

# CHAPTER 4:

## Affected Environment



## INTRODUCTION

This chapter describes the existing environment of the South Unit of Badlands National Park (South Unit). The focus is on elements (natural and cultural resources, visitor opportunities, socioeconomic characteristics, etc.) that would be affected by the actions proposed in the alternatives should they be implemented. These topics were selected on the basis of federal law, regulations, executive orders, National Park Service (NPS) expertise, and concerns expressed by the Oglala Sioux Tribe (OST), other

agencies, or members of the public during project scoping.

The first section in this chapter discusses impact topics that are analyzed in detail in the *South Unit General Management Plan / Environmental Impact Statement* (South Unit GMP/EIS). The next section discusses impact topics that are not analyzed in detail and explains the rationale for these decisions. Impact topics are described in table 6.

**TABLE 6. IMPACT TOPICS**

<b>Impact Topics Considered in this Plan</b> <i>Alternatives in this plan have potential to affect these resources or topics</i>	<b>Impact Topics Eliminated from Detailed Analysis in this Plan</b> <i>These resources or topics are important, but alternatives in this plan would have only positive impacts and/or any adverse impacts would negligible to minor.</i>
Natural Resources	Natural Resources
Vegetation	Water Resources (quantity and quality)
Wildlife	Floodplains
Paleontological Resources	Special Status Species – Threatened, Endangered, or Candidate Species
Soundscapes	Wetlands
Cultural Resources	Prime and Unique Farmland
Archeological Sites	Geologic Features and Process (including Minerals and Soils)
Museum Collections	Air Quality
Ethnographic Resources	Wilderness Values
Scenic Resources	Climate Change
Visitor Experience	Cultural Resources
Access	Historic Structures
Availability of Information	Cultural Landscapes
Range and Enjoyment of Visitor Activity	Indian Trust Resources
Socioeconomics	Natural or Depletable Resource Requirements and Conservation Potential
Park Operations	

## IMPACT TOPICS CONSIDERED AND ANALYZED IN DETAIL

### NATURAL RESOURCES

#### Vegetation

Badlands National Park is at the western edge of what was once the mixed-grass prairie ecosystem. The mixed-grass prairie of the central United States was a transition zone between the arid short-grass prairie to the west and the moist tall-grass prairie to the east. In conjunction with the adjacent Buffalo Gap National Grassland today the park supports one of the largest contiguous native mixed-grass prairies under federal protection in the United States, and it is part of one of the largest remaining mixed-grass prairies in North America (NPS 2007c).

The vegetation of the North and South Units was mapped in 1999 as part of a nationwide vegetation mapping project of the U.S. Geological Survey and the NPS (Bureau of Reclamation 1999). Based on the data, approximately 28 vegetation types were classified and ten land use/land cover types were also identified. Outside of sparsely vegetated areas, nine major vegetative communities were identified: dry mixed-grass prairie, mesic mixed-grass prairie, introduced grasslands, riparian/wet meadows, dry plains shrublands, mesic plains shrublands, riparian shrublands, dry coniferous forest and woodlands, and riparian deciduous forests and woodlands. Other minor vegetation communities include emergent wetlands and a prairie dog grassland complex.

Botanical studies have been conducted in the North and South Units. The plant inventories are estimated to be about 90 percent complete. A total of 457 vascular plant species, representing about 70 families, have been documented. About 38 more species are believed to inhabit the park but have not yet been documented. The largest number of species present is in the Asteraceae (sunflower) family (NPS 2001). There is also an inventory of lichens: a total of 171 lichen species and four species of lichenicolous fungi were recorded in the park (Will-Wolf 1998).

Little information is available on other nonvascular plants in the park.

Grasses are the dominant plants in Badlands National Park. Forty-one species of native grasses are recorded in the park. Among the most important are buffalo grass, blue grama, western wheat grass, and needle-and-thread grass. The grasses are well-adapted to environmental conditions, able to withstand high winds, long periods of dry weather, and frequent fires. They also furnish food and habitat for wildlife, add humus and fertility to the topsoil as they decay, and hold the soil from being blown or washed away.

#### Vegetation Communities

##### Grasslands

Grasslands are the dominant vegetative community in the park, covering about 55,065 acres (22,284 ha), or 40 percent of the South Unit. Many natural and anthropogenic factors have influenced the park's current grasslands, including soil type and depth, moisture levels, fires, and grazing. As a result, the park has a diverse grassland mixture that intermingles in small units across the landscape.

Mixed-grass prairie, the most common vegetative community in the park, covers about 52,200 acres (21,124 ha), or 38 percent of the South Unit. Dry mixed-grass prairies are found throughout the park. Western wheatgrass (*Pascopyrum smithii*), blue grama (*Bouteloua gracilis*), green needlegrass (*Nassella viridula*), threadleaf sedge (*Carex filifolia*), little bluestem (*Schizachyrium scoparium*), side-oats grama (*Bouteloua curtipendula*), and buffalo grass (*Buchloe dactyloides*) dominate this plant community. Other forbs and grasses are commonly present as well, including prairie coneflower (*Ratibida columnaris*), white milkwort (*Polygala alba*), and prairie dropseed (*Sporobolus heterolepis*). In wetter spots on selected hills, slopes, and buttes can be found mesic mixed-grass prairie, dominated by western wheatgrass and green needlegrass.

Riparian/wet meadows are a rare grassland community, covering less than 1 percent of the South Unit. They are found along the bottoms of drainage channels. Prairie cordgrass (*Spartina pectinata*) and pale spikerush (*Eleocharis palustris*) are two graminoids commonly found in these wet areas.

**Dry Mixed-Grass Prairie.** Three prairie types occur within the dry mixed-grass vegetation community in the South Unit. They are Western Wheatgrass-Blue Grama-Threadleaf Sedge Grassland, Little Bluestem-Grama Grasses-Threadleaf Sedge Grassland, and Blue Grama-Buffalo Grass Grassland. Western Wheatgrass-Blue Grama-Threadleaf Sedge Grassland occur in a variety of habitats throughout the park but generally on flat to moderately steep slopes on all aspects. Western wheatgrass is dominant in ungrazed stands but due to increased grazing in the South Unit this community is dominated by blue grama and threadleaf sedge on drier soils and Kentucky bluegrass (*Poa pratensis*) on more mesic sites. Little Bluestem-Grama Grasses-Threadleaf Sedge Grassland occurs in patches along drainageways and along the edges and at the heads of draws of variable steepness and aspect. Little bluestem is the dominant species, with lesser amounts of sideoats grama and forbs. The most extensive stands in the South Unit occur in the Palmer Creek subunit. Blue Grama-Buffalo Grass Grassland occupy drier soils on hilltops, ridges, and sandy soils that have a regular grazing regime either by livestock or prairie dogs. It contains a variable mix of grasses, dominated by blue grama and a variety of forbs (Bureau of Reclamation 1999).

**Mesic Mixed-Grass Prairie.** One prairie type occurs within the mesic mixed-grass vegetation community in the South Unit. It is Western Wheatgrass-Green Needlegrass Grassland. Western Wheatgrass-Green Needlegrass occurs on flats on plains and buttes and moderate hillslopes of all aspects. Dominant graminoid species vary within a stand and include western wheatgrass, green needlegrass, blue grama, and Japanese brome (*Bromus japonicus*). While stands of this community type or more commonly found in the North Unit large stands are found on Sheep Mountain Table and on

Stronghold Table in the South Unit (Bureau of Reclamation 1999).

**Riparian-Wet Meadow.** Three riparian-wet meadow types occur within the riparian-wet meadow vegetation community in the South Unit. They are Prairie Cordgrass-Sedge Wet Meadow, Pale Spikerush Wet Meadow, and Great Plains Cattail-Bulrush Marsh. Prairie Cordgrass-Sedge Wet Meadow is rare within the Badlands and is restricted to the margins of perennial linear wetlands and drainage bottoms. Prairie cordgrass is the dominant species with associated sedge species (*Carex* spp.). Pale Spikerush Wet Meadow is found throughout the park in association with saturated/inundated soils occurring in depressions, drainages, along pond margins, and water conveyance ditches that hold water for at least part of the growing season. Pale spikerush is found in association with other spikerush species (*Eleocharis* spp.) and foxtail barley (*Hordeum jubatum*). Great Plains Cattail-Bulrush Marsh is an introduced emergent wetland that occurs throughout the park, occupying edges of man-made ponds and dugouts where saturated soils or shallow water is present on a mostly permanent basis. This community is dominated by species of cattail (*Typha latifolia* and *Typha angustifolia*) and bulrush (*Scirpus validus* and *Scirpus americanus*) and forms mostly around and in constructed ponds and reservoirs (Bureau of Reclamation 1999).

**Introduced Grasslands.** Three grassland types occur within the introduced grassland vegetation community in the South Unit. They are Crested Wheatgrass Grassland, Smooth Brome Grassland, and Kentucky Bluegrass Grassland. These introduced grassland types are found on relatively level areas associated with disturbed areas along park roadsides and around facilities, abandoned fields on Sheep Mountain Table, and grasslands that were interseeded with exotic grasses on Cuny and Stronghold tables. While crested wheatgrass (*Agropyron cristatum*), smooth brome (*Bromus inermis*), and Kentucky bluegrass (*Poa pratensis*) are the dominant species in these vegetation communities they are often associated with numerous invasive species. However, smooth brome and Kentucky bluegrass often form monotypic stands. Many

species of forbs and shrubs are also found in these grasslands (Bureau of Reclamation 1999).

### Shrublands

Shrublands cover about 7,272 acres (2,942 ha), or 5 percent of the South Unit. They are mainly along river and creek floodplains and on sand deposits, mesic slopes, and gravelly or rocky draws. The shrublands most widespread in the park, dominated by silver sage (*Artemisia cana*), are regularly found on floodplains and adjacent slopes. Sand hills support extensive stands of sand sage (*Artemisia filifolia*) shrubland, particularly in the southern half of the park. Soapweed (*Yucca glauca*) stands typically are found along the margins of buttes, on low sandy ridges, and on dry canyon sides. Mesic draws, swales, slopes, and drainages support patches of various broad-leaved shrubs, including silver sage, western snowberry (*Symphoricarpos occidentalis*), chokecherry (*Prunus virginiana*), American plum (*Prunus americana*), and ill-scented sumac (*Rhus trilobata*).

**Dry Plains Shrublands.** Three shrubland types occur within the dry plains shrublands vegetation community in the South Unit. They are Sand Sage-Prairie Sandreed Shrubland, Soapweed-Prairie Sandreed Shrubland, and Common Rabbitbrush Shrubland. Sand Sage-Prairie Sandreed Shrublands occupy sand hills and high sand ridges, which are mostly disturbed on Red Shirt and Blind Man Tables with small amounts found on Sheep Mountain Table and the eastern edge of the Palmer Creek subunit. While sand sage is the dominant species soapweed can become a codominant species on lower sand ridges and interfaces of sand hills with butte tops. Herbaceous cover is sparse to moderate typically consisting of prairie sandreed (*Calamovilfa longifolia*) and other graminoids. Soapweed-Prairie Sandreed Shrublands occupy sandy ridges and silty clay flats on butte edges. Sandy ridges are predominant near the White River in the South Unit. Soapweed is the dominant species but there is typically good herbaceous cover including prairie sandreed and other graminoids. Common Rabbitbrush Shrublands occupy recently disturbed areas along park roadways (Cuny Table Road and Red Shirt Road) and moderately steep drainages.

Common rabbitbrush (*Chrysothamnus nauseosus*) forms nearly monotypic stands with few other shrubs and a dense herbaceous layer (Bureau of Reclamation 1999).

**Mesic Plains Shrublands.** Four shrubland types occur within the mesic plains shrublands vegetation community in the South Unit. They are Chokecherry-American Plum Shrubland, Western Snowberry Shrubland, Ill-Scented Sumac-Threeleaf Sedge Shrubland, and Greasewood-Western Wheatgrass Shrubland. Chokecherry-American Plum Shrublands occupy mesic draws and occasionally at the seep zones on the edges of sandhills, mesic hillslope slumps, and in old river oxbows. Chokecherry and American plum stands are very dense typically with a border of other shrubs and sparse herbaceous cover. Western Snowberry Shrublands are common in mesic swales, depressions, draws, oxbows, and drainage bottoms in the South Unit with large stands occurring in the Palmer Creek subunit. Western snowberry is the dominant shrub species in this dense cover community type with herbaceous species contributing sparse vegetative cover. Sparse stands of Ill-Scented Sumac-Threeleaf Sedge Shrublands occur throughout most of the park along the upper cliff borders of buttes, and on some ridges and knolls with moderately sparse stands occurring in areas in the South Unit. Ill-scented sumac can form open shrublands along the top of cliffs and the edges of draws or denser shrublands on ridges and hilltops. Greasewood-Western Wheatgrass Shrubland is uncommon in the Badlands with small stands occurring on alkaline flats on Cuny Table and Plenty Star Table and alkali-affected drainageways in the South Unit. Greasewood-western wheatgrass shrublands have sparse cover with greasewood (*Sarcobatus vermiculatus*) as the dominant large shrub species with other shrubs, grasses, and forbs occurring to a lesser extent (Bureau of Reclamation 1999).

**Riparian Shrublands.** Three shrubland types occur within the riparian shrublands vegetation community in the South Unit. They are Silver Sage-Western Wheatgrass Shrubland, Sandbar Willow Shrubland, and Buffaloberry Shrubland. Silver Sage-Western Wheatgrass Shrublands

occur widely throughout the Badlands but are mostly confined to drainage bottoms, creeks, and rivers. They may occur on gentle to moderate hillslopes and along the edges of broad drainages. The cover of silver sage is variable within this community depending on flooding regime and disturbance. Sites that are relatively undisturbed have higher densities of silver sage and good cover by western wheatgrass. Sandbar Willow Shrublands are limited in size and rare within the Badlands and occur along the banks of White River and Fog Creek in the South Unit on nearly level sites where moist sediments collect or adjacent to some wetland communities. Mature stands have dense sandbar willow (*Salix exigua*) cover with relatively sparse cover while stand is becoming established. Buffaloberry Shrublands are uncommon in the Badlands and occur in very dense small patches along the White River and near the White River Visitor Center in the South Unit. Buffaloberry (*Shepherdia argentea*) shrublands establish in riparian zones along streams and rivers after other species such as eastern cottonwood have colonized (Bureau of Reclamation 1999).

### Woodlands

Woodlands are uncommon in Badlands, covering about 2,566 acres (1,038 ha), or 2 percent of the South Unit. They generally are restricted to floodplains, drainage bottoms, the toes of sand hills, draws associated with eroding buttes, and slumps on butte and cliff faces. Rocky Mountain juniper (*Juniperus scopulorum*) forms the most common woodland in the park, growing on drier slopes and slumps, along butte edges, and in upper draws. Ponderosa pine (*Pinus ponderosa*) woodlands can be found in the upper elevations of the South Unit. Hardwoods are found in more mesic sites, including the bottoms of draws, river floodplains, and the toes of sand hills, with green ash (*Fraxinus pennsylvanica*) and American elm (*Ulmus americana*) being the most common trees. Extremely mesic sites, along river floodplains, minor streams, seeps, springs, and ponds, support stands of eastern cottonwood (*Populus deltoides*) and peachleaf willow (*Salix amygdaloides*).

**Dry Coniferous Forest and Woodlands.** Two woodland types occur within the dry coniferous forest and woodlands vegetation community in the South Unit. They are Rocky Mountain Juniper-Littleseed Mountain Ricegrass Woodland and Ponderosa Pine-Rocky Mountain Juniper Woodland. Rocky Mountain Juniper-Littleseed Mountain Ricegrass Woodlands occupy dry draws and the edges of buttes and tables on all aspects. Rocky Mountain juniper is the dominant overstory canopy species with little-seed mountain ricegrass (*Oryzopsis micrantha*) common in the sparse herbaceous layer. Ponderosa Pine-Rocky Mountain Juniper Woodlands occupy the rims of some tables and buttes (Cedar Buttes and Red Shirt Table) and the heads of some steep draws in the Palmer Creek subunit. Canopy cover varies from open along buttes and table tops to fairly closed within draws with ponderosa pine and Rocky Mountain juniper as the dominant species in the overstory with a sparse shrub layer and moderate herbaceous layer consisting mostly of little bluestem and sideoats grama (Bureau of Reclamation 1999).

### Riparian Deciduous Forest and Woodlands.

Three woodland types occur within the riparian deciduous forest and woodlands vegetation community in the South Unit. They are Green Ash-American Elm-Chokecherry Woodland, Eastern Cottonwood-Peachleaf Willow-Sandbar Willow Woodland, and Russian Olive Woodland. Green Ash-American Elm-Chokecherry Woodland occurs throughout the badlands occupying mesic draws, small perennial drainages, and the outer edges of river floodplains. The dominant species is green ash with lesser amounts of American elm and a sparse shrub and herbaceous layer. Eastern Cottonwood-Peachleaf Willow-Sandbar Willow Woodland occurs in the floodplain of river and smaller creeks and drainages, on the margins of ponds and reservoirs, and seeps and springs in mesic draws. This woodland has various canopy cover depending on stand age and position of the landscape that is dominated by eastern cottonwood with lesser amount of peachleaf willow. Older stands of eastern cottonwood and willow are typically invaded by green ash and eastern red cedar (*Juniperus virginiana*).

Russian Olive Woodland is very limited within the Badlands with one occurrence along the White River near the White River Visitor Center. The community is dominated by Russian olive (*Elaeagnus angustifolia*) with dense sandbar willow (*Salix exigua*) shrub cover and a sparse herbaceous layer (Bureau of Reclamation 1999).

### Sparsely Vegetated Areas

About 46 percent of the South Unit (63,123 acres, or 25,544 ha) is sparsely vegetated or barren. The Badlands formations provide a harsh, inhospitable environment for vegetation. Moisture is usually scarce, and rapidly runs off the steep slopes instead of soaking into the ground. Surface temperatures are often extreme. Sparse vegetation grows on the park's pinnacles, cliffs, mounds, outwash fans, intermittent drainages, and low hills covered by chalcidony (a flat, crystalline rock with properties similar to quartz). Sparse vegetation also is found in areas of established prairie dog towns. Constant prairie dog use of these areas results in a weedy, forb-dominated community.

Three sparsely vegetated area types occur within the sparsely vegetated vegetation community in the South Unit. They are Eroding Great Plains Badlands Sparse Vegetation, Wild Buckwheat-Snakeweed Badlands Sparse Vegetation, Great Plains Badlands Sparse Vegetation Complex, and Blacktailed Prairie Dog Town Complex. Blacktailed Prairie Dog Town Complex is widespread throughout the Badlands and range in size from less than one hectare to several hundred hectares. This community type typically occurs on level sites along drainages, in broad valleys, on gentle to moderately sloping hillslopes, and flats on tables and buttes. Vegetation is extremely variable and is dependent on age of town, soil type, and prairie dog population density. Vegetation type varies from the outer edges of the town inward with the outer edges typically dominated by western wheatgrass, blue grama, and buffalo grass. Species distribution is patchy with varying degrees of dominance within stands typical of early successional species on disturbed sites. Eroding Great Plains Badlands Sparse Vegetation, Wild Buckwheat-Snakeweed

Badlands Sparse Vegetation, and Great Plains Badlands Sparse Vegetation are widespread within the Badlands on exposed spires, cliffs, ridges, slopes, narrow gorges, buttes, mounds, fans, and drainages. Soils are undeveloped, poor, loose, and easily eroded on gently sloping to steeply sloping areas. These areas range from mostly devoid of vegetation to sparsely covered, typically with less than 1 percent cover and rarely exceeding 10 percent cover by wild buckwheat (*Erigeron pauciflorum*), snakeweed (*Gutierrezia sarothrae*), and curlycup gumweed (*Grindelia squarrosa*). Vegetation is relatively evenly distributed on level terrain and grows in patches on steeper slopes and cliffs (Bureau of Reclamation 1999).

Approximately an additional 1 percent of the South Unit is covered by other largely nonvegetated features, including developments, roads, utilities, drainages, ponds, and quarries.

### Special Status Species—Rare Plants

There are no federally listed plant species in Badlands National Park. However, several plants are listed as rare by the state. Three rare species endemic to the region are found primarily in sparsely vegetated badland areas: Barr's milkvetch (*Astragalus barrii*), Dakota buckwheat (*Eriogonum visheri*), and sidesaddle (or Secund) bladderpod (*Lesquerella arenosa* var. *argillosa*). Two state-listed rare plants are found in the park's prairies but are not endemic to the region, Easter daisy (*Townsendia exscapa*) and large flower Townsend daisy (*Townsendia grandiflora*).

Badlands has potential habitat for four state-listed rare plants that have not been recorded in the park to date, but may be there. Hopi tea (*Thelesperma megapotamicum*) grows in open sites. Hairy virgin's bower (*Clematis hirsutissima*) is often found near streams and creeks. Parry's rabbitbrush (*Chrysothamnus parryi*) grows in dry open plains. Silver-mounded candleflower (*Cryptantha cana*) is a perennial endemic that grows on dry sandy and gravelly soils of rangelands and slopes.



## Exotic Plants

Exotic (nonnative) plants can be found throughout the park on lands that have been disturbed by human activities. Grazing and dryland farming introduced exotic plants into Badlands. Seeds from lands outside the park also have blown in or have been carried into Badlands inadvertently. A total of 71 exotic plant species are known to grow in Badlands National Park. The distribution of most annual exotic plants is limited; they are found primarily in disturbed areas. Most of the species have been in the area for a long time and are likely to continue to exist in disturbed areas, posing little threat to native species.

Two exotic annual grasses, Japanese brome and downy brome (*Bromus tectorum*) are very common along foot and game trails. These species usually are present to some degree in all the park's grasslands, especially the western wheatgrass stands. Other relatively common exotic species found in various disturbed sites are smooth brome, crested wheatgrass, Kentucky bluegrass, alfalfa (*Medicago sativa*), Canada thistle (*Cirsium arvense*), and giant ragweed (*Artemisia trifida*).

A biennial yellow sweetclover (*Melilotus officinalis*) is widespread through the North Unit. During peak growing years, this plant can grow to about four feet tall, covering native grasslands. This plant is of concern because it may be causing ecological damage by its soil chemistry changes. Livestock grazing has an influence on the distribution and abundance of yellow sweetclover. Yellow sweetclover seems to be suppressed in the South Unit by livestock grazing and drier soils. The removal or reduction of livestock grazing may cause an increase in the distribution and abundance of yellow sweetclover in the South Unit.

Four of the annual exotics are of special concern for park managers. Japanese brome and downy brome both have demonstrated an ability to spread into native prairie, where they directly compete with native species. Halogeton (*Halogeton glomeratus*), which is common on badlands features in the Cedar Pass area, is poisonous to ungulates. At high density this plant could pose a risk to the park's bighorn

sheep population. Puncture vine (*Tribulus terrestris*), common along the edges of park's gravel-surfaced roads, frequently causes flat tires on visitors' bicycles, interfering with the visitor experience.

Noxious weeds in the park that have been designated by the county and state are the puncture vine mentioned above, field bindweed (*Convolvulus arvensis*), spotted knapweed (*Centaurea maculosa*), Russian knapweed (*Centaurea repens*), houndstongue (*Cynoglossum officinale*), perennial sow thistle (*Sonchus arvensis*), and Canada thistle. Infestations of Canada thistle are present, with the plant growing in an estimated 8,000 acres, of which almost 5,000 acres are in the park. Canada thistle primarily grows adjacent to roads and along watercourses, in wooded draws and swales, adjacent to wildlife water impoundments, and in prairie dog towns. It also is invading native grasslands. The plant has greatly altered riparian vegetative communities, excluding native vegetation.

Three other noxious species, leafy spurge (*Euphorbia esula*), hoary cress (*Cardaria draba*) and Dalmatian toadflax (*Linaria dalmatica*), are not known to be in the park at present but are expected to invade during the life of this plan. Leafy spurge can be found immediately west, east, and south of the park.

Tamarisk (*Tamarix* spp.) is just starting to invade the White River from upstream. It probably will spread along the two-mile stretch of the river in the park.

The staff has several ongoing efforts to control the spread of exotics in the North Unit and in the South Unit as necessary. Most of the effort has focused on stopping the spread of Canada thistle, with both chemical and biological controls being used, mowing, fire, and inter-seeding of native grasses (NPS 2006c, 2007c). In addition, much work has been done in the past five years to manage knapweeds. Cool-season exotic grasses have been experimentally treated since 2000 with spring prescribed fires, followed by interseeding with native species.

## Vegetation and People

Ranching, grazing, the elimination and reduction of native wildlife, and fire suppression have substantially affected the grasslands in Badlands National Park. Little of the land now in the park was plowed, but dryland farming was practiced in scattered areas throughout the park. Horses, cattle, and sheep also grazed on much of the native grasslands now in the park. Livestock grazed all of Badlands from 1942 to 1962 (Langer 1998). The OST still exercise their tribal grazing rights for domestic livestock in the South Unit; thus, livestock grazing continues through much of the South Unit.

The agricultural activities in both the North and South Units introduced exotic plants into the park and changed the distribution and extent of the natural vegetative communities. Introduced grasslands dominated by smooth brome, crested wheatgrass, and Kentucky bluegrass now occupy about 2 percent of the park. In the past, the NPS also planted nonnative grasses along road corridors, around facilities, and at overlooks.

Frequent low to moderate intensity fires formerly maintained the prairie ecosystem, but since the early 20th century, nearly all fires within park boundaries were extinguished before they could spread far. Without fire, the density and variety of plant species, particularly forbs, were altered — without fires, there are fewer annual forbs. However, starting in the early 1980s (and more often in the 1990s) prescribed burning has been used in the park to substitute for natural wildland fires. About 5,000 acres are burned annually in the North Unit; no acres are treated with fire in the South Unit.

The primary impact of visitors on park vegetation probably is the unintentional transport of exotic plants into and around the park. Seed can be transported in on vehicles and clothing, resulting in the introduction and spread of exotic plants. Other visitor impacts on park vegetation have not been documented. However, trampling of vegetation has been observed, particularly at overlooks along the Loop Road. In the South Unit there has been some (illegal) off-road vehicle driving, which has resulted in trails and loss of vegetation. Much vegetative

disturbance has been caused on Sheep Mountain Table by off-road vehicle travel and frequent human-caused fires.

Tribal members gather fruits, berries, nuts, wood, and traditional plants in the South Unit. This is allowed under the provisions of PL 90-468 (which added this area to the park), the *American Indian Religious Freedom Act*, and the *1976 Memorandum of Agreement* with the OST. It is not known if this activity has positively or negatively affected any of the park's native plants.

## Wildlife

A variety of wildlife species occupy the Badlands woodlands, shrublands, and grasslands. There are small mammals, ungulates, birds, reptiles, amphibians, and invertebrates. A total of 37 mammal species, 202 bird species, 11 reptile and amphibian species, and 15 fish species have been documented in the Badlands (NPS 2007a). In addition, 25 mammal species, 32 bird species, 9 reptile and amphibian species, and 8 fish species are probably present or unconfirmed in Badlands (NPS 2007a). One mammal species, one amphibian species, and one fish species are considered encroaching on the park (NPS 2007a). There are numerous arthropod and other insect species.

## Ungulates

White-tailed deer generally are restricted to scarce riparian habitats and are seen infrequently. Pronghorn and mule deer are commonly seen. Both deer and pronghorn move in and out of the park and are hunted on lands adjacent to the park, and they are hunted by tribal members in the South Unit. Grazing also may affect ungulate numbers in the South Unit, although this has not been documented.

Two species of special interest in the Badlands are bison and bighorn sheep. Both of these species were extirpated from the park in the late 1800s and early 1900s.

**Bison.** Bison do not currently occupy the South Unit. Bison were restored to the North Unit of the park in 1963, and more were released in 1983.

The concept of reintroducing bison into the South Unit is mentioned in the memorandum of agreement with the OST. To date, no bison reintroductions have occurred in the South Unit.

**Bighorn Sheep.** Rocky Mountain bighorn sheep were restored to Badlands in 1964 to fill the ecological niche formerly occupied by the now extinct Audubon's bighorn sheep. The sheep now number between 58 and 74 animals in Badlands, with the South Unit sub-population accounting for 10 to 20 sheep (Bourassa 2001). In the South Unit, they are found primarily in the vicinity of Cedar Butte. A key migratory route for the bighorns (and other wildlife) is the narrow neck between the North and South Units, which is bisected by SD 44. However, much of the historic bighorn sheep habitat in the park remains unoccupied. In addition, the sheep population suffered a major decline between 1994 and 1996. The cause of the decline is not known, but an epizootic disease is suspected. As a result, the sex ratios are skewed in the park. Thus, the long-term survival of the bighorn sheep population is uncertain in the park.

### Carnivores

Twelve species of carnivores are present in the Badlands, including coyote, bobcat, red fox, and American badger. Coyote and bobcat are the only carnivore species that are common. Since 1960 there have been 30 documented records of badger in the park and 16 documented records of the red fox; therefore, these species are considered uncommon (NPS 2002). The black-footed ferret and swift fox are addressed in the section concerning special status species.

### Small Mammals

Small mammal species common in the park are least chipmunk, eastern and desert cottontail rabbit, thirteen-lined ground squirrel, black-tailed prairie dog, deer mouse, muskrat, and several other smaller rodents.

**Black-tailed Prairie Dog.** The state of South Dakota classifies the black-tailed prairie dog as a species of management concern. This herbivorous, social, ground squirrel is considered a keystone species of the Great Plains.

Black-tailed prairie dogs live in large communities called colonies or towns. Groups of colonies make up a complex. Historically, prairie dogs lived in large, interconnected colonies that contained thousands of individuals and extended for miles. Most black-tailed prairie dog colonies today are smaller than 100 acres, disjunct, and geographically isolated from other colonies.

Black-tailed prairie dogs alter their environment, forming a microhabitat in mixed grass prairies. They alter the soil structure by digging burrows and alter the type and density of plant cover, providing sites for forbs that generally are less common in prairie communities. They reduce the height of vegetation and change the density and abundance of other wildlife, including birds and small mammals (Agnew 1983; Colo. State Univ. 1982; Cincotta, Uresk and Hansen n.d.).

A number of species depend on prairie dogs to varying degrees for their survival. At least nine species depend directly on prairie dogs or their activities to some extent, and 137 more species are associated opportunistically (Kotliar et al. 1999). Prairie dog burrows provide shelter for burrowing owls, rattlesnakes, swift foxes, and many other animals. The prairie dogs themselves are prey for black footed ferrets, ferruginous hawks, golden eagles, and many other predators. Sharps and Uresk (1990) found that at least 40 percent of all vertebrates west of the Missouri River are associated with prairie dog towns.

Today, black-tailed prairie dogs inhabit approximately 1 to 2 percent of their original home range in North America. In South Dakota, occupied prairie dog habitat declined from more than 1,757,000 acres in 1918 to about 147,000 acres in 1999 (*Federal Register* Feb. 4, 2000, 5481). The primary causes of decline of the species in South Dakota are conversion of mixed-grass prairie ecosystem to farm and ranchland, poisoning, and the spread of sylvatic plague in a national context (USFWS 2000). The vulnerability of the species to further decline depends upon many factors such as number, size, and spatial distribution of prairie dog colonies; barriers to colonization and expansion; and the nature of direct threats to prairie dog well-being.

The historic extent of black-tailed prairie dogs within the boundaries of Badlands National Park is unknown. In 2001, several small, previously undetected towns were found and mapped in the South Unit and the Palmer Creek Unit, increasing the total acreage of active prairie dog towns in those units to 1,396 acres. Towns are spread out over the entire park in low-lying, flat, grassy regions that are separated by badland formations and drainages. Most of the towns are small and fragmented, but both units still support large prairie dog complexes — there is a 430-acre complex composed of 18 towns in the South Unit.

It is estimated that only about 3 to 5 percent of suitable habitat in the South Unit is occupied by prairie dogs. This could indicate that the prairie dogs in the park have the ability to expand. The South Unit has potential for prairie dog expansion because cattle still graze in that area.

Information from five years of mapping and density estimates of the population indicates that the Badlands prairie dog population is stable or increasing slightly. Some towns have decreased because of the invasion of Canada thistle and clover, but most towns are stable. The reason that prairie dog numbers are not increasing and towns are not expanding may be related to five to six years of above-normal precipitation, with corresponding vegetation growth and less grazing pressure. For prairie dog towns to expand vegetation resources must be low.

A Black-tailed Prairie Dog Management Plan was completed for the North Unit in 2007. The principal objectives of the management plan are to ensure that the black-tailed prairie dog is maintained in its role as a keystone species in the mixed-grass prairie ecosystem on the North Unit, while providing strategies to effectively manage instances of prairie dog encroachment onto adjacent private lands (NPS 2007b). Plague was detected in the North Unit black-tailed prairie dog population for the first time in 2009. Deltamethrin dusting efforts have been ongoing in the North Unit to protect existing populations of black-tailed prairie dogs, as well as black-footed ferrets (NPS 2009b). Currently, there is no black-tailed prairie dog management plan for the South Unit or plague dusting efforts.

## Birds

Badlands National Park provides habitat for a diverse bird population, including raptors, waterfowl, shorebirds, herons, cranes, woodpeckers, and songbirds. Most of the park's bird species are either summer residents or migrants. Approximately 68 bird species have been observed nesting in the park. Common bird species found in the park include northern harrier, red-tailed hawk, prairie falcon, sharp-tailed grouse, killdeer, mourning dove, red-headed woodpecker, yellow-shafted flicker, eastern kingbird, Bell's vireo, warbling vireo, black-billed magpie, American crow, bank swallow, cliff swallow, barn swallow, mountain bluebird, American robin, field sparrow, dickcissel, and red-winged blackbird (NPS 2007b).

The sharp-tailed grouse is representative of the prairie ecosystem. It is suspected that grouse leks ("dancing grounds," where courtship "dances" occur) are in the park, although only one has been identified in the South Unit. Golden eagles are fairly common in the park in winter, and they nest in the park. Loggerhead shrikes also are common in the summer. Other birds of special interest that are summer or winter park residents include the long-eared owl, barn owl, burrowing owl, great horned owl, ferruginous hawk, Swainson's hawk, and wild turkey.

Burrowing owl are small owls that usually reside in treeless areas with short vegetation, primarily in association with prairie dogs. Burrowing owls have been found to nest on prairie dog colonies, both active and inactive, as long as the burrow system is intact (NPS 2007b). Because of their dependence on active prairie dog burrow colonies for breeding habitat, long-term persistence of well-connected, large, active prairie dog towns is important for the future of the burrowing owl (NPS 2007b). From 1994 to 1996, the burrowing owl was designated by the U.S. Fish and Wildlife Service (USFWS) as a Category 2 species for consideration to be listed as a threatened or endangered species. In 1996, the Category 2 designation was discontinued. The species is currently listed by the USFWS as a National Bird of Conservation Concern. The

burrowing owl is not listed as endangered or threatened by the state of South Dakota (Klute et al. 2003).

### **Reptiles and Amphibians**

Common amphibians found within Badlands National Park include the Plains spadefoot toad, Great Plains toad, and the chorus frog. Common reptiles found within the park include the red-sided garter snake, Western Plains garter, western hognose snake, bullsnake, and prairie rattlesnake (NPS 2007b).

### **Insects**

Common butterfly species found in Badlands National Park are eastern tiger swallowtail, checkered white, cabbage white, clouded sulphur, striped hairstreak, Melissa blue, regal fritillary, Atlantis fritillary, variegated fritillary, pearl crescent, Wiedemer's admiral, viceroy, mourning cloak, red admiral, painted lady, hackberry emperor, common wood nymph, common check skipper, and Delaware skipper. Several species of grasshoppers and crickets (Orthoptera) along with elm leaf beetles and elm bark beetles are also common within Badlands National Park.

## **PALEONTOLOGICAL RESOURCES**

The White River Badlands, which encompass both the North and South Units, contains the largest known assembly of Late Eocene and Oligocene Eocene mammal fossils in North America. Recognition of mako sica (bad land) as a significant paleontological area extends back to the traditional American Indian oral history of the area (Kiver and Harris 1999). Lakota people found large fossilized bones, fossilized seashells, and turtle shells. The OST considers paleontological resources to be part of their oral history and traditional beliefs (Potapova and Rom 2009).

Euro-American paleontological interest in the area began in the 1840s, when trappers and traders traveling along the Fort Pierre to Fort Laramie trail occasionally collected fossils. Alexander Culbertson, an agent of the American Fur Company, made the first collection from the

area. Culbertson sent a fossilized jaw fragment to Dr. Hiram A. Prout, who described and published it in 1846 (Macdonald 1951).

The Badlands has played a major role in the development of the science of paleontology. Scientists from major universities, museums, and the government have been attracted to and collected in this area. Thousands of specimens are housed in museums and collections around the world. Hundreds of scientific papers on the White River Badlands have been published. Many important finds from the area have served to define the North American Land Mammal Ages in the Late Eocene and Oligocene Epochs. Fossils from this area have provided valuable information for understanding mammalian evolution and diversity, paleoecology, and paleoclimates. Paleontological resources were a major reason for establishing Badlands National Monument in 1939 and designating the monument a national park in 1978 (NPS 2006a).

Marine fossils are found in the deposits of an ancient sea that existed in the region some 75 million to 67 million years ago, during the Cretaceous Period. Fossils that have been found in the Pierre Shale and Fox Hills Formations include ammonites, nautiloids, fish, marine reptiles, marine turtles, plesiosaurs (large marine reptiles), and mosasaurs (giant marine lizards) (NPS 2006a).

During the Late Eocene and Oligocene Eocene Epochs, 37 million to 25 million years ago, a great variety of animals lived in the Badlands. Untold numbers of those that died in the rivers, streams, swamps, floodplains, and lakes were preserved by layers of sediments. Fossils from the White River Group found in the park include camels, three-toed horses, oreodonts (a sheep like animal, the most common mammal found), antelope like animals, brontotheres (or "titanotheres," large grazing animals that resembled a rhinoceros), rhinoceroses, false deer, rabbits, beavers, creodonts (predatory animals), saber-toothed cats, land turtles, rodents, and birds (NPS 2006a).

All of the South Unit potentially contains fossils, but only a small percentage of the area has been inventoried for paleontological resources. Since 2002, the OST has implemented a moratorium

on excavation and collection of fossils. Due to this moratorium, Badlands National Park has refrained from conducting fossil inventories within the South Unit. However, paleontological inventories have been carried out on tribal lands adjacent to the South Unit with OST and Bureau of Indian Affairs (BIA) authorization (Rom, pers. comm., 2010).

The soft sediments of the White River Badlands allows fossils to disintegrate within a few years after exposure, when protective, surrounding sediments are removed, either by natural forces or human interaction. Exposed surface fossil are often lost before they can be recorded, legally collected, or preserved. Fossil collecting is known to be a popular activity. Visitors pick up an unknown amount of material every year, and an unknown amount of illegal commercial and private collecting also occurs in the park. Indications are that large scale collecting is prevalent in the South Unit. The park initiates 20 to 25 cases a year, which typically results in three to four citations / prosecutions a year (NPS 2006a).

There are three main issues, which threaten the preservation and future survival of fossils in this area (Potapova and Rom 2009):

1. **Natural Deterioration.** The fossils, if not legally collected, will be destroyed by weathering or erosion very quickly after exposure.
2. **Livestock Trampling.** If the area is used for livestock grazing most fossils will quickly be destroyed from trampling and increased erosion; and
3. **Theft.** Large specimens, especially complete skulls, mandibles, and skeletal parts, are generally easy to locate and remove.

## SOUNDSCAPE

NPS *Management Policies 2006* and Director's Order 47, *Soundscape Preservation and Noise Management*, recognize that natural soundscapes are a park resource and call for the NPS to preserve, to the greatest extent possible, the natural soundscapes of parks (NPS 2000,

2006b). The policies and Director's Order further state that the NPS is to restore degraded soundscapes to the natural condition whenever possible and protect natural soundscapes from degradation due to noise (undesirable human-caused sound). The natural soundscape (sometimes called natural quiet) is one resource that makes the South Unit a special place. Noise can cause direct or indirect adverse effects on the natural soundscape and other resources. It also can adversely affect the visitor experience. Visitors to the South Unit have the opportunity to experience solitude and tranquility in an environment of natural sounds. Actions in the alternatives that could potentially increase noise levels would be of concern to park managers, visitors, and the public.

Little quantitative information about sound levels in Badlands is available, but the park generally is considered to be a relatively quiet place. There is little noise caused by people in most of the park. Vehicles generate noise on various roads used for recreation and as farm-to-market routes (park neighbors hauling livestock and grain through parts of the park). The traffic mix includes recreational vehicles of all sizes, commercial trucks, and local residents' cars throughout the perimeter of the South Unit. Other sound disruptions are created by visitors talking and shouting, park administrative operations at the White River Visitor Center, and aircraft overflights (including military flights and commercial tour helicopters). In addition to road corridors, the primary developed areas where these sounds can be heard are visitor and administrative facilities, such as the White River Visitor Center.

Ambient sound in Badlands National Park can mostly be attributed to wind blowing through the prairie and badlands formations. Sounds from wildlife (such as bison and birds) are often heard. Interestingly, Badlands' ambient soundscape is believed to be "louder" than that of other parks in the Rocky Mountains and Colorado Plateau. This is probably due to the open landscape and the prevailing winds that blow through the Badlands area (Foch Assoc., Dr. James D. Foch, pers. comm., Dec. 19, 2001 as cited in NPS 2006b).

## CULTURAL RESOURCES

The OST Tribal Historic Preservation Officer considers all cultural resources to be eligible for the National Register of Historic Places, and for a proposed OST Register. The Tribal Historic Preservation Officer defines cultural resources to include archeological sites, paleontological resources, ethnographic resources, traditional cultural properties, gathering areas, spiritual areas, landscapes or specific places, human remains, artifacts, fossils, museum collections, and some structures. Increased public access and erosion have the potential to adversely affect these cultural resources.

### Archeological Sites

Federal land managers are required under Section 110 of the *National Historic Preservation Act* to develop plans for surveying lands under their control to determine the nature and extent of archeological resources on those lands. Although there has not been a comprehensive survey of archeological resources of the South Unit, several individual surveys have been conducted and 57 archeological resources have been recorded (Vawser, pers. comm., 2010).

Currently, there are 27 known and recorded archeological sites in the South Unit. Fourteen of the known sites are prehistoric artifact scatters; eleven of the sites are hearth or fire pit features that have been exposed in erosional surfaces, such as gullies or mesa edges. There is also one circular feature and one historic foundation. Four of these sites have been dated, and range from 1390 to 2280 years old. Sites in the South Unit could be as old as 10,000 years. There are additional known archeological locations, which are unrecorded.

### Museum Collections

There are no museum collection facilities within the South Unit that meet the requirements of 36 CFR 79 (Curation of Federally-Owned and Administered Archeological Collections). There is a partial listing of records for collections taken from the South Unit. Collections from the South Unit are stored at the South Dakota

Archaeological Research Center, the South Dakota School of Mines and Technology Museum of Geology, the OST Historic Preservation Office, the Badlands National Park collections facility, the Midwest Archeological Center, and at other museum facilities in North America and around the world. The South Unit collections consist of approximately 7,190 catalog records of vertebrate and invertebrate fossils from the Late Cretaceous, Late Eocene, and Oligocene. There is also a small collection of archeological materials.

Construction of a new storage and curation facility was completed in 2005 at the North Unit. Located at Cedar Pass, the facility meets current NPS museum standards for storage (36 CFR 79). Collections not used for display purposes are curated at that location. As appropriate, the NPS would consult with tribal members before treating or reproducing items in NPS collections (NPS 2006b, section 5.3.5.5; NPS 2006d; NPS 2008b).

### Ethnographic Resources

The NPS recognizes four categories of cultural landscapes: historic designed landscapes, historic vernacular landscapes, historic sites, and ethnographic landscapes. Ethnographic resources (such as a site, structure, landscape, or natural resource feature assigned traditional legendary, subsistence religious or other significance) and traditional cultural properties exist in the area and are generally acknowledged as part of the historical territory of the Lakota branch of the Sioux. Within the South Unit, ethnographic landscapes that possess the qualities of and have been identified as probable candidates for consideration as cultural landscapes include the site of prolonged Ghost Dances during the fall of 1890; Big Foot's route to the Ghost Dance, Stronghold Table, and Wounded Knee; historic resources associated with Bombing Range use; Oglala Sioux homesteads; and traditional gathering and spiritual areas. No formal assessment of these landscapes has been conducted. World War II bombing practice likely affected cultural resources.

Traditional cultural properties are ethnographic resources that can be associated with cultural practices or beliefs and that are either eligible for inclusion in, or are listed in, the National Register of Historic Places. Such properties could be sites regarded as sacred, locations for gathering resources, activity areas, or other areas of ongoing traditional use.

The South Unit contains evidence of continuing Lakota traditional spiritual uses. Current ethnographic information provided by the OST has indicated that there are several areas known to have special spiritual significance for the Oglala Sioux.

## SCENIC RESOURCES

Through the 1916 *Organic Act* the national park system was created to conserve unimpaired many of the world's most magnificent landscapes where visitors can immerse themselves in the beauty of such special places and renew the body, the spirit and the mind. One of the South Unit's outstanding resources and values is the scenic beauty of its landscape that extends far beyond the boundary of the park in sweeping vistas. The scenic resources of the South Unit have a high degree of cultural significance. For centuries the beauty and solitude of this landscape have been important qualities that have added to the importance and value of the spirituals and ceremonial site used by American Indians. These same resources today draw the eye and mind of professional and amateur artists, photographers, and writers whose works communicate the striking scenery of the park to visitors as well as others around the world.

The landscape is composed of flat to gently rolling grassland terraces that weave through and become a visually pleasing contrast to the rugged and barren peaks and gullies that frequent the landscape. For many visitors, the ever-changing play of light and shadows on these contrasting land forms provoke strong emotional responses as they capture one's eye and mind. These views contain a very limited number of contrasting elements, primarily consisting of occasional residences and ranching structures as well as farm roads. The high level

of interest in promoting the creation of the proposed Crazy Horse Scenic Byway is another indication of the beauty and scenic value of the landscape within the South Unit. (OSPRA is pursuing Federal Highway Administration approval for the 215-mile Crazy Horse National Scenic Byway.)

The remoteness and rural nature of the lands adjacent to the park have resulted in limited intrusions to the beauty and clarity of night sky. The intrusions are primarily from occasional residential structures, radio and cellular telephone towers located inside and outside the park boundary. Due to the remoteness of the park and the absence of competing sources of light, the night sky of the South Unit offers unparalleled opportunity to view the wonders and beauty of a boundless starry environment.

## VISITOR EXPERIENCE

Badlands National Park is divided into the North and South Units. The North Unit is operating under the *2006 North Unit General Management Plan* (NPS 2006a). The South Unit contains the undeveloped Stronghold Table area and the Palmer Creek area.

A *Long Range Interpretive Plan* has been prepared for the park (NPS 1999b). The plan outlines interpretive actions to bring the park's stories to visitors in a form they can enjoy and understand. The plan identifies two primary areas that could benefit from recommendations and improvements within the South Unit: the White River Visitor Center, and Sheep Mountain Table. Recommendations related to the White River Visitor Center include the following:

- Developing a closer relationship between the NPS and the Lakota and OST, which would be essential in determining which aspects of Lakota and Sioux history and culture are appropriate to tell, by whom, where, and how;
- Constructing the Lakota Heritage Education Center;
- Waiting for the construction of the Lakota Heritage Education Center and



until closer working relationships with the OST government have developed;

- Providing opportunities for the Lakota people to interpret their own culture, whether as paid NPS employees, as volunteers, or through another cooperative-type relationship;
- Providing wayside exhibits and bulletin boards to introduce visitors to the South Unit, orient them to the park in general, and addressing safety issues; and
- Developing an ethnobotany trail (NPS 1999).

The only recommendation in the Long Range Interpretive Plan concerning Sheep Mountain Table was to provide wayside exhibits addressing orientation and safety issues at the beginning of the unpaved road leading to Sheep Mountain Table (NPS 1999).

## **Visitor Access**

Over the past 11 years, an average of 922,000 visitors has visited Badlands National Park every year (NPS 2010b). Most visitors travel along I-90, the major highway west into the Black Hills. Badlands often is the first stop on a longer trip to Mount Rushmore National Memorial, Wind Cave and Jewel Cave national parks, and Custer State Park. I-90 is also traveled by people going to destinations farther west, such as Yellowstone National Park. Some visitors make a spur-of-the-moment decision to visit Badlands National Park when they see signs along the highway. The OSPRA expects that the Badlands Loop Scenic Byway (designated by the state of South Dakota) and the proposed Crazy Horse Scenic Byway might increase visitation by one million to two million visitors in the next decade (OSPRA 2000).

An average of 9,437 visitors has been counted at the South Unit every year since 2000 (Livermont 2010).

A formal visitor survey completed in July 2001 compiled statistics about visitors such as group

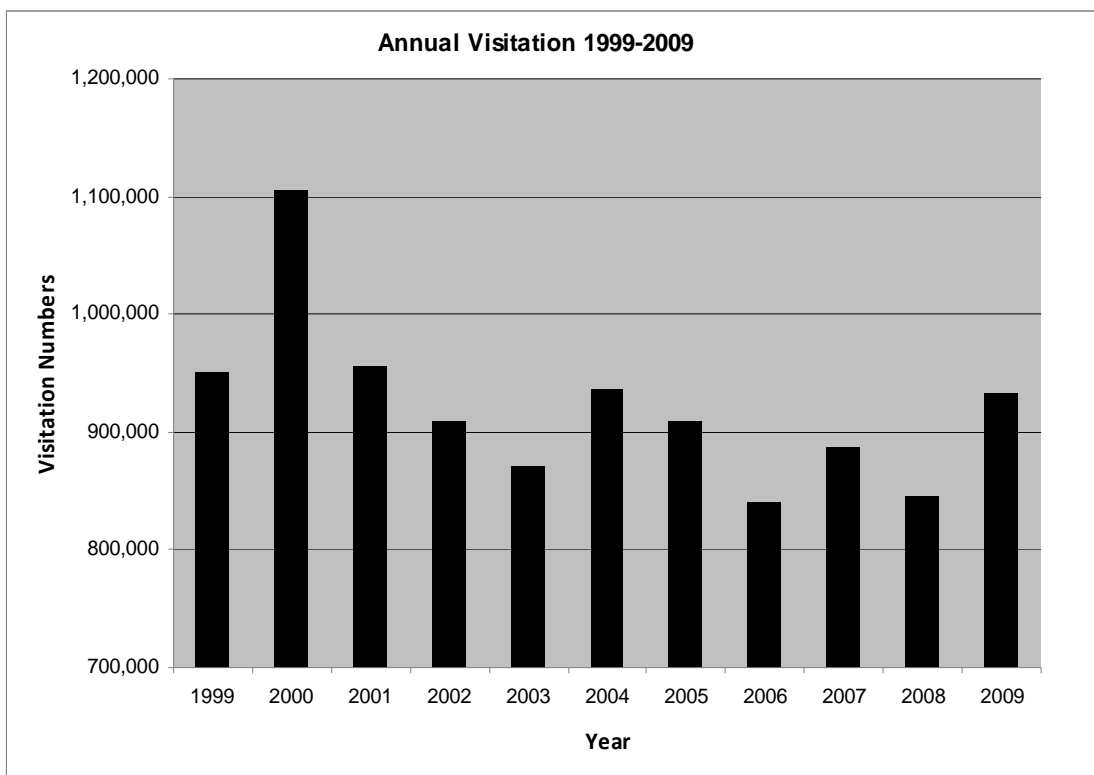
composition, trip origin and destination, length of visit, favorite park sites, and other data (Simmons and Gramann 2001). Park employees have collected other information about visitors at entrance stations, during routine patrols, and from registration of backcountry and wilderness visitors. The information collected from these various sources is summarized in this section.

## **Visitation**

Weather in South Dakota can be extreme, with an average temperature of 90°F in July and August and 80°F in June and September. Record high temperatures of 111°F have been recorded in August. Winters often are extremely cold, with below-zero temperatures as low as -40°F, with heavy, drifting snow and strong winds. The highest visitation to Badlands National Park is in June, July, and August (70 percent of the annual visitation), followed by the “shoulder season” months of September, October, and May. Visitation in the shoulder season has increased recently partly because more retired people are visiting the park (NPS 2006a).

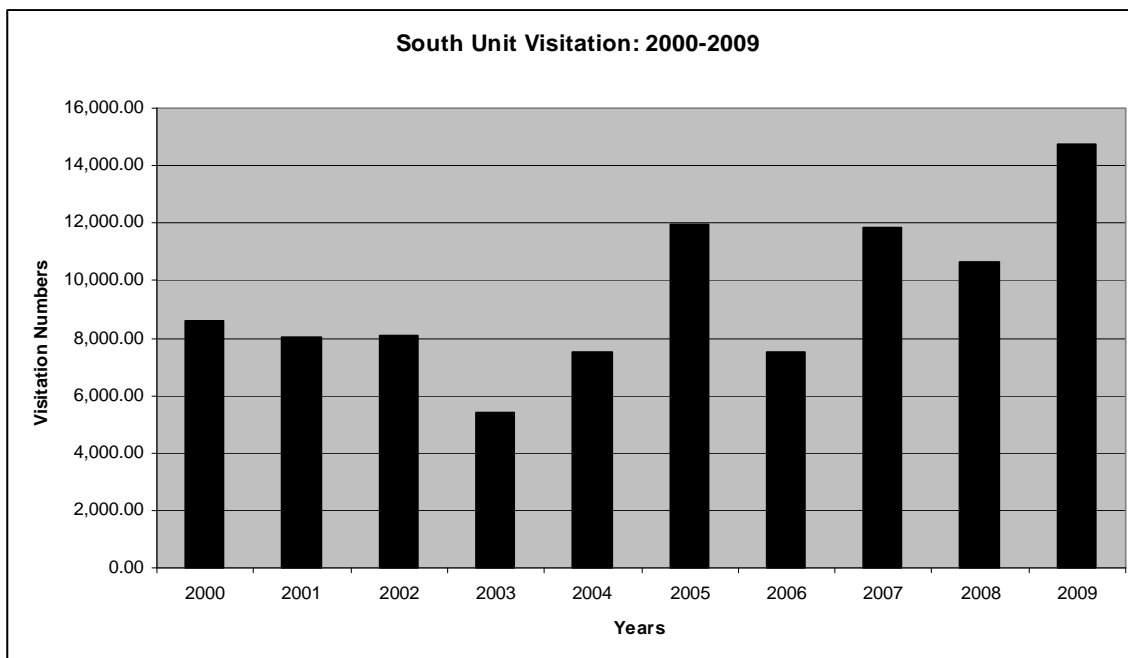
Visitation to the park for the years 1999–2009 is presented in figure 1 (NPS 2010b), and visitation to the South Unit is presented in figure 2. Even though visitation to the park has fluctuated between 1999 and 2009, an average downward trend in overall park visitation of roughly -0.9 percent per year, is apparent. However, approximately one million people per year visited the park in the past five years. Using one million recreation visits as a starting point, a 0.9-percent decline each year would result in visitation of approximately 955,800 recreation visits in five years (by 2014). Over this same period, a 0.9-percent increase in visits would result in about 1,045,800 recreation visits by the year 2014. Projecting future visitation is an inexact art. A steady downward trend is not likely over a long period. Likewise, a long-term upward trend may not be sustainable by the park’s resources or infrastructure. Visitation in the range of 1,000,000 recreation visits plus or minus 10 percent is considered a reasonable forecast, given the historic data presented here.

**FIGURE 1. NORTH AND SOUTH UNIT ANNUAL VISITATION**



Source: NPS 2010b

**FIGURE 2. SOUTH UNIT ANNUAL VISITATION 2000 – 2009**



Source: Livermont 2010

**Access.** The major roads on which visitors can drive to the South Unit are BIA 41 on the west, BIA Route 2 on the south, and BIA Route 27 on the east. BIA 41, a paved two-lane road, travels along the western boundary of the South Unit from the town of Red Shirt to BIA Route 2, passing over Red Shirt Table. BIA 41 intersects BIA Route 2 at the southwest corner of the South Unit. BIA Route 2, a gravel-surfaced road, travels 20 miles along the southern boundary between BIA 41 and BIA Route 27, passing about two miles south of the southern boundary of the South Unit across Cuny Table. The Tribe has requested that the BIA upgrade and pave BIA Route 2.

BIA Route 27, a paved and maintained road that intersects BIA Route 2, travels northwest about 20 miles to the town of Scenic, where it connects with SD 44. The White River Visitor Center lies at the intersection of BIA Route 2 and BIA Route 27.

Vehicles can travel on several primitive two-track roads in the South Unit. These roads are minimally maintained, and high-clearance vehicles are strongly recommended. There are few directional signs, and access is limited, because of road conditions or, in the case of Palmer Creek, it is necessary to cross private property to reach that area.

Sheep Mountain Table is near the western boundary of the South Unit off BIA Route 27, south of SD 44. Sheep Mountain Table can be reached by traveling a gravel-surfaced road about 6 miles long. The first 3.5 miles of the road are relatively flat; then the road ascends steeply to the table. Once on the table, the road diminishes into a series of two-track roads. The two-track roads are heavily rutted, and more routes are being created by visitors trying to avoid heavily rutted areas.

Blindman Table is in the northwest corner of the South Unit along BIA 41. Drivers can reach the table via a two-track dirt road about four miles long. However, the first mile of the road crosses private land.

The Badlands Loop Scenic Byway was designated by the state of South Dakota in 2001 and has been proposed for designation as a

federal scenic byway. This scenic byway begins at exit 131 on I-90 at Cactus Flats and travels south and west along the Loop Road to the Pinnacles entrance station.

## **Availability of Information**

**Orientation and Information Services.** Before visiting Badlands National Park, visitors can obtain information about the park from the NPS Web site (<http://www.nps.gov/badl>), and from travel guides, previous visits, and state or local welcome centers (Simmons and Gramann 2001). A trip planner is available from the park upon request. More information also is available in a rack card at state-operated rest areas along I-90, which are open from April to October each year.

Orientation and information about the South Unit is available at the three staffed entrance stations: Northeast, Interior, and Pinnacles. Visitors can receive orientation, a map, the park newspaper, and safety information at these three entrance stations. Information about the South Unit is also available at the Ben Reifel Visitor Center in the North Unit, as well as at the White River Visitor Center.

**Visitor Centers.** There is one visitor center in the South Unit, the White River Visitor Center. The White River Visitor Center currently is the only point of contact within the South Unit. Located on the Pine Ridge Reservation on BIS Route 27, the White River Center is operated in the summer only by the OSPRA, and offers a staffed information desk, park orientation movie, exhibits, restrooms, and water. It typically is open June through August. A small picnic area is adjacent to the visitor center. There are no interpretive trails.

Exhibits at the White River Visitor Center — mainly photographs covering Indian history before the 1940s — primarily interpret Lakota culture and history. There are seven exhibit panels and eight mannequins dressed in various Lakota clothing. A 28-minute videotape chronicling the Sioux and their culture is shown, but only six to eight people can view the program in comfort. The newest exhibits were installed in 2006 and 2007. These exhibits are mostly cultural in nature with some paleontology as well.

The White River facility was not designed to be used as a visitor center, and floor space cannot be used to the full capacity. When installed in 1979, this facility had a life expectancy of five years. In 2004, the doublewide trailer was replaced with a modular building.

### **Range of Enjoyment of Visitor Activity**

The South Unit is the least visited area of Badlands National Park, consisting of the Stronghold Table and Palmer Creek areas. These areas offer a rugged experience for people with a sense of adventure with extensive backcountry experience and self-reliance. Both units contain prehistoric, historic, scenic, scientific, and human resources, and there is evidence of significant archeological resources. However, to get to some places in these units, one must cross private lands.

In addition to typical park visitors, livestock grazers and tribal members use the South Unit. Members of the OST are permitted to hunt in these areas under the *1976 Memorandum of Agreement*.

The NPS has not encouraged visitors to explore much of the South Unit, because the area was used as a bombing range by the U.S. Air Force during World War II, and still contains unexploded ordnance.

Visitors who explore the South Unit use high-clearance vehicles or come on foot, with pack stock, or on bicycles. Vehicle access in the South Unit is restricted to the few existing two-track roads. Popular activities for visitors are driving the road onto Sheep Mountain and Blindman tables, which provide expansive overlooks. The White River Visitor Center is the only source of orientation, interpretation, and education in the South Unit until the Lakota Heritage and Education Center is constructed.

**Vehicle Use.** The South Unit has limited highway access and even less vehicle access to the interior of the unit.

**Picnicking.** The White River Visitor Center has limited picnicking opportunities available.

**Hiking and Pack Stock Use, and Camping.** These activities are currently available to the public, but access is limited.

## **SOCIOECONOMICS**

The South Unit is located entirely in Shannon County, South Dakota. Including the North Unit, the whole of Badlands National Park is located in Jackson, Pennington, and Shannon counties, South Dakota. Since economic impacts may occur across a larger region than Shannon County, the study area for the socioeconomic assessment includes the three counties in which the entire Badlands National Park is located. The discussion below provides an overview of social and economic conditions in each of these counties as well as conditions for the OST, where available.

### **Population Centers**

Population centers for each of the study area counties are shown in table 7. At the time of the 2000 Census, Rapid City in Pennington County has just less than 60,000 residents – a population center significantly larger than in either of the most populated areas in other study area counties. Pine Ridge in Shannon County – a population center with a relatively high concentration of Oglala Sioux residents – reported having approximately 3,171 residents at the time of the 2000 Census. Population estimates for 2008 as provided by the American Community Survey (a product of the U.S. Census Bureau) indicate that the population of Kadoka in Jackson County has decreased approximately 10 percent while the population of Rapid City has increased by approximately 10 percent since the 2000 Census.

TABLE 7. POPULATION CENTERS IN STUDY AREA COUNTIES

County	Most Populated Municipality	2000 Census	2008 Estimate	% Change (2000 to June 2008)
Jackson	Kadoka	706	635	-10.1%
Pennington	Rapid City	59,607	65,491	9.9%
Shannon	Pine Ridge	3,171	N/A*	N/A

Source: U.S. Census Bureau 2010; Note: \*2008 population estimates are not available for Pine Ridge in Shannon County.

## County Summaries

A summary profile for each study area county is provided below. Each profile includes a brief history of the county as well as major industries and economic conditions.

**Jackson County.** In 2008, the American Community Survey estimated that approximately 2,660 people live in Jackson County. This is a decrease of approximately 10 percent or 280 residents from 2000. Because of disclosure issues, there is little employment information available for Jackson County (see Employment section below). However, it is known that the government sector accounts for just less than 30 percent of county employment while farming related employment accounts for approximately 18 percent of county employment.

**Pennington County.** In 2008, the American Community Survey estimated the Pennington County population to be approximately 98,845, an increase of 11 percent since 2000. In 2008, industry sectors with the greatest share of total county employment include retail trade (14 percent) and government services (17.0 percent).

**Shannon County.** In 2000, the population of Shannon County was 12,556, a number that would increase to an estimated 13,641 by 2008. In 2001, the government sector accounted for approximately 70 percent of county employment, this decreased to 65.4 percent in 2008. In 2008, private employment accounted for approximately 30 percent of all county jobs, an increase 5 percent from 2001.

## Oglala Sioux Tribe

The OST government operates under a constitution consistent with the *Indian*

*Reorganization Act* of 1934. The Tribe is governed by an elected body of officials; each official serves a two-year term.

In 1824, 1851, and 1868, the Tribes of the Great Sioux Nation entered into treaties with the United States. These treaties recognized the rights of the Nation to exist as a sovereign government. The Pine Ridge Reservation was originally part of the Great Sioux Reservation, a total land area that was further reduced by the Great Sioux Settlement of 1889. Presently, the Pine Ridge Reservation encompasses more than 70,000 square miles. The majority of residents live in eleven main towns/housing areas.

The people of the Sioux Nation refer to themselves as Lakota or Dakota, which translates into friend or ally. The Oglala Lakota are part of the Titowan Division. After the Battle of Little Big Horn with General Custer and the 7<sup>th</sup> Cavalry in 1876, many members of the Great Sioux Nation began to disperse to protect themselves.

The population of the OST has been disputed for years, a dispute which affects federal funding for housing programs and other services. In a 2005 study entitled *Pine Ridge Work Force Study*, Dr. Kathleen Pickering identified 28,787 people living on the Pine Ridge Reservation (Pickering 2005). A figure just recently accepted by the U.S. Department of Housing and Urban Development is considered the most accurate count in the last ten years. A 2005 report released by the BIA identified 43,146 enrolled tribal members, living both on and off the Pine Ridge Reservation.

Pine Ridge Village, which is located in the southwestern corner of the reservation, is the administrative center for the Indian Health Service Unit, the BIA, and Tribal Government and State agencies. Kyle is home of the main

campus of Oglala Lakota College; there are several other campuses on the reservation.

A number of different plans have been prepared and implemented to improve economic conditions on the Pine Ridge Reservation. Measures include business development strategies, roadway and infrastructure improvements, tourism development, improving education and health services, and construction of appropriate housing.

### Demographic Characteristics

This section describes demographic characteristics for each of the three counties located in the socioeconomic study area. Included below is information on population growth since 1969, age characteristics, and racial and ethnic characteristics. Information specific to the OST is included where available. Data has been retrieved from the U.S. Census Bureau and the BIA.

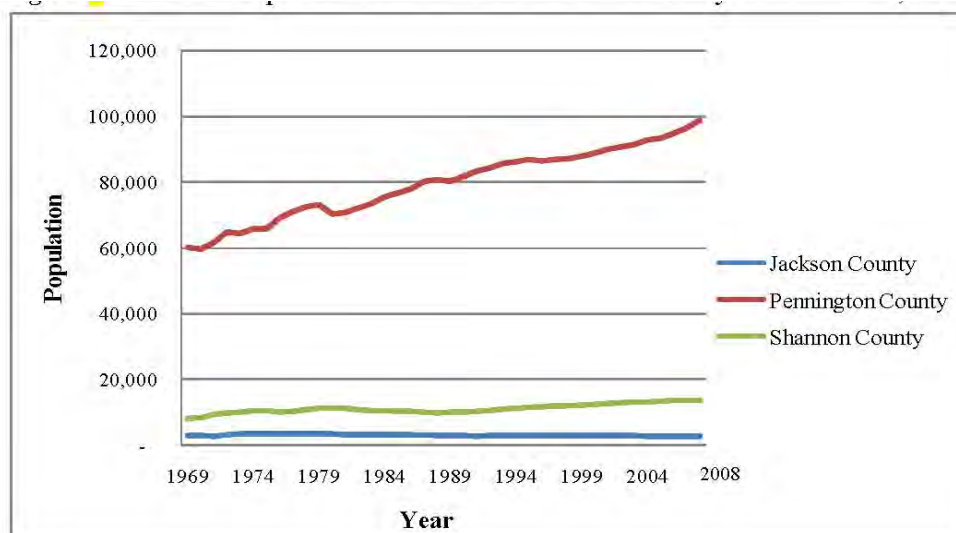
**Population Trends.** Population numbers for each study area county for the years 1969 through 2008 were retrieved from the U.S. Department of Commerce, Bureau of Economic

Analysis (BEA). As shown in figure 3, Pennington County has grown at a rate considerably faster than either Jackson or Shannon Counties. Over the approximate forty-year period, Jackson County experienced a decrease of slightly less than 10.0 percent while Pennington and Shannon Counties experienced population growth of 64 percent and 68 percent, respectively.

Between 2000 and 2008, Pennington County increased by approximately 10,000 people or 11 percent. During the same period, Shannon County increased by approximately 1,085 people or 9 percent while Jackson County experienced a decrease of approximately 280 people or -10 percent.

The BIA issues a report every few years on population, employment, and poverty levels for tribal populations across the country. The most recent report, entitled the *2005 American Indian Population and Labor Force Report*, identifies approximately 43,146 individuals as part of the OST, an increase of approximately 9 percent from 1997.

**FIGURE 3. HISTORICAL POPULATION AND CURRENT ESTIMATES FOR STUDY AREA COUNTIES, 1969–2008**



Source: BEA 2010

**Age Characteristics.** The age composition of the three study area counties varies considerably, as shown in table 8. Shannon County reports the greatest percentage of those who identify themselves as being less than 16 years of age. This is notably higher than either Jackson or Pennington Counties, which report approximately 32 percent and 24 percent of residents who identify themselves the same. The OST and Shannon County overall have a smaller percentage of residents 65 years of age and older than Jackson or Pennington Counties and South Dakota overall.

**Racial and Ethnic Characteristics.** The presence of the Pine Ridge Reservation in Shannon County has resulted in the racial and ethnic composition of the county to be notably different than either Jackson or Pennington Counties. As demonstrated in table 9, approximately 94 percent of Shannon County residents identify themselves as being American Indian or Alaska Native Alone. More than 86 percent of Pennington County residents identify themselves as being White Alone as compared to approximately 50 percent in Jackson County. Of study area counties, the racial and ethnic composition of Pennington County most closely resembles that of South Dakota overall. In each of the three study area counties, there are very few residents who identify themselves as being Black or African American, Asian, or some other race.

## Economic Characteristics

The following provides an overview of economic conditions in each of the three study area counties as compared to South Dakota and the United States overall. Information for the OST is included where available.

### Personal Income

Of the three regional counties, only Jackson County experienced an increase in per capita income between 2000 and 2008. In 2008, the per capita income in Jackson County increased approximately \$5,658 or 22 percent from 2000. Between 2000 and 2008, Pennington County experienced a per capita income decrease of approximately \$1,638 while Shannon County experienced a decrease of approximately \$492 per person. This decrease is most closely aligned with the change in South Dakota per capita income which decreased approximately \$307 during the same period.

In Shannon County, the per capita income is considerably less than in either Jackson or Pennington Counties (see figure 4). In 2008, the per capita income in Shannon County was approximately \$12,795 less than the per capita income in Jackson County and approximately \$22,563 less than the per capita income in Pennington County. Per capita income in Pennington County is slightly less than the South Dakota average, a number approximately \$1,500 less than the national average. In 2008, the per capita income in Jackson County was approximately \$8,246 less than for South Dakota overall.

**TABLE 8. AGE CHARACTERISTICS OF THE OGLALA SIOUX TRIBE, STUDY AREA COUNTIES, AND SOUTH DAKOTA, 2000**

Age	Jackson County		Pennington County		Shannon County		Oglala Sioux Tribe*		South Dakota	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Under 16 Years of Age	932	31.8%	20,853	23.5%	5,050	40.5%	15,584	34.5%	177,715	23.5%
16-64 Years Old	1,646	56.2%	57,318	64.7%	6,827	54.8%	26,614	58.9%	469,013	62.1%
65 Years of Over and Over	352	12.0%	10,394	11.7%	589	4.7%	3008	6.7%	108,116	14.3%
<b>Total</b>	<b>2,930</b>	<b>100.0%</b>	<b>88,565</b>	<b>100.0%</b>	<b>12,466</b>	<b>100.0%</b>	<b>45,206</b>	<b>100.0%</b>	<b>754,844</b>	<b>100.0%</b>

Source: U.S. Census Bureau. SF3 data tables. Department of the Interior, BIA.

Note: \*Population numbers for the OST are from 2001.

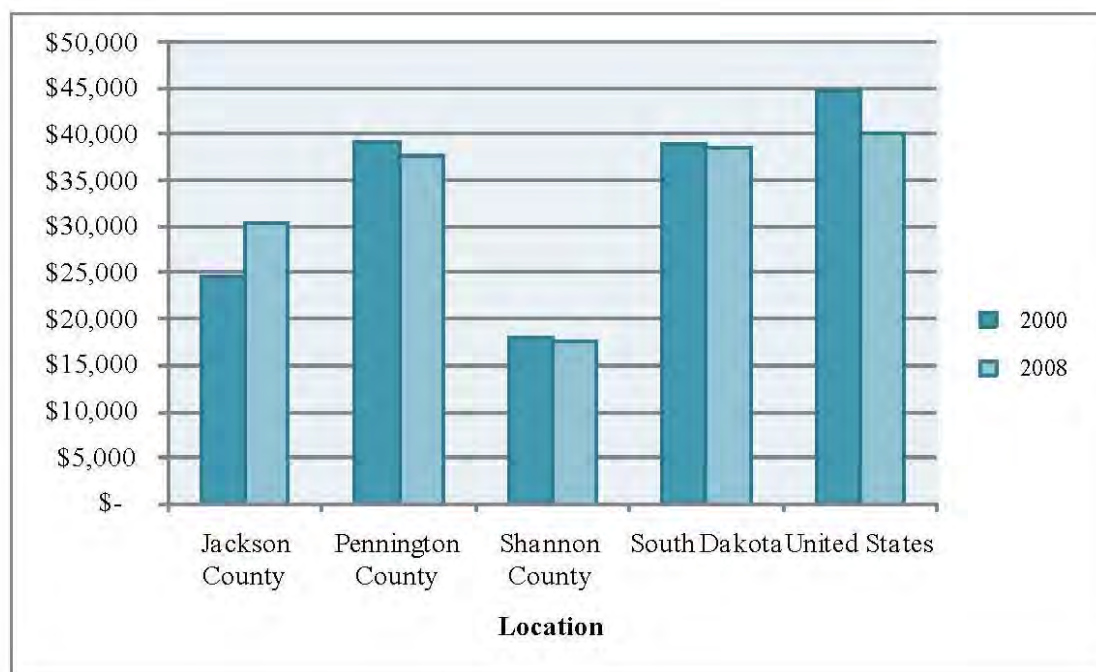
**TABLE 9. RACIAL AND ETHNIC COMPOSITION FOR STUDY AREA COUNTIES, 2000**

Race and Ethnicity	Jackson County		Pennington County		Shannon County		South Dakota	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
White Alone	1,467	50.1%	76,789	86.7%	562	4.5%	669,404	88.7%
Non-Hispanic White	1,465	99.9%	75,797	98.7%	554	98.6%	664,585	99.3%
Hispanic White	2	0.1%	992	1.3%	8	1.4%	4,819	0.7%
Black or African American Alone	1	0.0%	755	0.9%	10	0.1%	4,685	0.6%
American Indian and Alaska Native Alone	1,402	47.8%	7,162	8.1%	11,743	94.2%	62,283	8.3%
Asian Alone	1	0.0%	776	0.9%	3	0.0%	4,378	0.6%
Other*	59	2.0%	3,083	3.5%	148	1.2%	13,833	1.8%
<b>TOTAL</b>	<b>2,930</b>	<b>100.0%</b>	<b>88,565</b>	<b>100.0%</b>	<b>12,466</b>	<b>100.0%</b>	<b>754,583</b>	<b>100.0%</b>
Minority**	1,465	50.0%	12,768	14.4%	11,912	95.6%	89,998	11.9%

Source: U.S. Census of Population and Housing. SF1 data tables.

Notes: \*The Other category includes those individuals who identify themselves as being of some other race alone or two or more races.

\*\*The total minority population includes all those who have classified themselves as Black or African American, Hispanic White, American Indian or Alaska Native, Asian, Other Pacific Islander and Other.

**FIGURE 4. 2000 AND 2008 PER CAPITA INCOME FOR STUDY AREA COUNTIES, SOUTH DAKOTA, AND THE UNITED STATES (IN 2008 DOLLARS)**

Source: BEA 2010



**Badlands National Park.** The *2008 National Park Visitor Spending and Payroll Impacts* report prepared by the Department of Community, Agriculture, Recreation and Resource Studies at Michigan State University, summarizes employment, spending and economic impacts of national parks across the country. The report indicates that approximately \$3.4 million in salaries were earned by the 80 people employed at Badlands National Park during fiscal year (FY) 2008. The average annual salary of these employees was \$42,725, a per capita income higher than in study area counties. Jobs indirectly supported by park payroll and associated spending resulted in 107 jobs with a total income of approximately \$5.0 million. The average annual salary of such individuals was estimated at \$46,785.

### Employment by Industry

Data was obtained from the BEA on total annual employment for study area counties from 2001 and 2008. This information can be used to understand employment trends as well as current industry employment figures<sup>1</sup>.

The following section describes employment trends in terms of the number and percentage of jobs gained or lost in each industry sector over the seven year period as well as the percentage of industry jobs in 2008 as a percent of total employment. Employment by industry is not yet available for 2009. However, it is anticipated that employment numbers have been affected by the recent nationwide recession.

---

<sup>1</sup> U.S. Department of Commerce, Bureau of Economic Analysis. Bureau of Economic Analysis (BEA) estimates annual employment for counties nationwide. Data can be incomplete in some counties due to disclosure issues associated in areas where few firms are operating. Estimates of total employment, however, do include those numbers that are unreported or omitted at the specific industry level.

Total annual employment includes both part-time and full-time jobs. Therefore, individuals having more than one job are counted twice in the totals. The employment estimates include those individuals who are employed by business and public entities, as well as those who are self-employed. Since 2001, the BEA has employed the North American Industry Classification System to better capture new industries that did not exist under the previous Standard Industrial Classification System (SICS).

**Jackson County.** The small number of businesses operating in Jackson County has resulted in the majority of employment information to be nondisclosed. In both 2001 and 2008, there were approximately 1,350 jobs in Jackson County. Just less than 30 percent of jobs are associated with federal, state, and local government services. In 2001, 352 jobs or approximately 26 percent of total employment was related to farming activities. This decreased to 20 percent by 2008. In both 2001 and 2008, employment in the retail trade sector accounted for approximately 13 percent and 12 percent of total employment, respectively.

**Pennington County.** The number of jobs in Pennington County increased by approximately 9 percent between 2001 and 2008. In both 2001 and 2008, the largest single employment sector was government and government enterprises which accounted for approximately 17 percent of total employment in the county. The second largest employment sector was retail trade which constituted approximately 14 percent of total county jobs in both 2001 and 2008. In 2001, the manufacturing sector employed approximately 4,148 people or 7 percent of the total labor force. This decreased by approximately 1,164 employees or 28 percent in 2008. Industry sectors that experienced notable growth during this period include utilities, management of companies and enterprises, and professional, scientific, and technical services.

**Shannon County.** There is little employment information available for Shannon County. In 2001, there were approximately 4,679 people employed in Shannon County. This increased slightly to 4,833 in 2008. The largest employment sector is government and government enterprises, which in 2001, accounted for approximately 70 percent of all county jobs. This industry decreased to 65 percent in 2008. In 2008, farming activities employed approximately 237 people.

**Badlands National Park.** The operation of Badlands National Park brings jobs and spending to the larger region. Currently, a large part of visitor patronage to the park occurs in the North Unit. As a result, much but not all of the employment and economic activity supported by

such visitor patronage is experienced in areas within close proximity to the North Unit. As mentioned in the Visitor Experience section, there were approximately 845,734 visitors to the park in 2008 (this includes both the North and South Units). The following provides an overview the jobs and spending generated by such patronage.

The *2008 National Park Visitor Spending and Payroll* summarizes spending and economic impacts of national parks across the country. Visitor patronage to the park matriculated in 32,597 overnight stays in the area. Such overnight visits as well as other local spending generated approximately \$20.3 million in visitor spending in calendar year 2008. Economic impacts of non-local visitor spending in the area generated approximately 436 jobs, \$6.9 in local incomes, and \$11.0 million in value added to local markets. Visitor spending as well as the \$2.2 million in payroll spending by park employees in local markets generated approximately \$22.5 million in sales during calendar year 2008. Employment supported by visitor patronage coupled with jobs induced by employment at the park resulted in 544 total jobs in calendar year 2008.

### Unemployment

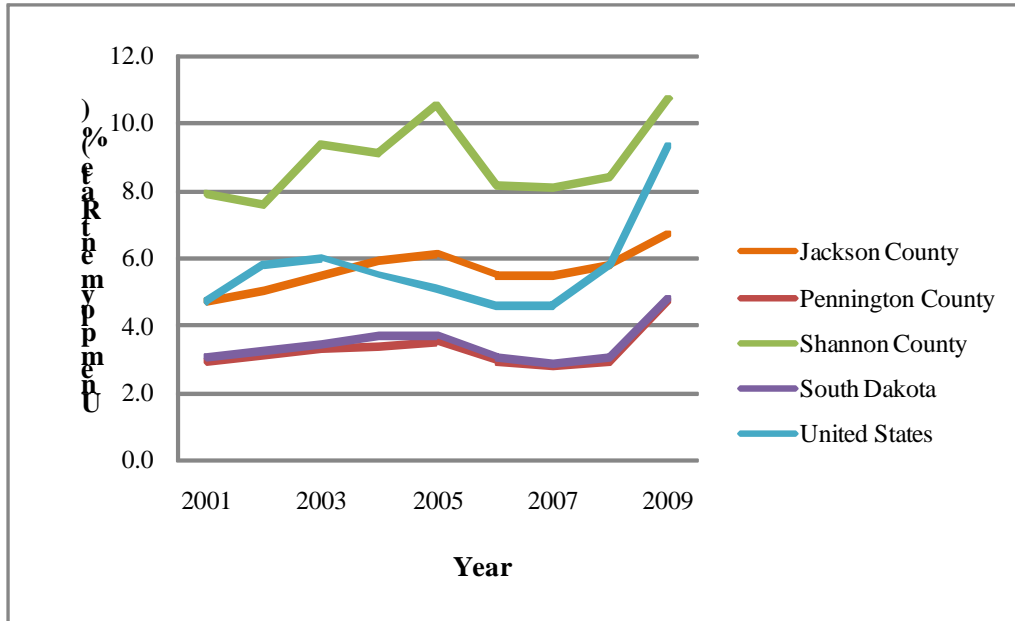
Annual unemployment rates from 2001 to 2009 for each of the study area counties, South Dakota, and the United States have been retrieved from the Bureau of Labor Statistics. As shown in figure 5, Shannon County has consistently had unemployment rates higher than Jackson or Pennington Counties, South Dakota and the United States (BEA 2010c). Unemployment rates in Pennington County most closely resemble unemployment rates for South Dakota as a whole. During the time series shown in figure 5, South Dakota has consistently had an unemployment rate notably lower than the United States overall, and particularly since the nationwide recession began in 2008.

Unemployment rates among the Oglala Sioux, as reported by the BIA, are significantly higher than study area counties, South Dakota, and the United States. In 1997, unemployment among the Oglala Sioux was approximately 73 percent, a rate that would continue to increase in the coming years. Just two years later, in 1999, the unemployment rate had increased to approximately 85 percent. In 2005, the most current year for which information is available, reported an unemployment rate of approximately 89 percent.

### Poverty Rates

The numbers presented in table 10 were retrieved from the 2000 Census and Small Area Income and Poverty Estimates prepared by the U.S. Census Bureau. As shown in table 10, the percentage of those living below the poverty line in Shannon and Jackson Counties is considerably higher than in Pennington County, South Dakota, or United States. At the time of the 2000 Census, more than 50 percent of Shannon County residents reported living below the poverty line. Current estimates for 2008 anticipate that the percentage of those living below the poverty line in Shannon County has decreased since the 2000 Census. Between 2000 and 2008, the most significant change of those living below the poverty line was in Pennington County, which experienced an increase of approximately 2 percent of those living below the poverty line.

The BIA also reports on the number and percentage of employed individuals living below the poverty line. In 1997, approximately 4 percent of employed Oglala Sioux members were living below the poverty line, a percentage that would continue to increase at a relatively fast pace. In 1999, the percentage of employed Oglala Sioux living below the poverty line increased to 19 percent. This increased to approximately 34 percent in 2005, the latest year for which information is available.

**FIGURE 5. STUDY AREA COUNTIES, SOUTH DAKOTA, AND UNITED STATES UNEMPLOYMENT RATES, 2001–2009**

Source: U.S. Department of Labor, Bureau of Labor Statistics 2010

**TABLE 10. POVERTY AND MEDIAN HOUSEHOLD INCOME, 2000 AND 2008**

Geographic Area	Persons Living Below the Poverty Line					Median Household Income (in 2008 Dollars)		
	2000		2008		% Change (2000 to 2008)	2000	2008	% Change (2000 to 2008)
	Number	Percent	Number	Percent				
Jackson County	1,053	36.5%	868	32.6%	3.9%	\$35,293	\$28,119	-20.3%
Pennington County	9,967	11.5%	12,987	13.1%	-1.6%	\$55,250	\$46,887	-15.1%
Shannon County	6,385	52.3%	6,175	45.3%	7.1%	\$30,829	\$25,867	-16.1%
South Dakota	95,900	13.2%	98,248	12.2%	1.0%	\$52,003	\$46,244	-11.1%
United States	33,899,812	12.4%	39,108,422	13.2%	-0.8%	\$61,896	\$52,029	-15.9%

Source: U.S. Census Bureau. SF3 Data Tables. Small Area Income and Poverty Estimates. U.S. Census Bureau 2010

High unemployment and poverty levels coupled with low per capita income in Shannon County have matriculated into a comparatively low average median household income. Information from the 2000 census and 2008 estimates reveal that the average median household income in Shannon County is notably lower than in either Jackson or Pennington Counties. In 2008, the average median household income in Shannon County was approximately \$20,000 less than the average median household income in Pennington County.

Between 2000 and 2008, the average median household income in each of the three study area counties as well as South Dakota and the United States decreased. Each of the three study area counties experienced a percentage decrease in average median household income higher than the South Dakota average. Jackson County experienced the greatest decrease while Pennington and Shannon Counties experienced a decrease similar to the United States overall.

## MINORITY POPULATIONS AND LOW-INCOME POPULATIONS

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, was signed by President Clinton on February 11, 1994. This Order requires that all federal agencies incorporate environmental justice into their missions by identifying and addressing any disproportionately high and adverse human health or environmental effects that their programs and policies may have on minorities and low-income populations and communities. The Secretary of the Interior established Department of the Interior policy under this order in a Memorandum dated August 17, 1994, which directs all bureau and office heads to consider the impacts of their actions or inaction on minority and low-income populations and communities, to consider the equity of the distribution of benefits and risks of those decisions, and to ensure meaningful participation by minority and low-income populations in the department's wide range of activities where health and safety are involved.

The Environmental Protection Agency (EPA) defines a community with potential minority and low-income populations as one that has a greater percentage of minority or low-income populations than does an identified reference community. Minority populations are those populations having (1) 50 percent minority population in the affected area (EPA 1998); or (2) a significantly greater minority population than the reference area. There are no specific thresholds provided for low income or poverty populations. For the purposes of this study, it is assumed that if the study area minority and/or poverty status populations encompass more than ten percentage points higher than those of the reference area, there is likely a minority and low-income population of concern. The thresholds for poverty levels for an individual and a family of four were income levels of \$8,501 and \$17,029, respectively (U.S. Census 2003).

As mentioned earlier, the South Unit is located entirely in Shannon County. Thus the evaluation of potential minority and low-income

populations focused on Shannon County and used the State of South Dakota as a reference community. Following the EPA's criteria for identifying minority and low-income populations, Shannon County clearly has minority and low-income populations present as shown in table 9. According to the U.S. Census, approximately 94 percent of Shannon County residents identify themselves as being American Indian or Alaska Native Alone. This is much higher than the 50 percent threshold established by the EPA. In addition, this is a much higher percentage of a minority population than exists throughout South Dakota (approximately 10 percent). In addition, Shannon County also reports a high percentage of individuals that are living below the poverty line. In 2008, it was estimated that over 45 percent of individuals living in Shannon County were living in poverty. This is substantially higher than either the State of South Dakota (12 percent) or the U.S. (13 percent).

Given the presence of minority and low-income populations within in study area, the impact analysis will consider if any disproportionate high or adverse impacts would occur to these populations.

## Local Resources

This section provides an overview of local resources including land ownership and property valuation within the study area. The discussion identifies primary travel corridors, schools, law enforcement units, and medical facilities. Information specific to the OST has been included where available.

## Land Use and Landownership

Land ownership patterns for each study area county are summarized in table 11. The majority of land in Jackson County is privately held or owned by local governments. Such lands include agricultural areas, highways, railroads, and municipal lands. Federally-owned land in Jackson County includes parts of the Badlands National Park and the Buffalo Gap National Grassland, administered by the U.S. Department of Agriculture, Forest Service. Approximately 32.3 percent of Jackson County is tribally owned.

**TABLE 11. PERCENT OF LAND OWNERSHIP OF STUDY AREA COUNTIES**

County	Land Area (square miles)	Land Area (million acres)	Federal	Private/Local Government	State	Tribal Lands	Public Domain
Jackson	1,864	1.2	10.0%	57.3%	0.4%	32.3%	0.03%
Pennington	2,784	1.8	39.2%	60.7%	0.1%	N/A	N/A
Shannon	2,100	1.3	11.0%	14.0%	0.1%	74.9%	N/A

Source: Fall River/Shannon County Equalization Office. Communication with Brad Stone, Jackson County Assessor on May 4, 2010. Pennington County parcel data provided by Don Jarvinen, Pennington County GIS Department.

More than 60 percent of Pennington County parcels are privately owned or owned by local governments (i.e., municipal and county). Less than 1 percent of County parcels are state owned while approximately 39 percent of parcels are federally owned. Federally owned lands include part or all of the following: Black Hills National Forest; Badlands National Park; Buffalo Gap National Grassland; Minutemen Missile National Historic Site; and Mount Rushmore National Memorial.

The vast majority of Shannon County is tribally owned (75 percent). Federally owned land in Shannon County is part of the Badlands National Park. There is very little state-owned land in the county.

### Property Valuation and Taxation

Local and state government entities generate a portion of their tax revenues by assessing and taxing certain categories of property. This section describes the property tax information for each of the study area counties. Taxable valuations for 2009 are shown in table 12.

The State of South Dakota and its four Indian tribes have entered into tax collection agreements which cover sales, use, and contractors' excise tax. The percentage share of different tax revenues collected in Jackson and

Shannon Counties are similar. In both counties, more than 80 percent of tax revenues collected during FY 2009 were the result of agriculture-related activities while less than 3 percent of tax revenues in Pennington County were the result of the same such activities. The percentage share of tax revenues generated by commercial and utility properties was significantly higher in Pennington County than either Jackson or Shannon Counties.

On tribal lands that are covered by a tax collection agreement, the state and the respective tribe each have the ability to tax certain individuals and transactions. The state collects all state taxes in the tribal areas as well as collects and remits the taxes in those areas for the respective tribe. During the 2009 fiscal year, the OST paid approximately \$2.5 million in taxes, a slight increase from the approximately \$2.3 paid during FY 2008.

### Police Protection and Emergency Services

An increase in visitor patronage to the South Unit has the potential to place additional demand on the delivery of existing police protection and emergency services in the area. This section provides an overview of existing services in the study area.

**TABLE 12. TAXABLE VALUATIONS FOR 2009**

County	Agriculture	Owner Occupied	Other	Total
Jackson	80.4%	9.5%	10.1%	\$129,524,282
Pennington	2.6%	52.4%	45.0%	\$6,910,844,603
Shannon	80.8%	8.9%	10.4%	\$27,706,379

Source: South Dakota Department of Revenue & Regulation 2010

Note: The "Other" category includes residential property not occupied by the owner, and commercial and utility properties.

As demonstrated in table 13, a total of five police departments and sheriff's offices providing police protection and law enforcement services are located in the study area. As the most populous of study area counties, Pennington County has the greatest number of law enforcement units.

In addition to county police protection, residents, employees, and visitors are also protected by the South Dakota Department of Public Safety, the state law enforcement agency with statewide jurisdiction. The Department of Public Safety works closely with the South Dakota Highway Patrol, a division of the Department of Public Safety, and the South Dakota Fire Marshal. The NPS also provides law enforcement within the park.

In addition to county and state police protection and law enforcement, the OST established a Tribal Department of Public Safety. The department provides law enforcement services that are guided by cultural beliefs and traditions. It is tribally chartered professional law enforcement agency that serves the people of the Pine Ridge Reservation. The mission of the department is twofold. The first objective is to prevent outside interests from encroaching upon the sovereign status of the Tribe, and the second is to help maintain peace and social order among the people living on the Pine Ridge Reservation. The department pursues its mission by enforcing tribal and federal law, upholding the Constitution and By Laws of the OST, and carrying out the lawful decisions of the various branches of tribal government – the OST

Council, the Oglala Sioux Tribal President, and the OST Courts (OST, Department of Public Safety 2010).

There are 31 professional and volunteer-run fire stations located in the study area. There are a total of 641 paid and volunteer firefighters at these locations (see table 14). Again Pennington County, as the most populated of study area counties, also has the greatest number of fire stations and personnel. Fire stations operated in both Jackson and Shannon Counties are run by volunteer firefighters and other personnel.

The population per emergency service personnel is calculated by dividing 2008 County population estimates by the number of firefighting personnel in each county. Since the U.S. Fire Administration continuously updates the National Fire Department Census, it was appropriate to use 2008 population estimates provided by the American Community Survey rather than 2000 Census information for this calculation. Of study area counties, Shannon County has the highest number of residents for every one emergency service personnel (390 residents for every 1 emergency service personnel). This is considerably higher than either Jackson or Pennington Counties. Jackson County has the fewest residents per emergency service personnel (20 residents for every one emergency service personnel).

There are five hospitals and emergency medical centers located in the study area (see table 15). Pennington County has four such facilities while Jackson County currently does not have any hospitals or emergency medical centers.

**TABLE 13. POLICE PROTECTION IN STUDY AREA COUNTIES**

County	Unit
Jackson	Jackson County Sheriff's Office
Pennington	Pennington County Sheriff's Office
	Box Elder Police Department
	Rapid City Police Department
Shannon	Shannon County Sheriff's Office

Source: USACOPS 2010

**TABLE 14. FIREFIGHTING SERVICES LOCATED IN STUDY AREA COUNTIES**

County	Number of Fire Stations	Personnel	2008 Population Estimates	Population per Emergency Service Personnel	Type
Jackson	5	130	2,660	20	Volunteer
Pennington	25	476	98,845	208	Career, Mostly Volunteer, and Volunteer
Shannon	1	35	13,641	390	Volunteer

Source: National Fire Department Census, U.S. Fire Administration 2010

**TABLE 15. HOSPITALS AND MEDICAL CENTERS LOCATED IN STUDY AREA COUNTIES**

County	Number of Hospitals/Medical Centers	Number of Patient Beds	2008 Population Estimates	Population per Available Patient Bed
Jackson	0	0	2,660	N/A
Pennington	4	488	98,845	203
Shannon	1	58	13,641	235

Source: U.S. Department of Health and Human Services 2010

Since the U.S. Department of Health and Human Services continuously updates its Health Resources and Service Administration Geospatial Data Warehouse – Report Tool, it was appropriate to use 2008 population estimates provided by the American Community Survey rather than 2000 Census information to determine number of residents per available bed. As shown in table 15, based on 2008 population estimates, Shannon County has the greatest number of residents per available bed (235 residents per available bed). Pennington County has slightly less residents per available bed (203 residents per available bed).

In addition to hospitals located within the study area, there are three rural health clinics – two located in Pennington County and the other in Jackson County.

Parts of both Jackson and Pennington Counties and all of Shannon County have been designated as medically underserved areas<sup>2</sup>. Residents from these counties must travel to neighboring areas

or counties to receive the medical attention they need.

## PARK OPERATIONS

One of the major factors directly influencing operations in the South Unit as well as certain management operations in the North Unit is embodied in the Public Law (PL) 90-468 and the Memorandum of Agreement between the OST of South Dakota and the NPS. Public Law 90-468 authorized the addition of tribal lands, here after referred to as the South Unit, to the existing Badlands National Park. Based on the public law, these lands are being held by the United States in trust for the Tribe and the NPS was authorized administrative jurisdiction of the lands pursuant to the special provisions identified in the public law and in accordance with applicable laws and Department of the Interior regulations.

The Memorandum of Agreement recognized the additions of the South Unit to the Badlands National Park and detailed more specific conditions. The agreement further granted the right of administration to the NPS solely for the purpose of providing public recreation and for the development and administration of public use facilities which are also subject to the terms

<sup>2</sup> Medically Underserved Areas/Populations are areas or populations designated by the Health Resources and Services Administration of the U.S. Department of Health and Human Services as having too few primary care providers, high infant mortality, high poverty and/or high elderly population.

and conditions identified in the Memorandum of Agreement. The OST and the NPS agreed that the NPS would provide for the care, maintenance, preservation, and restoration of features of prehistoric, historic, scientific, or scenic interest and to develop roads, trails or other structures or improvements as may necessary in connection with the administration, visitor use, and protection of the South Unit. The Memorandum of Agreement stipulated that the NPS and the OST to work toward the objective of having members of the OST fill all Service positions in the South Unit. To achieve this end, the NPS is responsible for encouraging and assisting tribal members to train and qualify for all positions in the South Unit as well as the North Unit. Under the terms and conditions of the agreement the OST is entitled to 50 percent of the fees charged for vehicles entering the park and the OST is responsible for 50 percent of the direct cost (i.e., salaries, and other cost directly attributed to fee collection) of collecting the entrance fees.

As for parkwide operations, Badlands National Park operates on an annual budget of approximately \$4.6 million and supports a staff of 47 full-time employees which is supplemented with seasonal staff, volunteers, and the Badlands Historic Association. The staff is organized into six divisions: Resource Management, Resource Protection, Resource Education, Maintenance, Administration, and Management. The Resource Management Division includes inventory, monitoring, planning, and restoration of natural and cultural resources throughout the park. The Resource Protection Division collects fees, provides search and rescue, and provides law enforcement. The Resource Education Division operates the visitor center and provides information, orientation, and interpretation parkwide. The Maintenance Division is responsible for maintaining all, roads, parking areas, overlooks, campgrounds, trails, trailheads, utilities, signs, and buildings (i.e., entrance stations, visitor center, residences, restrooms, etc.). The Administrative Division manages human resources, payroll, procurement, and information technology. The Management Division is responsible for overall management

and direction of the park by providing oversight for each the previously listed divisions to ensure that the goals and objectives of the park are being met.

Approximately 95 percent or more of the facilities that accommodate visitor use and administration of the park are located in the North Unit of Badland National Park. This is primarily due to its location in relation to I-90 which is a major East/West route to national parks such as Yellowstone National Park, Grand Teton National Park, Glacier National Park, and others. Due to the distances people travel from more populated areas of the country and due to limited time, the North Unit is often a quick side trip in the push to reach the more iconic parks. Such trends in visitation have resulted in minimal visitation to the South Unit, which is the most remote area of Badland National Park. Considering the extremely low visitation rates in the South Unit due to visitor use trends, the extremely limited funding levels, and the constant demands to keep facilities and services at a safe and acceptable level, very little funding and staff has been available to manage the South Unit. For fiscal year 2010, the park is devoting approximately \$166,000 to cover the annual operating costs for the South Unit. This includes the cost of two full-time employees and their overhead for operating the White River Visitor Center. This amount is a portion of the park's \$4.6 million annual operating cost.

Badlands National Park can compete with other national park units for various funding sources. These include construction of new facilities, major repair and rehabilitation of facilities, historic preservation projects, resource management, inventory and monitoring programs, and various levels of planning. Levels of funding for these programs are flat or declining. Fees are collected at three entrance stations in the park during busier spring, summer, and fall months and at the visitor center during the rest of the year. The entrance stations are located at the Interior, Pinnacles, and the Northeast entrances. Currently fees are not collected anywhere in the South Unit. Under the Recreation Fee demonstration program established by Congress, 80 percent of the revenue is available to the park for certain types



of projects, and the remaining 20 percent of the revenue is used agency-wide. The 80 percent of the fees retained by the park are divided between the park and the Tribe. Those retained by the park are to be primarily dedicated to address the growing repair and maintenance priority needs (including projects related to health and safety) and the interpretation, signage, habitat, facility improvements, and natural and cultural resources preservation projects. With visitation levels fairly constant, this source of revenue is not increasing. This program is not permanent, and Congress will decide whether or not to renew it. Park staff is involved in developing proposals and managing projects through these programs.

The Badlands Natural History Association is a nonprofit organization with a mission to assist the NPS with scientific, educational, historical, and interpretive activities. Through operation of the bookstore, membership dues, and other fund-raising activities, the association raises money to publish interpretive materials and to help fund NPS activities and projects in the park as well as outreach activities in nearby communities.

Volunteers are integral to the operation of the park. The park has been fortunate in drawing highly skilled people willing to donate their time and expertise.

Partnerships are another important element in the management of the park. For example, the NPS has concurrent jurisdiction with the State of South Dakota, which allows the NPS to enforce federal criminal statutes and also to assimilate State law under 18 USC 13, when no applicable federal law or regulation exists. Concurrent jurisdiction also allows for the more efficient conduct of both state and federal law enforcement functions within the park.

Like many national parks servicewide, in real dollars adjusted for inflation, the annual operating budget for the park has been declining. At the same time, there have been increasing demands on staff time, such as partnership initiatives, more volunteer coordination, homeland security (park staff can be detailed to other sensitive areas for lengthy periods), risk management, wildland fire fighting (park staff are shared throughout the country), and unfunded mandates.

## IMPACT TOPICS CONSIDERED BUT NOT ANALYZED IN DETAIL

Several potential impact topics were dismissed because the potential for impacts under any of the alternatives would be negligible. These topics are listed below, with an explanation of why they were not considered in detail.

### NATURAL RESOURCES

**Special Status Species – Threatened, Endangered, or Candidate Species.** Several state-listed and federally listed species are known to exist in and around Badlands National Park and use habitats in the park. The USFWS determined black-footed ferret, whooping crane, and western prairie fringed orchid can be found in the three counties that encompass the park (Appendix E: USFWS letter of consultation). The state of South Dakota lists sturgeon chub, bald eagle, peregrine falcon, whooping crane, black-footed ferret, and swift fox as threatened or endangered species. Most of these species occupy the park in limited numbers and would not be affected by this plan. The proposed alternatives have no impact because the listed species are either not present or unknown / unlikely to occur within the South Unit. The following provides brief descriptions of each species and their relation to the South Unit:

**Bald Eagle.** The bald eagle is federally listed as threatened and listed by the state of South Dakota as an endangered species. Bald eagles are known to inhabit Badlands National Park, but only 27 observations have been documented in the park since 1960 (NPS 2002). Most of these observations were between December and April, near water sources such as the White River or livestock dams or near prairie dog towns. Consequently, bald eagle use of the park is considered sporadic, uncommon, and unpredictable. Large congregations do not occur in this area, and there are no known regularly used winter perch sites, roost sites, or nest sites in the park. Given the limited, sporadic use of the park by bald eagles, it is unlikely that they would be affected by the actions of any of the alternatives.

**Whooping Crane.** The whooping crane, listed as endangered federally and by the state, is a migrant that occasionally uses the park's shallow, sparsely vegetated wetlands, wet meadows, and agricultural fields. No actions of any alternative would detrimentally affect the areas used by cranes. With their limited use of the park, there would be no impacts on whooping cranes under any of the alternatives.

**Peregrine Falcon.** The peregrine falcon is listed by South Dakota as endangered; however, the park's database indicates that there never has been a documented record of a peregrine falcon in the park, and the possibility that a pair would try to nest in the park is believed to be remote. Thus, the actions in the alternatives would not affect any rare migrant peregrine falcons passing through the park.

**Mountain Lion.** The range of the mountain lion, a species listed as threatened by the state, is believed to be expanding out from the Black Hills. The park's natural history database records only 37 documented observations of mountain lions in the park since 1960, or an average of less than one sighting per year from 1960 to 1995. Although sightings in the park have increased since 1995 to an average of two or three per year, most appear to have been young transient males probably emigrating from the expanding Black Hills population. No dens have been documented in the park.

Mountain lions have extremely large home ranges (territories can be greater than 500 square kilometers, depending on the mountain lion's age, sex, and season of the year) and there is a large land base in and around the park for them to use, if disturbed. Consequently, any impacts on mountain lions from the actions of any alternative would be unlikely.

**Sturgeon Chub.** The sturgeon chub, a state-listed threatened species that is found in large, turbid rivers, is known to occupy the White River in the park. None of the actions of the alternatives would be likely to affect chubs in the river or to affect water quality or flows that would indirectly affect the chubs.

**Swift Fox.** Badlands National Park falls within the estimated historic and current range of the swift fox, which the state of South Dakota lists as threatened. Before European settlement of the Great Plains, the swift fox was believed to be relatively abundant. It generally inhabits flat, open prairie areas. The decline of this species in its northern range is believed to have been the result of fur trapping and hunting, predator and rodent control programs, habitat loss, droughts, severe winters, and disease (Carbyn et al. 1993). By 1900 the swift fox was relatively rare in the northern plains.

Swift fox habitat in the park is concentrated in the Sage Creek area and along the northern edge of the North Unit. Computer modeling by the South Dakota Gap Project also predicts that Blindman Table, Stronghold Table, Plenty Star Table, Cuny Table, and the White River areas of the South Unit and the southeast corner of the Palmer Creek Unit are potential fox habitat. Swift foxes have been documented infrequently southwest of the South Unit in 1995 and in the national grassland adjacent to the North Unit in 1996, 1997, 1998, and 1999, primarily in the Upper Sage Creek area. In 1987 a family group of swift fox were trapped on the Pine Ridge Indian Reservation and translocated into the North Unit. Foxes also were released in the Cedar Pass area in 1988, but no sightings were subsequently reported.

In 2003, Badlands began a swift fox restoration project in the North Unit, with the release of 30 swift foxes from Colorado. From 2004 through 2006, an additional 84 foxes were released originating from Colorado and Wyoming. Due to the success of the initial reintroductions, no swift foxes were released after 2006 (NPS 2009c).

The current presence of swift fox in the South Unit is unknown and assumed to be limited. Therefore the alternatives would have limited impacts on the swift fox.

**Black-Footed Ferret.** The black-footed ferret is listed by both the federal and state governments as endangered. In 1987, only 18 individuals survived. However, an aggressive captive-breeding and reintroduction program has made progress in recovering the ferret population.

Black-footed ferrets, a member of the weasel family, are the only ferrets native to North America. These predators feed primarily on prairie dogs. Because they are solitary and hunt at night, ferrets are seldom seen. Black-footed ferrets live in prairie dog towns and cannot survive for extended periods outside of prairie dog colonies — ferrets would not be able to survive in the wild without the right number, quality, and distribution of prairie dog colonies (Licht 1997).

Black-footed ferrets rely on prairie dog burrows for shelter, family rearing, and escape from predators. Small ferret populations survive best on larger complexes of prairie dogs. Individuals may use small prairie dog towns for dispersal, but they appear to be unable to persist in them long-term. At its peak in 1984, the average density of the Meeteetse, Wyoming, ferret population (the last ferret population discovered in the wild before the recovery effort began) was about one ferret per 124 acres of habitat. The smallest prairie dog colony (which supported one ferret) was 31 acres, and only towns greater than 250 acres supported more than one adult. Colonies larger than 445 acres were continuously occupied by ferrets, while smaller colonies were used only seasonally (USFWS et al. 1994).

Black-footed ferret populations are characterized by short individual life-spans and high turnover rates of individuals. Few ferrets live longer than three years in the wild. They have many natural predators, including owls, hawks, eagles, coyotes, badgers, and bobcats.

At one time, ferrets were found throughout the Great Plains, including South Dakota. It is believed they never were abundant, although their underground nocturnal habits make it difficult to know for certain. The decline and near extinction of the species is attributed to three main causes: habitat conversion for agriculture, extensive efforts to control prairie dogs (which competed with livestock for available prairie forage), and sylvatic plague, a disease that wiped out large numbers of prairie dogs. These three factors also fragmented prairie dog colonies, making large areas of habitat unsuitable for black-footed ferrets. The

introduction of canine distemper probably also played a role in the decline of the species. In the Badlands area, after large carnivores such as bears and wolves were removed, the proliferation of coyotes (the main predator on ferrets in this area) may have increased predation on ferrets.

Little historical information is available about ferret densities in the Badlands National Park area. They probably were resident in some number; documented populations were found in neighboring Shannon and Mellette Counties in the 1960s and 1970s. It is not known when ferrets disappeared from the park, but the last confirmed sightings of individual black-footed ferrets in South Dakota were in 1979 and 1983.

Badlands National Park and the Conata Basin area of nearby Buffalo Gap National Grassland were designated as a reintroduction site in 1994 (USFWS et al. 1994). A total of 217 captive-bred individuals were released in the park from 1994 through 1999 (when the reintroductions ended) or an average release of 35 animals each year. Many of these ferrets died soon after their release because of high levels of avian and terrestrial predation. Predation also was a major cause in high natural mortalities of juvenile kits born in the wild. In spite of the loss of many of the released individuals, successful reproduction of ferrets has been detected every year. The minimum detected wild born production at Badlands from 1995 through 2001 was 29 litters consisting of 66 ferret kits.

Since the end of the captive born ferret releases in 1999, the ferret population has begun to disperse outward from the release sites to smaller adjacent prairie dog colonies in the park, on the national grassland, and onto private lands. This dispersal has resulted in an increase of prairie dog towns confirmed to be occupied by ferrets, with a corresponding decrease of ferret densities in the prairie dog towns used for the original release. The ferret population now is concentrated in the Kocher Flats and Roberts areas in the North Unit; however, one animal is also confirmed to be in the South Unit. Plague was detected in the North Unit population for the first time in 2009 and has affected the Kocher Flats population (NPS 2009b).

The park's ferret population reached a high in late summer 2000 with a minimum of 33 individuals, then declined to an estimated 14 individuals in the autumn of 2001. The ferret population is currently estimated at a minimum of 28 individuals in the North Unit (NPS 2009b). The black-footed ferret population in the North Unit of Badlands is currently considered stable and all suitable habitat is occupied (Greg Schroeder, pers. com. 2010). The current status and population of ferrets in the South Unit is unknown.

The park's reintroduced black-footed ferret population is designated a nonessential experimental population under the Endangered Species Act. This designation allows federal, state, and tribal resource managers more flexibility in managing this population. The proposed alternatives would have no impact because black-footed ferret are present in limited numbers within the South Unit.

**Western Prairie Fringed Orchid.** The western prairie fringed orchid is a federally listed threatened species that is typically associated with intact native prairie, but has been found on disturbed sites. It has not recently been documented anywhere in South Dakota.

**Water Resources.** Surface water is scarce in the South Unit. Water that does occur in the park is usually ephemeral, occurring after storms and spring melt, and is not potable due to naturally occurring dissolved minerals and very fine sediment. Water quality is believed to vary seasonally and from stream to stream, although the causes of these fluctuations are unknown (Black & Vetch 1998). The actions proposed in the alternatives would not be in the vicinity of surface water, or would be built to avoid areas with sensitive water resources. The application of mitigation measures and best management practices, such as the use of silt fences and erosion-control materials, would reduce the potential for water quality impacts. No long-term adverse impacts on water quality would be expected as a result of the alternatives being considered; consequently, water quality was dismissed as an impact topic.

**Floodplains.** The South Unit has relatively few perennial drainages and, thus, few floodplains. A

portion of the South Unit contains the regulatory 100-year floodplain of the White River, but none of the developments proposed in the alternatives would fall within the 100-year floodplain. The ranger residence is partially in the 100-year floodplain, but is not subject to extreme depths or high velocity floodwaters. In the event of a 500-year flood, the area of the garage would be in two to three feet of water. The concern here is fuel storage, which is a “critical action” subject to 500-year floodplain compliance. Either the fuel should be stored above that elevation, or the building should be protected to that level with a ring dike or levee. In accordance with Executive Order 11988, “Floodplain Management,” and NPS guidelines for implementing the Order, this situation is discussed in more detail in the “Statement of Findings” in appendix F. The NPS has determined that retaining the visitor facility, residence, and garage marginally in the 100-year floodplain of the White River is the most practical option. This determination was made based on the low likelihood of risk to visitors and staff from retaining the structures, the possibility of mitigating damage by adding a berm, dike, or levee around the structures, and the minimal effect of the facilities on the floodway and groundwater recharge.

**Wetlands.** Wetlands are rare in the Badlands because of the topography and low precipitation. Most wetlands are along or adjacent to rivers, streams, seeps, springs, old stock ponds, and ephemeral washes. Riparian woodlands within the floodplain of the White River, riparian shrub lands, and riparian/wet meadows all can be considered wetlands. The park also has artificial wetlands that developed near human-made ponds and dugouts. However, none of the developments in any alternative would be built in wetland areas.

**Prime and Unique Farmland.** According to the Natural Resources Conservation Service, U.S. Department of Agriculture, there are no prime or unique agricultural soils in Badlands National Park (Shurtliff, pers. comm., 2002). Therefore, this impact topic was not carried forward for analysis.

**Geologic Features and Processes.** The South Unit is located in the Great Plains Physiographic

Province in southwestern South Dakota. Elevations range from 2,460 feet (along streams) to 3,280 feet (on tablelands). Rivers flowing from the Black Hills carried sediment into the region and created the unique layers seen in the Badlands today. The Badlands strata record approximately 75 million years of earth history, containing both marine and terrestrial deposits. Processes including weathering, mass wasting and erosion formed the modern landscape, creating the distinctive badlands topography and landforms and expose the fossils that are visible today (NPS 2008a).

Some of the distinctive land forms include spires, pinnacles, hoodoos, monuments, buttes, and mesas, collectively known as the White River Badlands. These landforms are controlled by the characteristics of the rocks themselves (NPS 2008a). The Chadron Formation forms grey rounded mounds resembling haystacks. The rugged peaks and canyons are found in the Brule and Sharps Formations. These formations are silty, ash-rich sediments more resistant to erosion than the clay-rich Chadron strata.

The drainage networks of the White River, Cheyenne River and Bad River carry sediment away from the region. The White River cut a broad valley about 500,000 years ago and erosion began to carve the serrated badlands topography. Closely spaced tributaries flowing down the valley caused the valley sides to erode and migrate as a line of cliffs. This long, narrow spine of buttes is known as the “Badlands Wall.” The wall is just one of prominent geologic features that welcome visitors to the park every year.

Potential impacts to minerals and soils associated with the alternatives have minor or less, short-term impacts associated with construction activities. Overall, the proposed alternatives provide for a degree of protection for all geologic features and processes and would result in overall beneficial impacts; therefore, this impact topic was not carried forward for analysis.

**Air Quality.** Badlands National Park is considered a class I air quality area as defined in the *Clean Air Act* of 1977. A class I designation affords the greatest level of air quality protection

provided under the *Clean Air Act*. Only minimal deterioration of air quality is allowed under this designation. There are three air quality monitoring stations in operation at Badlands National Park. Two of these stations, the Badlands and Park Headquarters sites in the North Unit, have collected data on gases, meteorology and visibility since 1987. The Badlands site ceased monitoring in 2006 while the Park Headquarters site currently only monitors for visibility. A third station, the White River Visitor Center site, has monitored for gases, meteorology and particulates since 1997 and currently monitors for only gases (nitric oxide, nitrogen dioxide, oxides of nitrogen and sulfur dioxide) and particulates (PM10 and PM 2.5) (NPS 2010a).

The air quality in Badlands National Park is generally good. The amount of haze and other pollutants that affect the park's airshed depends on several factors, including the speed and direction of winds, the season, and the time of day. Visibility at Badlands sometimes is affected by haziness caused by fine particulates and gases. Historically, changes in weather patterns, winds, and smoke from fires have affected visibility in the area. Photography was used to monitor visibility from 1987 through 1995. The photographs indicate that on a clear day one often can see from a point in the park for 199 to 236 miles (320–380 km), whereas on a hazy day views can typically decline to only 37 to 50 miles (60–80 km). On an "average" day the visual range in the park is typically 62 to 81 miles (100–130 km) (NPS 1998). Interestingly, it is believed that pre-settlement visibility was lower than current levels because of frequent fires in the area in summer (NPS 1998). More recently, long-term visibility trends were calculated for park visibility monitors with at least 10 years of data (NPS 2009c). Results indicated a statistically significant trend toward improving visibility at Badlands. Despite this general improvement, however, future emissions of air pollutants could be increased by new developments currently under consideration in the region, including several new coal-fired power plants, coalbed methane production, oil and gas production facilities, and railroads (NPS 2006a). If these plans are carried out, some

pollutants would be blown into Badlands by the wind.

## WILDERNESS VALUES

There is no designated wilderness in the South Unit, and none is being proposed in this document. Therefore, this impact topic was not carried forward for analysis.

## CLIMATE CHANGE

The South Unit is located in a geographic area that is subject to long periods of drought. Although climate change may exacerbate drought conditions, there are no projects anticipated in any of the alternative that would be likely to involve actions that would produce a significant amount of greenhouse gas emissions or could be meaningfully connected to significant climate change effects.

## CULTURAL RESOURCES

**Historic Structures.** There are no known historic structures formally recorded in the South Unit. Therefore, historic structures were considered but not analyzed in detail.

**Cultural Landscapes.** The landscapes of the South Unit are likely to be considered an ethnographic resource and will be considered in the ethnographic resources section of the "Affected Environment" and "Environmental Consequences."

## INDIAN TRUST RESOURCES

The South Unit is held in trust for the OST by the federal government, meeting the definition of an Indian trust resource. Secretarial Order 3175 requires that any anticipated impacts on Indian trust resources from a proposed project or action by agencies of the Department of the Interior be explicitly addressed in environmental documents. The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes. There would not be any adverse impact on the

trust status of the South Unit land, and no adverse impacts are likely to occur to trust resources in the South Unit. Therefore, this impact topic was not carried forward for analysis.

### **NATURAL OR DEPLETABLE RESOURCE REQUIREMENTS AND CONSERVATION POTENTIAL**

None of the alternatives being considered would result in the extraction of resources from the park. Under all alternatives, ecological principles would be applied to ensure that the park's natural resources would not be impaired.

