administrative boundaries by cooperating with public agencies, appropriate Native American representatives, and private landowners. The Service recognizes that cooperation with other land managers can accomplish ecosystem stability and other resource management objectives … Such cooperation also may involve … providing essential habitats adjacent to, or across, park boundaries."* (4.1.4)

Using an ecosystem or landscape perspective is also consistent with the spirit and intent of the National Environmental Policy Act and with conservation biology principles and concepts. Collaboration allows for the conservation of resources that would otherwise not be possible.

Lower level guidance documents such as Director's Orders and NPS handbooks can sometimes expound or clarify on the Management Policies and statutes. However, there is no lower level guidance that clearly and directly instructs Theodore Roosevelt NP as to how to address the issue of elk overabundance and population targets. Existing park-developed management plans such as the General Management Plan, the Resource Management Plan, and other plans are also lacking in regards to specific guidance for management of elk at the park.

Therefore, it is incumbent on this EIS to develop detailed management goals and objectives that are consistent with the guidance and bounds set by the NPS Management Policies and other authorities. The emphasis of such goals shall be on the conservation of natural conditions and processes in the park while at the same time taking an ecosystem perspective.

Although empirical data are lacking, it is fairly well accepted by the scientific community that the pre-Columbian Great Plains was a temporally and spatially dynamic mosaic of grassland seral stages, a consequence of fire, grazing, weather, soil, and other factors (Collins and Glenn 1995, Knapp et al. 1999, Fuhlendorf and Engle 2001). This conclusion is based on the reports and journals of early explorers, on ecological theory and models, and on existing natural areas. Therefore, managing Theodore Roosevelt NP for a spatially and temporally dynamic system with a diversity of habitat types would be consistent with NPS policies. As long as the park was conserving a mosaic of grassland stages it could be generally inferred that it was conserving most or all of the native species and processes associated with the site.

The National Grasslands surrounding the park are currently managed for livestock grazing among other uses. The Forest Service has identified seral stage (specifically, for “grass and grass like life forms, as well as sagebrush”) as a means to meet compositional and structural vegetation objectives (USDA Forest Service 2002). Although monitoring of seral stage has been problematic and contentious, workable models have been developed (see Benkobi and Uresk 1996). The Forest Service defines seral stage as “the sequence of a plant community’s successional stages to potential natural vegetation” (USDA Forest Service 2002). The majority of the Forest Service lands are currently in early to mid-seral stages (likely the result of livestock grazing), with comparatively little in late seral stages. To better conserve biological diversity, the Forest Service has recently established the following seral stage goals for lands near Theodore Roosevelt National Park (USDA Forest Service 2002):

Early	Mid	Late
10-15%	65-75%	15-20%

Samson et al. (2003) recommended that the Little Missouri National Grasslands maintain 29-46% in “high” structural categories, analogous to late seral stages. They stated that species of conservation concern in the Northern Great Plains could most efficiently be conserved by “emphasizing low- and high-seral habitats.”

Since most rangelands in western North Dakota are generally heavily grazed it behooves the NPS to manage their lands for a lightly grazed condition. Some might argue that lightly grazed or ungrazed lands are not “natural” in the Northern Great Plains; however, Kay (1998) suggested that much of the Great Plains was lightly grazed, due in large part to the harvest of ungulates by aboriginal people. We acknowledge that providing specific recommendations for seral conditions is outside the scope of the current Science Team; however, we do recommend that the park maintain its efforts to develop a protocol for measuring and monitoring seral condition of selected grassland communities. This information will greatly facilitate the development and implementation of a vegetation management plan in the future, which in turn will help guide ungulate management.

We believe that once the park develops a protocol for monitoring of seral condition, and determines the status and trends of selected communities, managers will be better able to consider the park in a regional context with other adjacent lands, and to better evaluate its contributions to biodiversity, and evaluate efficacy of its management actions relative to DFCs identified by a vegetation management plan. The Science Team contends that various DFCs could be achieved by utilizing a scientifically established culling program of ungulates, by implementing an ambitious prescribed fire program, and by conducting a rigorous and timely vegetation monitoring program that feeds back into management decisions. However, we acknowledge that seral stage goals established for the park in the future may be less precise than those set by the Forest Service for the neighboring Grassland. Whereas the latter agency can set more specific targets because their land management program, which includes fenced pastures, tightly controlled stocking rates managed via a permit system, and the use of artificial water sources and supplemental feeding, the NPS generally limits management intervention to those actions that mimic natural processes. For those reasons, if it is ultimately determined that future seral stage objectives are not the desired targets, or that they are not achievable, or it cannot be determined that they are being achieved, we recommend that the park re-evaluate its vegetation objectives.

In summary, some of the advantages/justification for monitoring seral stage include:

- Seral stage can be reasonably linked to the NPS policies of conserving natural conditions and processes.
- Ecological heterogeneity at multiple scales, including diversity of seral stages, is the ultimate source of biodiversity and is the basis for ecosystem resilience.
- Seral stage measurements and sampling protocols can be information rich (they are typically comprised of floral species composition, relative abundance, and structural measurements).
- Seral stage is widely recognized as a critical component of ecosystems and therefore is monitored in some form by many entities including land management agencies near the park.
- Conservation of seral stages allows park management to best contribute to the conservation of regional biological diversity.

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APPENDIX B - PRINCIPLES OF ECOLOGICAL MODELING WITH IMPLICATIONS FOR ELK MANAGEMENT AT THEODORE ROOSEVELT NATIONAL PARK

PROBLEM STATEMENT

The forage allocation model developed by Westfall et al. (1993) has been central to discussions of population management objectives for elk at Theodore Roosevelt National Park. Discussions of that model have highlighted several common misconceptions about models and the role of modeling in wildlife management. Because it is likely that decisions about elk management will be based in part on the Westfall et al. (1993) model projections, decision makers must be well-informed about relevant aspects of the utility and limitations of ecological models. In this document, we review principles underlying the construction and use of ecological models, with an emphasis on issues with implications for elk management at Theodore Roosevelt National Park. We conclude by discussing an evaluation of the Westfall et al. (1993) model conducted by Irby et al. (2002) in the context of the modeling concepts we present.

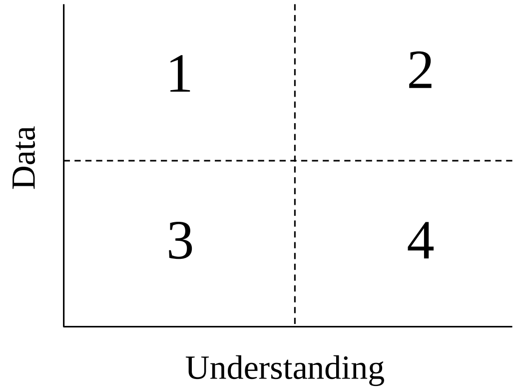
PRINCIPLES OF ECOLOGICAL MODELING

What is an Ecological Model?

Models are often perceived to be complex and mysterious. However, models are actually nothing more than abstract descriptions of systems or processes (Starfield and Bleloch 1986:1). In other words, a model is a formal framework for organizing and synthesizing existing knowledge of an ecological system. Model output is conditional on model structure, parameterization, underlying assumptions, and data quality. Consequently, models facilitate insights and decision-making, but do not produce new information.

The Principle of Parsimony

In wildlife management we often build models with limited data and an incomplete understanding of the system. A useful presentation of modeling was presented by Holling (1978) and is illustrated in the following figure.



In Hollings classification diagram, the x-axis represents understanding of a system (from limited to complete) and the y-axis (from incomplete to adequate) represents the quality and quantity of data that are available for use in model-building (Figure 1). Ecological models typically are based on limited data and incomplete understanding of systems, and thus fall in region 3 (Starfield and Bleloch 1991). Because of uncertainty surrounding our knowledge of the system and limited data, the use of complex models may not improve one's understanding of a system. Occam's razor is a logical guiding principle in ecological modeling: the simplest model that is consistent with existing knowledge is likely to be most appropriate and is most likely to produce reliable insights. Models should be no more complex than necessary to capture the key features of the system.

Uses of Models

In the context of resource management, a "good" model is one that promotes a better decision than could be made without it (Starfield 1997, Johnson 2001). Consequently, models may be very useful tools for decision-making even when they are based on imperfect data and incomplete understanding. The very process of model building helps us evaluate the relative importance of various influences on a system and identify data that should be collected.

Models can serve a number of useful purposes that Johnson (2001) assigned to the following categories: explanation, prediction, and decision-making.

- *Explanatory models* are used to describe or decipher the workings of systems.

- *Predictive models* are used to forecast future states of systems or results of management actions.

- *Decision support models* are used to identify management strategies that will produce desired results.

A given model may be used for more than one purpose. For example, models of elk population dynamics at Theodore Roosevelt National Park are being used to 1) investigate the relative importance of various population processes and 2) predict future elk numbers. The forage allocation model that Westfall et al. (1993) developed for Theodore Roosevelt National Park is a decision-making model that allows managers to estimate numbers of ungulates that will result in various levels of forage utilization. As a result, the Westfall et al. (1993) model allows managers to evaluate trade-offs with resource management objectives.

Characteristics of Ineffective Models

As frameworks for the organization and synthesis of existing information, "all models are wrong, but some are useful" (Box 1979). Ineffective or unreliable models maintain the following characteristics (Starfield 1997):

- Explicit accounting for processes that are not well understood.
- Explicit accounting for processes that are not relevant.
- Dependence on parameters that cannot be estimated precisely.
- Dependence on too many parameters (uncertainty is compounded).

Using Models Developed from Other Systems

Models are developed to meet specific objectives and are influenced by available data, knowledge of the system, and assumptions. Although many models are structurally similar (e.g., matrix models for demographic analyses), many models are uniquely suited for specific regions and applications.

When applying a model developed for another region and purpose, several important assumptions must be made. For example, you must assume that specified relationships are appropriate and relevant to your system, and that parameters in the model can be estimated precisely. Moreover, the model must have been developed for the same intended purpose. For these reasons, applying models from one system to another should be done judiciously.

USE OF THE WESTFALL MODEL FOR ELK MANAGEMENT AT THEODORE ROOSEVELT NP

Review of the Westfall et al. (1993) model by Irby et al. (2002)

Irby et al. (2002) evaluated a forage allocation model developed by Westfall et al. (1993) for Theodore Roosevelt National Park. Here we summarize their key findings.

- Maintenance of ungulates near optimal numbers identified in the model was associated with minimal negative changes in plant communities they monitored over a 12-15 year period. Some categories expected to decline under over-use, increased (e.g., climax graminoids). Some variables expected to decline under moderate, sustainable grazing did decline (e.g., bare ground).

- The model was not generally sensitive to low precipitation or to animal numbers close to maxima. Changes in vegetation that they interpreted as probable if animal numbers exceeded estimated carrying capacity under high or low precipitation conditions did not occur consistently.

- The model results were not overly sensitive to unpredictable events. During their monitoring period, portions of the Park burned (not portions with sample sites, however), two multi-year droughts occurred, prairie dog towns increased by > 100% reducing forage available for ungulates in some preferred habitat types (and destroying three sampling sites), and land impacted by leafy spurge increased from 280 to 730 hectares.

- The model optima were not developed based on the most sensitive plant species or communities. Their subjective observations as they walked to their monitoring sites indicated ungulates were using plant species and/or communities that were not captured by their model.

- When all attributes they measured were considered, the Westfall et al. (1993) model produced conservative estimates of maximum sustainable numbers for elk, mule deer, bison, and horses. At the same time, it did not predict that overuse would occur where animals were concentrated.

- The model was useful as a tool for planning future monitoring; it allowed managers to assess the feasibility of some ungulate population scenarios proposed by the public (more of everything) without risking plant community health.

The limitations of the Westfall et al. (1993) model discussed by Irby et al. (2002) are not uncommon or unique in ecological modeling. Because model output is conditional on model structure, parameterization, underlying assumptions, and data quality we should not expect any model to predict unpredictable events not considered in the model (#3 above). Moreover, the Westfall et al. (1993) model was parsimonious; it was no more complex than necessary to capture the *key* features of the system. Therefore, one should not expect the model to detect all subtle changes in vegetation (#1, #2, and #4 above). The model was built without complete understanding of the system; therefore, some estimates and features of the model might provide imperfect estimates for all features of the system (#1 and #5 above). Despite these inherent drawbacks of modeling, the Westfall et al. (1993) model was useful and maintained properties of a "good" model (#6 above); the model improved the management decision process. In other words, as with all models, there were drawbacks, but the Westfall et al. (1993) model proved extremely useful to managers at Theodore Roosevelt National Park.

Use of Other Models

With regard to elk management at Theodore Roosevelt National Park, it has been suggested that use of other forage models might help facilitate management decisions. In considering the utility of other models, the applicability of a model must be evaluated in terms of modeling objectives, the appropriateness of assumed relationships in the model, and the relevancy of those relationships.

Several modeling attempts to estimate carrying capacity or forage allocation of herbivores are available in the published literature (e.g., Hobbs and Swift 1985, Hanley and Rogers 1989) and some have been used in the Environmental Impact Statement process. For example, the model used by Grand Teton National Park is described on the internet as “supporting the development of the environmental impact statement for the National Elk Refuge in Jackson, Wyoming.” The Grand Teton model is parsimonious and maintains a similar accounting type approach used by Westfall et al. (1993) to assess the number of ungulates that might be supported at 50% forage utilization (NREL 2005). It also considers how snow accumulation modifies the accessibility of forage. However, the Grand Teton model might be too simplistic given available data for elk in Theodore Roosevelt National Park. Data are available that would support use of a more sophisticated model. For example, the Grand Teton model does not consider plant species separately in ungulate diets: more detailed information is available for Theodore Roosevelt National Park and should not be ignored.

Other models to estimate carrying capacity of herbivores might be overly complicated for elk management objectives at Theodore Roosevelt National Park. The model of Hanley and Rogers (1989) considers nutritional constraints and restrictions in biomass consumption, which may or not be appropriate for elk at Theodore Roosevelt National Park. For example, the Hanley and Rogers (1989) model assumes that no one plant species may comprise more than 40% of the total dietary biomass and that only biomass greater than 25 kilograms per hectare is available for consumption. Their approach considers the availability of specific plants, but assumes that foraging dynamics will be largely dictated by nutritional constraints. The validity of these assumptions remains untested for elk at THRO. Therefore, use of a nutritional constraints model might unnecessarily include irrelevant parameters and assumptions.

Recommended Use of the Westfall et al. (1993) Model

As related to elk management at Theodore Roosevelt National Park, the forage allocation model by Westfall et al. (1993) represents the best available tool to establish the initial maximum elk population size for the following reasons:

- *The model was developed for Theodore Roosevelt National Park.* Consequently, specified relationships are appropriate and relevant to the system. The model appropriately considers forage species separately at Theodore Roosevelt National Park and forage selection (based on diet analyses conducted at the park) by elk and other ungulates.

- *The model is parsimonious*. The model considers only those parameters that are relevant. There is not an over reliance on parameters that cannot be estimated precisely. Instead, the Westfall et al. (1993) model captures the key features of forage allocation for elk and other ungulates at Theodore Roosevelt National Park. The use of more complex models would not necessarily improve our understanding of forage allocation at Theodore Roosevelt National Park.

- *The model promotes better management decisions than could be made without it*. Despite the difficulty in modeling complex systems, the Westfall et al. (1993) model is useful in making management personnel aware of the biological constraints they face when making management decisions (Irby et al. 2002). The model also provides a formal framework for organizing and synthesizing existing knowledge of Theodore Roosevelt National Park. It also allows for managers to consider appropriate trade-offs when implementing various management strategies.

Conclusions

For reasons discussed above, the Science Team views the Westfall et al. (1993) model as the best-available resource for the setting the maximum population limit of approximately 400 elk at Theodore Roosevelt National Park; however, this limit should not be viewed as the default population objective. Indeed, depending on other resource goals and objectives, the park may choose to manage below this limit. Moreover, the Science Team does not view model refinement as a necessary step in effective application of the model at the park. Furthermore, the model should not be used to establish new population objectives on a regular basis. Instead, after implementation of a management action, the effects of the treatment are directly observable through monitoring of the appropriate resource**.**

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APPENDIX C - THE CONCEPT OF CARRYING CAPACITY: IMPLICATIONS FOR ELK MANAGEMENT AT THEODORE ROOSEVELT NATIONAL PARK, NORTH DAKOTA

PROBLEM STATEMENT

The concept of carrying capacity is central to the topic of herbivore population regulation. However, inconsistent interpretations and terminology led MacNab (1985) to remark that "rarely in the field of resource management has a term been so frequently misused to the confusion of so many." That confusion is evident in disparate definitions implied by the use of terminology in discussions of elk management at Theodore Roosevelt National Park.

WHAT IS "CARRYING CAPACITY?"

Use of the term "carrying capacity," especially in the popular lexicon, often implies management objectives extrinsic to herbivores themselves. For example, plant associations have finite capacities for forage production. This constraint limits the number of herbivores a landscape can sustain over the short term. Over the long term, the removal of plant material by herbivores can influence plant succession and the landscape capacity for forage production. Consequently, carrying capacity is often defined with respect to the number of herbivores that can be sustained over the long term without incurring undesirable effects on plant communities. This range-management perspective can readily be generalized to other management objectives. For example, a species might be managed at a level consistent with public tolerance, or social carrying capacity.

In contrast, carrying capacity has also been defined with respect to demographic processes of animals. When forage is limited, herbivores may experience an increase in mortality rates or a decrease in birth rates. Consequently, the number of individuals added to the population annually (the annual increment) may decline at a progressively increasing rate as numbers grow. Ultimately, density-dependent changes in growth rates imply regulation of the population at a level where the average annual increment is equal to zero. In principle, this equilibrium population level represents demographic carrying capacity.

These disparate definitions have profoundly different implications for elk management at Theodore Roosevelt National Park. They describe different population levels, with dramatically different implications for park resources other than elk. To prevent further confusion, we will dispense with the term "carrying capacity" and instead discuss the implications of management strategies that are commonly associated with these definitions: "natural regulation" and "objective-driven" models for elk management. We conclude with a review of issues with ramifications for the selection of population objectives: these include the uncertainty associated with estimates of sustainable use, implications of population objectives for risk management, and implications of management objectives and strategies for animal welfare.

NATURAL REGULATION OF ELK NUMBERS

"Natural" regulation sometimes connotes regulation, mediated by nutritional restriction, at demographic carrying capacity. However, a clearer understanding of natural regulation requires the consideration of population processes and population states.

Historically, densities of native ungulates on the northern plains were spatially and temporally variable (Bailey 1926, Roe 1970, Hart 2001). Population processes were subject to the influences of aboriginal hunting and predation as well as nutrition, and animal movement profoundly influenced local herbivore densities (Laliberte and Ripple 2003). Modern-day circumstances at Theodore Roosevelt National Park are much different. The park is situated in a matrix of public and private lands managed for livestock ranching, mineral extraction, and agriculture, which likely contribute to disproportionate use of the park by elk. Elk are no longer subject to the influence of aboriginal hunting. Recruitment rates and survival rates are among the highest observed in elk and predation has not been documented (Sargeant and Oehler 2007).

Past experience supports informed speculation about the likely consequences for elk, vegetation, and other wildlife of Theodore Roosevelt National Park. Ungulate populations relieved of limitation by nutrition, predation, or hunting typically undergo an irruptive sequence that was described by Caughley (1970). In a stereotypical case, numbers increase rapidly and exceed the range capacity for sustainable use. Persistent effects of herbivory on plant communities lead to resource limitation, causing a marked population decline.

Most newly established elk populations exhibit high initial rates of population growth consistent with the irruptive sequence Caughley described (Murphy 1963, Burris and McKnight 1973, Gogan and Barrett 1987, McCorquodale et al. 1988, Eberhardt et al. 1996). Few examples exist, however, of elk populations that have experienced stereotypical population declines. Even the examples cited by Caughley (Banfield 1949) were precipitated by periodic severe winters, not by persistent changes in the plant community *per se*, and were succeeded by periods of population growth.

Elk are generalists with flexible dietary requirements (Cook 2002). Consequently, elk inhabiting relatively mild environments may be able to defer the demographic consequences of nutritional restriction by broadening diets. This flexibility exacerbates effects on vegetation by enabling elk to reach very high densities before nutritional restriction leads to a significant decline in survival or recruitment rates. In Missouri, for example, captive elk that reached a density of 0.043 ha^{-1} (11 mi^{-2}) were removed to alleviate "very heavy" utilization of available forage. Tule elk at Pt. Reyes National Seashore nevertheless sustained a high rate of increase (r = 0.19) at densities ranging from 0.733 ha^{-1} (190 mi^{-2}) to 1.043 ha^{-1} (270 mi^{-2}) (Howell 2002).

Elk populations may also continue to grow, and densities may remain high indefinitely, if such influences as range expansion, emigration, or hunting prevent nutritional restriction from occurring. For example, elk colonized the Fitzner-Eberhardt Arid Lands Ecology Reserve (ALE), which encompasses ca. 330 km^2 of arid shrubsteppe in south-central Washington, in 1972 (Rickard et al. 1977). Although the ALE remained the focus of elk activity, numbers of elk using adjacent lands increased with population size (Washington Department of Wildlife 2000). Rapid population growth continued until elk numbers (≥838 in 1999) were reduced by hunting and live removals in 2000 (McCorquodale et al. 1988, Eberhardt et al. 1996, Washington Department of Wildlife 2000). Hunting removals in 2000 were facilitated by a range fire that destroyed much of the forage within ALE.

Based on the preceding examples, we believe elk densities will continue to increase rapidly in the short term and remain high indefinitely if the NPS does not regulate elk numbers at Theodore Roosevelt National Park. Through effects on forage availability and plant succession, high elk densities are likely to have repercussions for the welfare of bison and feral horses, which are confined to the park by a boundary fence. Population processes, elk densities, and the state of vegetation resulting from a "hands-off" approach to elk management will not be analogous to historical manifestations of "natural regulation."

OBJECTIVE-DRIVEN ELK MANAGEMENT

The elk population at Theodore Roosevelt National Park originated in 1985 with the translocation of 47 animals from Wind Cave National Park. In 1993, in response to rapidly increasing elk numbers, the National Park Service agreed to "periodically reduce the [elk] herd when numbers exceeded carrying capacity." Elk were subsequently captured and translocated from the park to reduce numbers when population estimates exceeded 360 animals.

This population objective was derived from a model developed by Westfall et al. (1993) and was intended to prevent undesirable effects on park vegetation. Clearly, the Service envisioned a "carrying capacity" driven by objectives for the management of park resources other than elk, and not by demographic responses of the elk themselves. Although vital rates of elk can be measured and related to elk densities relatively easily (given time and an adequately broad range of observed elk densities), they are not a suitable metric for measuring the effects of elk on other park resources. For example, demographic responses of elk may not precede undesirable consequences for park vegetation or other wildlife.

Although population objectives for elk at Theodore Roosevelt National Park have been based on a forage allocation model in the past, population objectives can be based on considerations other than the condition of vegetation. For example, elk population objectives have implications for visitor experiences, elk depredations, and the number of elk subjected to management actions.

POPULATION OBJECTIVES

In discussions of objective-driven elk management, the Scientific Advisory Team has identified 3 key considerations for the development of population objectives. These include uncertainty accompanying estimates of sustainable use, management of risks associated with various population objectives, and the implications of population objectives and management prescriptions for animal welfare.

Estimating sustainable use

Translating management objectives into population objectives is the principal challenge of objective-driven ungulate management. Difficulties associated with the estimation of sustainable use are seldom fully appreciated. However, predictions are difficult even for comparatively simple systems. For example, considerable uncertainty exists regarding numbers of cattle that should be sustained on the National Grasslands outside Theodore Roosevelt National Park (Report of the Scientific Review Team, Dakota Prairie Grasslands, 2005).

Sustainable use is much more difficult to predict for wild herbivores than for cattle, and will be especially difficult to predict precisely for Theodore Roosevelt National Park. In general, difficulties result because plant associations do not respond immediately to herbivory, forage production is subject to considerable environmental variation, short-term natural variation in the density of large herbivores is typically modest, and achievable sample sizes (replicate applications of grazing treatments) for studies of large herbivores are typically small. Additional complications will arise at Theodore Roosevelt National Park because 1) the herbivore community includes not only elk, but also bison, feral horses, prairie dogs, and a number of other species with diverse and flexible dietary requirements; 2) numbers of wild herbivores will vary annually and will not be known with certainty; 3) the landscape is complex and heterogeneous, the plant community is diverse, and the distribution of herbivore activity is uneven; and 4) annual environmental variation (e.g., in rainfall, hence forage production) is substantial.

Risk management

Pervasive use of the term “carrying capacity” is unfortunate because it introduces the anthropocentric ideal of managing for the maximum level of production consistent with some external goal. From a more objective point of view, managing a highly variable system at the margin of acceptable limits that are not known precisely poses a substantial risk of failure. Managers should therefore weigh the consequences of failure before choosing to manage for maximum production. Ranchers, for example, mitigate the risk of failure by monitoring range conditions continually and removing cattle or providing supplemental feed as needed to ameliorate emerging problems. In contrast, bison, feral horses, elk, and other free-ranging herbivores are not as tractable as cattle. Manipulating free-ranging populations on short notice may not be feasible.

Animal welfare

Implications of managing for maximum sustainable population size are paradoxical. If a population is to be reduced, a gradual, minimal reduction might seem desirable from an animal welfare standpoint. However, this strategy also maximizes animal production over the long term, hence the number of animals that must ultimately be treated to reduce and maintain the population at a desired level. This result occurs because the annual increment produced by a population well below demographic carrying capacity is proportional to population size. Over the long term, the strategy that reduces the population to the minimum acceptable level, as rapidly as possible, will minimize the number of animals treated or removed.

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APPENDIX D - SUMMARY OF SCIENCE TEAM DISCUSSIONS AND SIMULATIONS OF ELK POPULATION DYNAMICS

Sargeant and Oehler (2007) developed and parameterized a parsimonious density-independent deterministic model that described growth of the THRO elk population from 1987-2005. The Science Team used that model to explore the possible consequences of management prescriptions that could increase mortality rates or reduce fecundity. This document summarizes results of those simulations and conclusions that have been reached by the Science Team in discussions to date. The simulations summarized in this document have been reviewed only by members of the Science Team. Our objectives in conducting simulations were to gain insights about implications of vital rates and logistic constraints for population sizes and treatment intervals that might result under various management scenarios.

METHODS

The Science Team noted that it is possible to imagine an endless variety of management scenarios based on various tools that have been discussed (e.g., translocation, shooting, fertility control) and various treatment schedules. However, effects of various methods are all manifested through increased mortality or reduced fecundity. Simulations can thus provide general insights that transcend differences between management tools. The Science Team conceived and implemented a series of scenarios that were analogous to potential management strategies in some respects, but which can be viewed more generally as attempts to achieve a balance of 5 objectives by manipulating survival and/or fecundity of a model population:

1. Rapidly reduce elk numbers to <400.
2. Minimize the number of animals treated.
3. Minimize the frequency of treatments.
4. Minimize the maximum number of animals treated.
5. Sustain a population that includes approximately 100 cows, calves, and associated yearling bulls.

This list of objectives reflects the recommendations/suggestions made by the Science Team through various documents, as well as other concerns that have been expressed during Science Team discussions. Those included potential impacts of high elk numbers on park vegetation and other wildlife (1), animal welfare (2), logistic constraints associated with implementation (3 & 4), and persistence of the elk population (5).

Scenarios simulated by the Science Team included the following:

Scenario A-1 Survival rates of cows, calves, and associated yearling bulls temporarily reduced by 50% whenever the simulated population size exceeded 400.

Scenario A-2 Survival rates reduced by 63% for cows, calves, associated subadult bulls, and adult bulls during the first year; thereafter, survival rates reduced by 50% for cows, calves, and associated yearling bulls whenever the simulated population size exceeded 400.

Scenario B-1 Pregnancy rates reduced by 75%.

Scenario B-2 Pregnancy rates reduced by 90%.

Scenario C Survival rates reduced by 63% for cows, calves, associated subadult bulls and adult bulls during the first year; thereafter, survival rates reduced by 50% for cows, calves, and associated yearling bulls whenever the simulated population size exceeded 400 individuals. Pregnancy rates temporarily reduced by 50% whenever the simulated population size exceeded 400.

Scenario D Scenario A-1 implemented for initial population sizes ranging from 1000 to 1800.

Scenario E Similar to Scenario A-1 but with survival rates reduced by 10-50%.

Scenario F Annual survival rates reduced by 25% for cows only.

Scenario G Exponential population growth at rates of 20-30% annually.

We considered the following results and reported the most relevant comparisons:

1. Number of years required to achieve a population objective of <400 elk
2. Largest single annual removal
3. Total number of elk removed
4. Number of elk treated but not removed
5. Minimum numbers of cows, calves, and subadult bulls observed
6. Bull:cow ratios (included subadult and adult males)
7. Sex ratios (included all males)

The following features were common to all simulations:

- We specified a starting population size of 1000 and an initial population composition of 14% juvenile females, 11% subadult females, 38% adult females, 14% juvenile males, 11% subadult males, and 11% adult males. This composition was derived from a working draft of the projected herd composition for 2005 (Sargeant and Oehler 2007).

- Social groups of elk captured by the NPS in 1993 and 2000 included 0.66 subadult male per subadult female (n = 161 subadults). We thus assigned 66% of subadult males to social groups that consisted primarily of cows and calves (cow/calf groups). This issue plays a role in the feasibility of managing sex ratios because subadult males associated with cow/calf groups can be readily captured.

- In practice, some elk are overlooked during surveys used to plan management actions. We incorporated a "detection rate" of 0.75 and used it to compute numbers of elk observed in cow/calf groups. Our detection rate was based on estimated detection rates for elk surveys conducted at THRO in 2001 and 2004, but should be considered approximate.

- Unless otherwise specified, we treated sex and age classes in proportion to their representation in groups of cows, calves, and associated subadult bulls.

- Model projections represented counts obtained in January, prior to treatment. Treatments preceded reproduction.

- We used cause-specific mortality rates that did not include deaths due to hunting (i.e., mortalities due to hunting would have counted as removals in our simulations).

RESULTS AND DISCUSSION

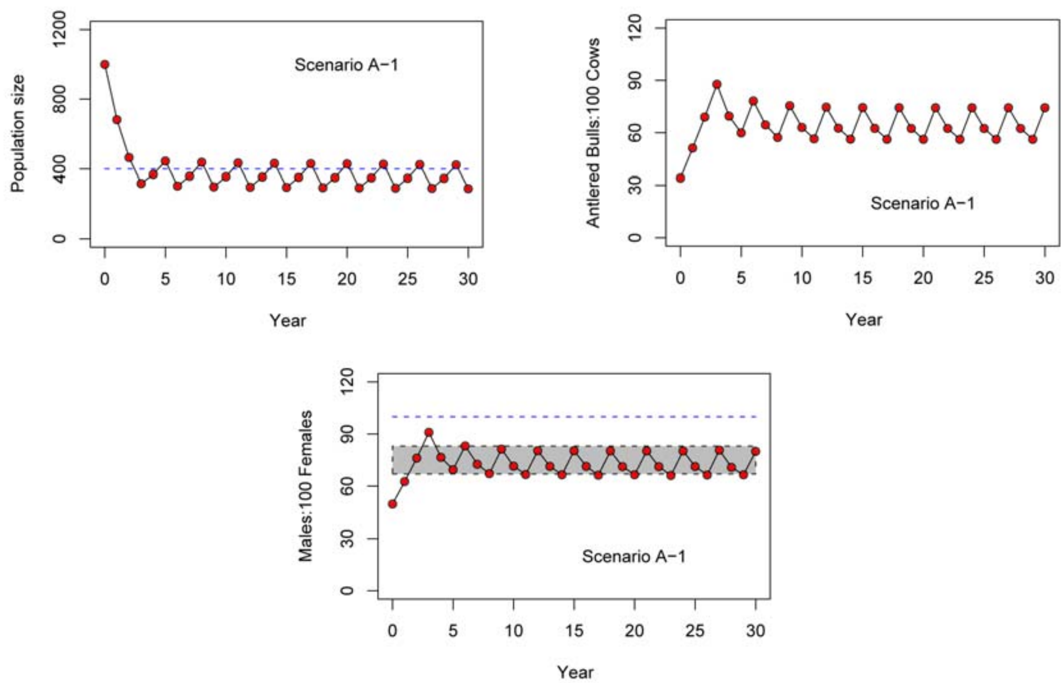
Scenario A-1: 50% reduction in survival

Scenario A-1 was analogous to removing cows, calves, and associated subadult males when elk numbers approached or exceeded 400. Scenario A-1 reduced our model elk population from 1000 in year 1 to 316 in year 4 by removing 860 elk. Thereafter, <200 elk were removed every third year. The minimum number of cows, calves, and associated yearling bulls observed annually was $\geq$84.

Because Scenario A-1 did not reduce survival rates for adult males, bull:cow ratios increased abruptly from 45:100 in year 1 to 100:100 in year 4. Despite high bull:cow ratios, sex ratios did not exceed parity. After elk numbers declined to <400, comparatively high mortality rates of bulls caused bull:cow ratios to decline and range from approximately 55:100 to 75:100.

Consequences of Scenario A depended on the composition (i.e., a representative sample of cows, calves and associated subadult bulls) but not the method of removal.

Figure A-1. Projected population sizes, bull:cow ratios, and sex ratios for Scenario A-1. In the plot of sex ratios, the dashed blue line corresponds with a population size of 400. In the plot of sex ratios, the dashed blue line indicates parity and the shaded region delineates a range of 67-83 males per 100 females.



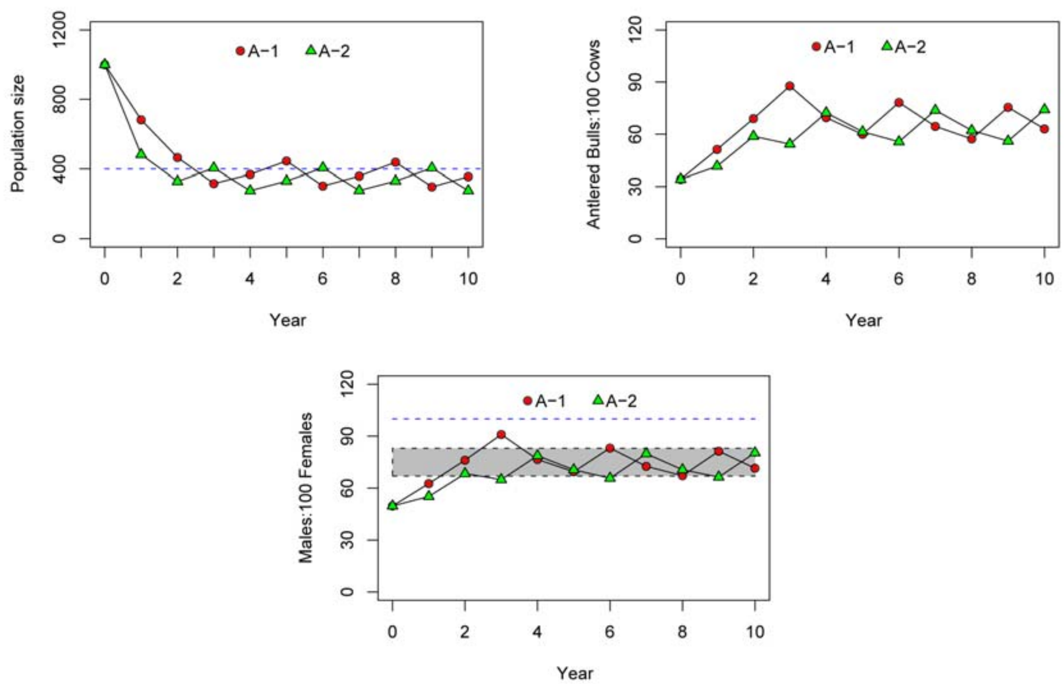
Scenario A-2: 63% reduction in survival

The Science Team noted that the number of cows, calves, and yearling bulls remaining after the first-year reduction in Scenario A-1 (213) could have been reduced further without jeopardizing population persistence. The Science Team also noted that reducing survival rates of adult bulls during the first year could have moderated the initial increase in bull:cow ratios observed under Scenario A-1. Scenario A-2 implemented these changes.

Scenario A-2 reduced elk numbers to <400 within 2 years (1 year less than for Scenario A-1) by removing 734 elk. Bull:cow ratios peaked at 83:100 in year 4. Sex ratios also peaked in year 4 at 87m:100f. These ratios are relatively high: for example, Bubenik reported that elk herds should have 67-83 males per 100 females (Raedeke et al. 2002). Opportunities to observe very high bull:cow ratios have been limited and consequences, if any, are uncertain.

Management prescriptions implemented in Scenario A-1 and A-2 were identical after year 1 and would have produced identical results, given the same starting values for the maintenance phase.

Figure A-2. Comparisons of projected population sizes, bull:cow ratios, and sex ratios for Scenarios A-1 and A-2. In the plot of sex ratios, the dashed blue line corresponds with a population size of 400. In the plot of sex ratios, the dashed blue line indicates parity and the shaded region delineates a range of 67-83 males per 100 females.



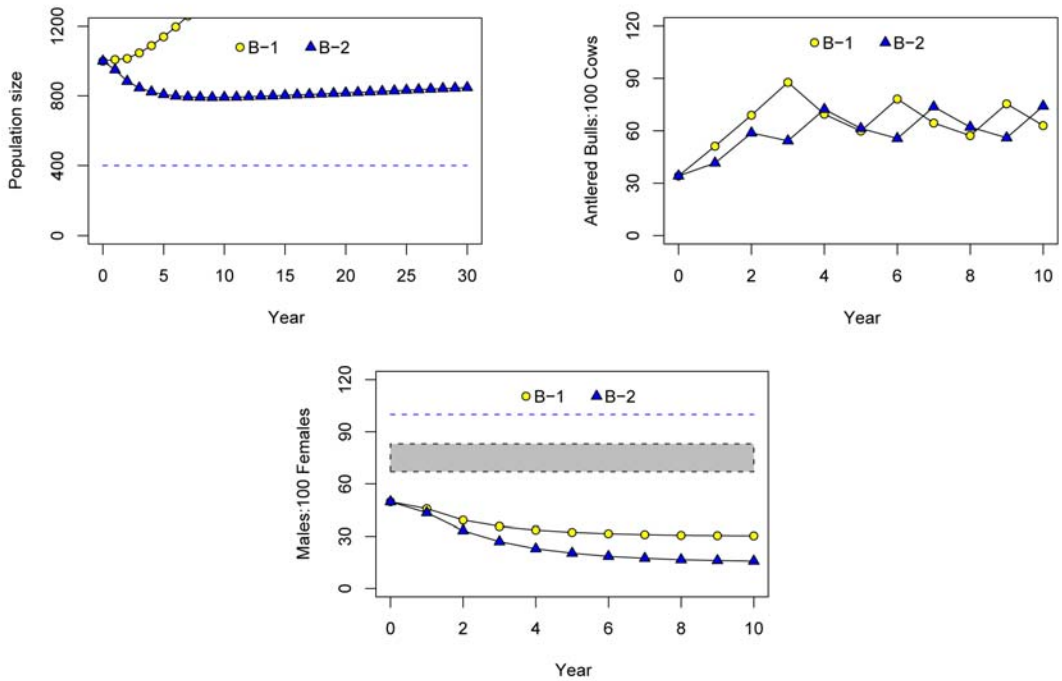
Scenarios B-1 and B-2: pregnancy rates reduced by 50 and 75%

Scenarios B-1 and B-2 were analogous to administering a contragestive (an agent that causes abortion) to pregnant female elk on an annual basis. Administering a contraceptive (an agent that prevents pregnancy) to an equal number of elk after parturition would have a lesser effect on population growth rates.

Terminating 75% of pregnancies annually led to a brief suspension of population growth. However, that result reflected a decline in the representation of adult males, which was caused by reduced recruitment acting in concert with higher mortality rates of males. Population growth resumed at a rate of 6.5% annually after bull:cow ratios and sex ratios declined.

Terminating 90% of pregnancies annually caused an initial reduction that resulted from declining sex ratios, but ultimately resulted in very slow population growth at a rate of 1.5% annually.

Figure B-1/2. Projected population sizes, bull:cow ratios, and sex ratios for Scenarios B-1 and B-2. In the plot of population sizes, the dashed blue line corresponds with a population size of 400. In the plot of sex ratios, the dashed blue line indicates untreated parity and the shaded region delineates a range of 67-83 males per 100 females.

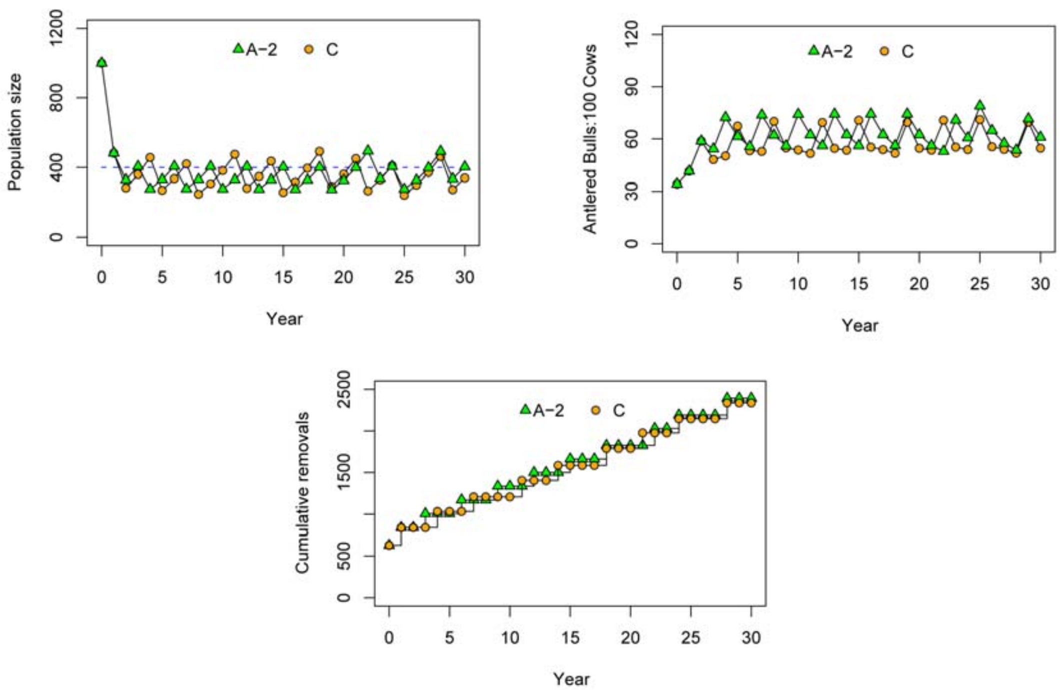


Scenario C: variable reduction in survival combined with 50% reduction in pregnancy rates

Scenario C was analogous to removing elk as described for Scenario A-2, then terminating pregnancies for 50% of remaining cows (i.e., 75% of cow elk were removed or treated). Treatment intervals, bull:cow ratios, and total numbers of elk removed for Scenario C were similar to results for Scenario A-2.

The Science Team expects that untreated animals would likely become progressively more difficult to locate, identify, and treat or capture as they dwindle in number; more so because an uncertain number of elk would be distributed across a large area typified by rugged terrain and patches of dense vegetation, and because elk may leave the park to evade capture. These considerations were the basis for capping the number of elk affected at75% for this scenario.

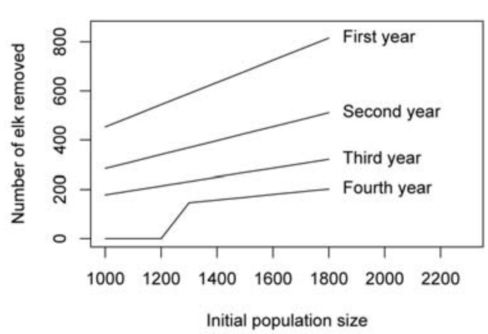
Figure C. Projected population sizes, bull:cow ratios, and cumulative numbers of elk removed for Scenarios A-2 and C. In the plot of population sizes, the dashed blue line corresponds with a population size of 400.



Scenario D: A1 with different initial population size

The Science Team implemented Scenario D to illustrate consequences of varying starting population sizes. Under the prescription implemented in Scenario A-1, the number of elk removed the first year was proportional to population size. Variable initial population sizes had a progressively smaller effect on numbers of elk removed annually after the first removal.

Figure D. Numbers of elk removed during the first, second, and third years of Scenario A-2 for initial population sizes ranging from 1000 to 1800.



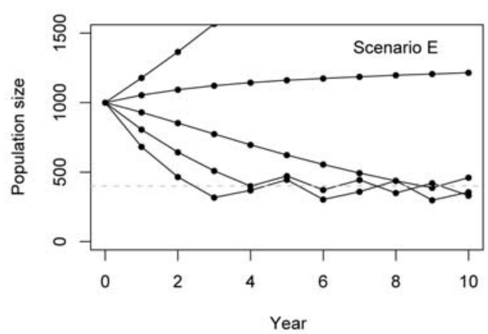
Scenario E: reduction in survival from 10 to 50%

In practice, logistic constraints might limit the maximum number of elk, hence the proportion of elk that could feasibly be removed in 1 year. For example, it might be feasible to remove 60% of 500 elk but only 30% of 1000 elk. In addition, uncertainty associated with estimates of elk numbers could cause the proportion of elk removed to vary substantially from expectations. For example, a manager attempting a 50% reduction might remove 200 elk from an estimated population of 400: however, the population might actually number 500 elk, resulting in an achieved reduction of 40%.

Scenario E emphasizes the sensitivity of population trajectories to proportions of animals removed. In other words, a modest change in the proportion of animals removed for management could have a substantial effect on the rate of population decline, hence the magnitude, duration, and frequency of population reductions.

Such sensitivity dramatically limits the ability of managers to predict the consequences of management actions that must be planned without access to perfect knowledge (e.g., based on population estimates rather than known elk numbers).

Figure E. Projected elk numbers for projections with survival reduced by 10% (top line) to 50% (bottom line) for cows, calves, and associated subadult bulls when elk numbers exceeded 400.



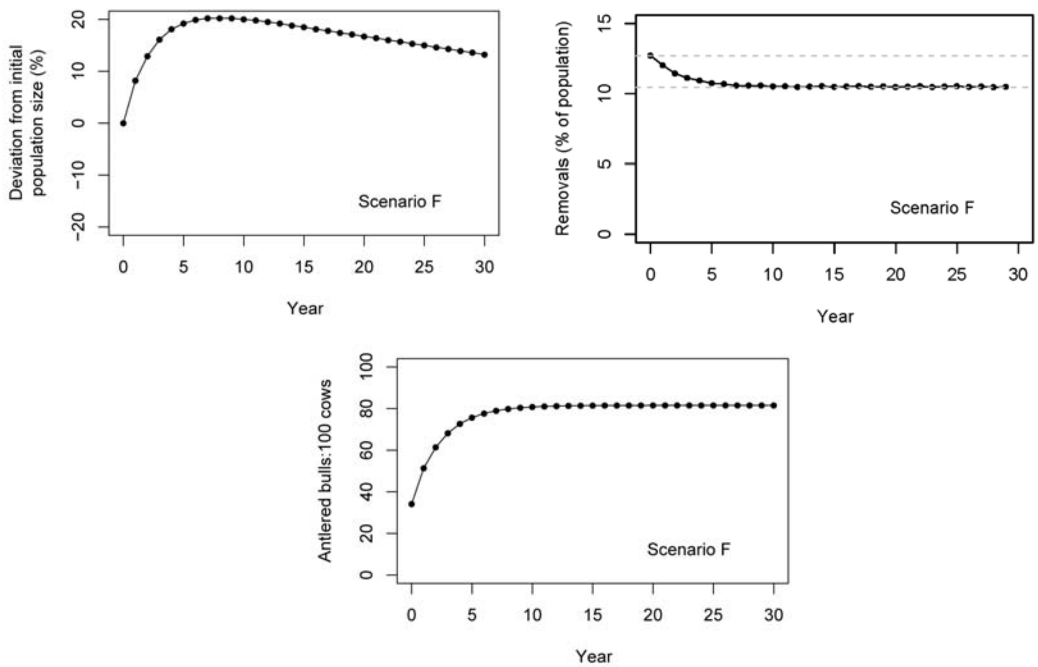
Scenario F: survival reduced to 25% for cows only

Scenario F was analogous to removing 25% of cow elk annually (10-12% of the simulated elk population) to stabilize elk numbers. Reducing survival rates of cow elk resulted in a temporary population increase (reflecting an increase in the representation of males), followed by a gradual decline.

Scenario F permitted a larger minimum population size (up to 400) than strategies that imposed population fluctuations. Total numbers of elk removed were a function of population size and could be either greater than or substantially less than for maintenance phases of scenarios that imposed population fluctuations (i.e., A-1 and A-2).

The initial growth and high bull:cow ratios observed under this strategy could have been mitigated by including calves in removals. In practice, preferential harvesting of males by hunters outside the park would also moderate changes in sex ratios that would result from preferential removals of females.

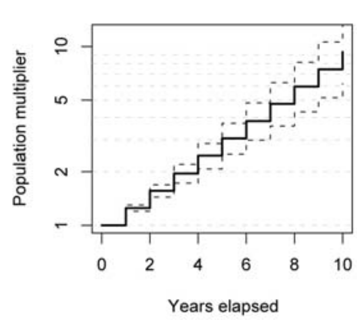
Figure F. Projected deviations of elk numbers from initial population size, proportions of population removed annually, and bull:cow ratios for Scenario F.



Scenario G; exponential population growth (20-30% annually)

For comparative purposes, the Science Team plotted exponential population growth at 20% (lower dashed line), 25% (solid center line), and 30% (upper dashed line) annually over a period of 10 years. Results represent population sizes as multiples of initial population size. For example, a population growing at 25% annually would double in approximately 3 years and triple in approximately 5 years. This result may be useful to the EIS team as they discuss strategies that vary with respect to the frequency or magnitude of treatments.

Fig. E. Exponential population growth at rates of 20% (bottom red dashed line), 25% (solid line), and 30% (top red dashed line). Population size (y axis) is presented as a multiple of initial population size for time spans of 0 to 10 years.



MANAGEMENT IMPLICATIONS

Model projections produced by the Science Team should be interpreted with caution and an awareness of limitations inherent in the use of models for prediction. Some of these have been addressed elsewhere in the Science Team white paper on ecological modeling. Others are addressed here.

Projections were based on a deterministic model that very accurately described growth of the THRO elk population from 1987-2005. However, a deterministic model developed to describe a particular realization of population growth cannot be expected to predict future population growth with equal accuracy because data used to construct models are subject to sampling variation, parameters themselves are subject to environmental influences (e.g., higher elk densities), and realizations of population growth are subject to demographic stochasticity.

In addition, real management prescriptions are not implemented with perfect knowledge. In our simulations, vital rates were manipulated exactly as prescribed and manipulations were triggered by actual population sizes. In contrast, management decisions will be guided by population estimates that will be subject to sampling variation and bias. Logistic constraints may also affect the implementation of prescriptions.

For these reasons, the Science Team viewed simulation as a learning tool, of greatest value for comparing the consequences of manipulating some factors while holding others constant. We used discussion and results of simulations to reach general conclusions about population dynamics. We have not prescribed or endorsed any management strategy: rather, we have tried to gain insights about the potential consequences of various strategies. Our conclusions include the following:

1. To succeed, management strategies must provide the flexibility and information needed to adapt prescriptions on an annual basis and thus compensate for such factors as environmental variation, consequences of uncertainty in the estimation of demographic parameters, logistic difficulties, and unforeseen events. Minimum information needs will include reliable population estimates.

2. In simulations, the Science Team was able to reduce and regulate elk numbers by removing animals when numbers exceeded population objectives (Scenarios A-1 and A-2).

    a. Simulations did not specify a method of removal or even require that removals be conducted by the NPS. For example, elk removed by hunting outside the park would have been counted among removals in simulations.

b. The number of animals handled annually during the reduction phase of simulated removals was approximately proportional to population size.

c. For fixed rates of removal, numbers of elk removed during the first year of reduction were proportional to initial population sizes. Initial population sizes had a lesser impact on numbers of elk removed in subsequent years (Scenario D).

d. Durations of reduction phases and treatment intervals during maintenance phases were quite sensitive to the removal rate (see Scenario E).

e. During maintenance phases, numbers of elk removed were similar to numbers removed from THRO by the NPS in 1993 and 2000 (Scenarios A-1 and A-2).

3. In simulations, the Science Team was able to reduce elk numbers initially and then prevent population growth by removing a relatively small proportion of the population each year (Scenario F).

    a. Science Team simulations did not specify a method of removal or even require that removals be conducted by the NPS. For example, elk removed by hunting outside the park would have been counted among removals in simulations.

    b. Simulated annual removals permitted a relatively large minimum population size and substantially reduced the maximum number of elk removed in a single year.

    c. The total number of elk removed depended on the population objective specified by the Science Team. For the same minimum population size, removals were less for this strategy than for periodic removals (Scenarios A-1 and A-2).

    d. Relatively large minimum population sizes pose less risk to population persistence and help to preserve genetic diversity.

    e. In practice, risks of substantial error (i.e., large departures from objectives) are likely to be least for relatively large population sizes and relatively modest manipulations.

4. Population estimates are subject to substantial sampling error. Resulting uncertainty raises the possibility that an overestimate of population size could lead to a larger population reduction than desired. After considering high rates of recruitment and survival that have been observed at THRO, the Science Team has concluded that the population could be reduced to approximately 100

cows, calves, and associated sub-adult bulls (and possibly further) without jeopardizing population persistence.

5. The Science Team could not accomplish timely reductions in the size of simulated populations by reducing pregnancy rates 75-90%.

6. Reducing pregnancy rates reduced the total number of elk removed to reduce and regulate simulated elk numbers (Scenario C). However, relatively large numbers of elk had to be treated to achieve relatively small reductions in numbers of removals.

7. In practice, decreased recruitment would cause the average age of adult female elk to increase. Mortality rates would increase as a result. We did not incorporate this behavior in Scenarios B-1, B-2, or C because we used a model that was developed without age-specific estimates of survival rates for very old elk. However, elk are long-lived and our simulated population was dominated by young animals. Consequently, we would expect effects of changing age structure to be manifested gradually and would not expect them to substantially change the nature of our results in the short term.

8. Fertility control in ungulates is an area of active research. Improvements in effectiveness or administration may warrant reconsideration of this management tool.

9. The Science Team noted that large-scale manipulations of ungulate populations may have unforeseeable consequences (e.g., disturbance associated with manipulations could result in emigration).

10. The model used by the Science Team shows promise for improving the precision of population estimates and for short-term (3-4 year) management planning. An extended version of the model, incorporating stochastic processes and uncertainty, would likely be a valuable tool for risk assessment. However, additional data collection will be required to assure the continued relevance of parameter estimates based on historic data. Key parameters include pregnancy rates (estimable from blood samples, rectal palpation, or necropsies), survival rates for adult females (estimable via mark-recapture or radio telemetry), and calf survival rates (estimable from age ratios, pregnancy rates, and adult survival rates).

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APPENDIX E - PRINCIPLES OF SERAL STAGE CLASSIFICATION AND MONITORING

PART I. BASIC PRINCIPLES

Numerous vegetation studies have been conducted in Theodore Roosevelt National Park and the adjacent Forest Service lands over the last 40 or so years. These studies include phytosociological classification of the major vegetation types and autecological evaluation of selected species. The vast majority of these studies were conducted prior to the introduction of elk in the Park in 1985 (Nelson 1961, Sanford 1970, Hladek 1971, Williams 1976, Aipperspach 1980, Hansen et al. 1980, Wali et al. 1980, Mastel 1982, Butler and Goetz 1984, Girard 1985, Hirsch 1985, Butler et al. 1986). Several of these studies used the Park as a reference for non-grazed or lightly grazed conditions (see Butler and Goetz 1984 for example). More recently, the vegetation of the Park was classified and digitally mapped following the procedures outlined by the National Vegetation Classification System (NVCS) as part of the National Vegetation Mapping Program (Von Loh et al. 2000). For this effort, detailed sampling plots were subjectively placed in vegetation that was representative of an area, relatively homogenous for that particular vegetation type, and covered more than 0.5 ha (the minimum mapping unit). The vegetation type was then hierarchically classified based upon the NVCS (www.natureserve.org). Although descriptions of plant alliances and associations (the two finest level of the NVCS) included discussions on select aspects of disturbance drivers and ecological conditions, no attempt was made during the classification and mapping process to assign seral stages to individual sample plots. Consequently, quantitative data on seral stage classification (ecological condition) is very limited for the Park.

Fluctuations in community composition can be caused by grazing, drought, fire or absence of fire acting singly and in combination. Such fluctuations are within the range of natural variation and are often used to define the dynamic equilibrium boundaries or state for a particular plant community (Herrick et al. 2000, USDA-NRCS 2003). Resistance and resilience are important community level characteristics of a state. Resistance describes the ability of the community to absorb disturbances and not change appreciably while resilience describes the ability of the community to endure disturbances and return its original condition once the disturbance is removed. However, plant communities are often subjected to disturbances outside the range of natural range of variation, which alters the ecological condition of the community and transitions it into another relatively stable state. Frequent and intensive grazing or droughts greater than historic levels can drive the community across the dynamic equilibrium threshold into a new state. Heavy grazing combined with a severe drought can greatly accelerate the transition process. Intensive inputs are often necessary to return a community to its original state. Consequently, monitoring that includes both an evaluation of current ecological condition (seral stage) and trend, indicating the direction of change, are extremely important.

A single, universally accepted method of assessing ecological condition through seral stage classification and evaluating trend in a heterogeneous landscape such as Theodore

Roosevelt National Park is not readily available. However, the classical approach to such questions usually involves identifying which specific abiotic and biotic factors at small spatial and temporal scales contribute the most to large scale patterns. In the process, the relevant community level attributes that may influence patterns and processes are identified and explored, and, when appropriate, extrapolated to scales suitable for long-term, sustainable management.

PART II: GOALS

1. Provide a preliminary evaluation of the ecological condition through seral stage classification and determine trend of select plant communities at the stand level using a combination of biological and edaphic characteristics.
2. Provide a mechanism for identifying areas that are potentially at risk of degradation (accelerated soil erosion, rapid shifts in plant composition, increase in non-native plants, especially invasives).
3. Help select monitoring sites as part of an overall landscape level monitoring program.
4. Provide a mechanism to communicate basic ecological concepts to a wide audience.

The approach is not designed to identify the cause(s) of any changes in the plant community at the stand level (see # 2 above). Achieving those goals will require more detailed analysis over relatively long periods of time.

PART III: GENERAL APPROACH

Seral Stage Classification

Plant associations suggested for possible evaluation include the Needle-and-Thread / Threadleaf Sedge Herbaceous Vegetation (STCO/CAFI) and the Western Wheatgrass – Green Needlegrass Herbaceous Vegetation (PASM/NAVI). The two associations respectively account for 51% and 8% of the total vegetated land area of the South Unit (Von Loh 2000). Both associations are characterized by major species that respond differentially to drought and grazing by large ungulates.

Needle-and-thread, western wheatgrass, and blue grama are the principal diagnostic species for the STCO/CAFI association. Green needlegrass, western wheatgrass, buffalo grass (or blue grama) are used to assess the PASM/NAVI association. Each species differs in their respective ability to tolerate or avoid grazing that conveys a relative degree of grazing resistance. Grazing tolerance consists of mechanisms that facilitate regrowth following grazing while grazing avoidance include those plant characteristics that reduce the probability and severity of grazing. Avoidance includes low growth form, spines or hairs on the plant, or secondary chemical compounds that reduce palatability. Plants that are more grazing resistant tend to increase in abundance and frequency under heavy grazing pressure (increasers) while plants that lack such characteristics tend to decrease (decreasers). Shifts in the relative contribution of increaser/decreaser species within the association can be used as assessment of change in the ecological condition, usually described by a successional sere, of a particular site

(Uresk 1990). Furthermore, similarity indices that compare current composition to historic climax condition are also valuable in concurrently assessing the ecological condition of a site (USDA-NRCS 2003).

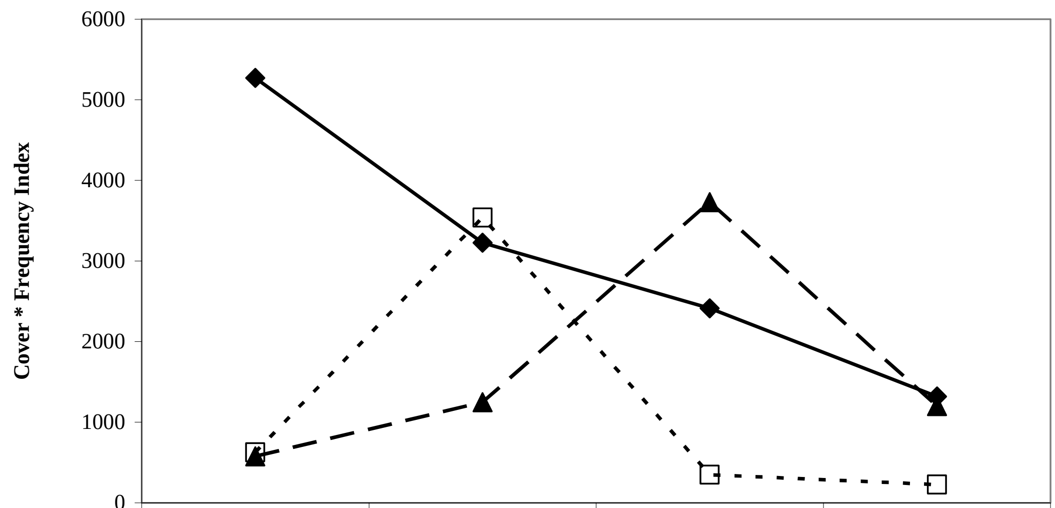
The general technique is as follows:

1. Establish 2 parallel permanent 30 meter transects 20 meters apart in an area of at least 800 square meters. Location of transects will be stratified according to elk location data (heavy, moderate, light, and no use). Specific site selection within each level of use will be conducted randomly.

2. Record canopy cover, using 6 cover classes, for the 3 major indicators species for each association within a 20 X 50 cm quadrat placed at 1 m intervals along each transect. Cover classes will also be assigned to litter, bare ground, and non-native plants.

3. The midpoint of each cover class will used to calculate average foliar cover for the 3 species for each transect. Multiply average cover and percent frequency for each transect, and average the two transects to produce an index value. The index value will be located within seral stage probability tables for that association to determine seral stage (see figure below).

General Seral Stage Classification Model
Needle-and-Thread Ecological Site



	Late	Late Intermediate	Early Intermediate	Early
Needle and Thread	5271	3226	2413	1319
Western Wheatgrass	626	3538	347	225
Blue Grama	577	1249	3730	1200

Seral Stage

4. Similarity indices using average percent foliar cover will be calculated for each level of use, and compared to historic (pre-1985) data when appropriate.

Determining Trend

Factors included in the evaluating the direction of change for each site include:

1. Amount of bare ground
2. Amount of litter.
3. Evidence of over-utilization of key plant species (plant vigor, hedging, browse lines, significant use of low-preference plants, etc.).
4. Contribution by non-native plants, especially invasive species.

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