Oglala Sioux Tribe

South Unit:
Buffalo Expansion Feasibility Study

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Written by:

RANCH ADVISORY PARTNERS

EXECUTIVE SUMMARY

Badlands National Park (BNP) is located approximately 70 miles from Rapid City, South Dakota. The South Unit, a unit of BNP and the focus of this document, consists of 133,300 acres.

Between 2006 and 2010, a planning team consisting of members of the Oglala Sioux Tribe (OST) and the National Park Service (NPS) worked to find a way to manage the South Unit. The resulting April 2012 *South Unit Final General Management Plan/Environmental Impact Statement* (GMP/EIS) describes the general path for South Unit management for the next 20 years or so. Under the *Preferred Management Option*, Congress would designate the South Unit as the first *Tribal National Park* to be managed by the National Park Service with special provision for Tribal involvement.

The 1976 MOA stated NPS' intentions to reintroduce species including buffalo to the South Unit. The purpose of this study is to assess the feasibility and dynamics of how a conservation- and culturally-oriented buffalo herd would fit into the management of the South Unit. While BNP would manage the land, OST would own and oversee buffalo in the South Unit. Any revenues generated from live animal sales or hunts would go directly to the Tribe.

Ideally, a herd of roughly 1000 or more total buffalo could roam the South Unit. This number arose through conversations that occurred among BNP, OST, OST Lands Office, Bureau of Indian Affairs (BIA), Oglala Sioux Parks and Recreation Authority (OSPRA), and recommendations from the bison conservation community. Further, these parties expressed interest in creating a free-roaming herd of buffalo that would largely be unmanaged. It was this target of 1000+ head and the free-roaming nature of the herd that defined much of the analysis of the landscape, its carrying capacity, and the grazing management strategy employed. In an effort to maintain the wellbeing of the resource, stocking the area with buffalo was intended to be conservative so limits to the resource were not pushed.

Since the South Unit's existing fences are largely unable to contain buffalo, new fencing must be constructed wherever buffalo graze. These fences must meet BNP standards to contain buffalo, but also allow movement of migrating wildlife herds. Further, new corrals must be constructed to enable handling of buffalo during fall buffalo works.

Given the landscape, its boundaries, the desire to create a wild, free-roaming herd of buffalo numbering over 1000 head, and the uncertainty regarding inclusion of ideal buffalo grazing lands within the management area, this document identifies four possible buffalo management alternatives. Extensive analysis was conducted of existing forage production data, including comparable stocking rates, to arrive at the carrying capacity of the four alternatives. Each of them will possess different management strategies, fence requirements, grazeable acres, and herd sizes. They are described briefly below:

Alternative A: The Stronghold: Highway-to-highway implementation. This alternative presents the "original idea" of utilizing the Stronghold for buffalo. The alternative involves 59,601

grazeable acres, 1072 buffalo in the herd, with 74 miles of fence required (plus corrals). This alternative most closely matches the ideal of a free-roaming, low-maintenance buffalo herd.

Alternative B: The Herding Alternative. This alternative arises due to uncertainty regarding inclusion of the vast and highly productive Range Unit 506. Should the 506 be excluded, then additional lands may need to be incorporated into the buffalo program to keep the herd size up. This alternative would require buffalo to be herded from one grazing area to another, including moving animals under Highway 27 (to an area known as the Palmer Creek Unit) to be implemented. It involves 41,607 grazeable acres, 753 buffalo in the herd, and 79 miles of fence.

Alternative C: The Big Picture. This alternative implements Alternative A (including Range Unit 506), but also adds a Range Unit from the Palmer Creek Unit (514), representing the largest-acreage alternative. The alternative includes 63,325 grazeable acres, 1156 buffalo, with 88 miles of fence required. Buffalo would still likely need to be herded under Highway 27 to reach the Palmer Creek Unit.

Alternative D: The Western Option. This alternative arises from the realization that loss of the highly productive Range Unit 506 essentially means that several other smaller Range Units of lower productivity have limited value to the buffalo program. Thus, their inclusion is unnecessary. This alternative includes only the westernmost range units of the South Unit and represents the option that would be the smallest, yet easiest and cheapest to implement. The alternative includes 28,010 grazeable acres, 485 buffalo, and 40 miles of fence. This alternative may offer a viable alternative for initially stocking the South Unit with buffalo, but has profound implications for the visitor experience in the Tribal National Park, for buffalo would graze far from the discussed visitor center, which would lie to the eastern portion of the Park.

Depending on the alternative implemented, the OST could expect annual buffalo revenues, including animals for tribal use, ranging from $84,000 to $203,000 and total economic benefits from buffalo grazing in the South Unit ranging from $212,000 to $416,000.

In summary, Alternative A presents the greatest advancement toward the vision, values, and objectives of this effort. It would be the easiest to implement from a managerial perspective, yet blends the greatest revenue per buffalo cow with the cheapest cost per cow, while achieving the vision of running over 1000 free-roaming buffalo.

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I. ACKNOWLEDGEMENTS

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II. INTRODUCTION

Project Background

Badlands National Park (BNP), established in 1939 (as Badlands National Monument) and redesignated in 1978 as a National Park, is located approximately 70 miles from Rapid City, South Dakota. Most of the park is bordered by Buffalo Gap National Grassland, the Pine Ridge Indian Reservation, and private lands, primarily ranches and farms. The entire park is comprised of 242,756 acres, 64,144 acres of which have been designated as Wilderness. The South Unit, which includes the Palmer Creek Unit, consists of 133,300 acres.

The lands comprising the South Unit, located within the boundaries of the Pine Ridge Indian Reservation, were taken through condemnation to create a Bombing Range to train servicemen for World War II. The Bombing Range, consisting of 341,725 acres, was created in 1942 and displaced 890 families in the Pine Ridge Indian Reservation. In 1968, the Bombing Range was declared excess property, and Congress conveyed the lands to the Oglala Sioux Tribe (OST) with the stipulation that two largely undeveloped, remote tracts of lands totaling 133,000 acres (the South Unit) be held in trust and administered by the National Park Service (NPS) as part of the legislation to redesignate Badlands National Monument to Badlands National Park.

In 1976, the Secretary of the Interior and the OST signed a Memorandum of Agreement detailing the terms of management for the South Unit as an extension of BNP. The agreement remains, but has not proven to be an effective management framework acceptable to either the OST or the NPS.

Between 2006 and 2010, a planning team consisting of members of the OST and the NPS worked to find a way to manage the South Unit. The resulting April 2012 *South Unit Final General Management Plan/Environmental Impact Statement* (GMP/EIS) describes the general path for South Unit management for the next 20 years or so.

Under the *Preferred Management Option*, Congress would designate the South Unit as the first *Tribal National Park*. Federal environmental and historic preservation laws like the Endangered Species Act, the National Environmental Policy Act of 1969, and the National Historic Preservation Act of 1966, would continue to apply. The TNP will be a NPS unit and will be managed by the NPS. Special provisions for preferential tribal hiring and special inclusions for tribal culture and customs will be included. It is intended that the TNP will have an NPS budget with base funding for much of the equipment, staff, and other operational costs for the buffalo program, and that projects related to buffalo restoration would be subject to internal NPS project funding opportunities. Costs of having buffalo on the TNP will not be borne by the buffalo program, but rather by the NPS.

The purpose of this study is to assess the feasibility and dynamics of how a conservation- and culturally-oriented buffalo herd would fit into the management of the South Unit.

Sources: (NPS & OST, 2012; OST & NPS, 1976)

Statement of Purpose

"The Buffalo represents the people and the universe and should always be treated with respect, for was he not here before the two-legged peoples and is he not generous in that he give us our homes and our food? The Buffalo is wise in many things, and thus we should learn from him and should always be as a relative with him." (Black Elk, Oglala Holy Man as quoted in the Sacred Pipe, Joseph Epes Brown, 1953)

"Buffalo have for many thousands of years provided our people with food, shelter, and clothing. We depended on them for our life. We followed them wherever they roamed. It is from the buffalo that we received our seven laws that we live by. They gave us our sacred pipe. It is in their image that we make camp and to pray in our Sundance.

"Today, it is our responsibility to ensure that our relatives have plenty of food, water, and a place to roam. That is how they live. As Lakota people, we must continually strive to make sure the buffalo survive.

"It is our best intention to maintain these buffalo in a wild, respectful manner. This includes little to no handling, unless necessary. This includes no castration, no dehorning, no ill treatment. These animals are considered a close relative to the Lakota and will remain as a respected, sacred and important part of the OSPRA mission" (Mesteth, no date; OSPRA, 2009).

From the perspective of the Lakota people, there are four overarching reasons to have buffalo:

1. The Lakota Oyate strongly believe in the connection amongst all things. This concept stands out foremost in OST's management of buffalo and elk. Our purposes begin with traditional cultural activities or practices and end with the same. Cultural activities, or practices include the kill ceremony, sundance, healing, naming, pow wows, memorials, and educational purposes. We try to provide each sundance with a buffalo to utilize in the many different sacred ceremonies or cultural activities. We provide material to local artists for their crafts or to crafts people who make various articles of clothing, ceremonial ware, games, etc. We also invite local educational institutions to come and record these activities on video or still photos with a narrative describing how an item is made and its purpose.

2. Aesthetic value is a term used to identify the feeling of pride, goodness, or whatever comes in just having these magnificent animals roam our country once again. The idea that we, as Lakota people who once depended on these animals as a staple commodity, can give back to them that provided so much (house, food, clothing, recreational/leisure activities, etc.) is comforting. We accomplish this in part through guided tours through our pastures and interviews or lectures. We also encourage our local schools to bring our children to the annual round up in order for them to know that the OST has a buffalo/elk herd in which is managed for them.

3. Nutritional sustenance is provided through our meat donations to funerals for the purpose of feeding friends and relatives at the wakes, through providing meat for cultural ceremonies and celebrations where the public is invited to participate in the feed, and through meals for the elderly program.

4. Economic contribution to the reservation economic system is accomplished through providing employment, purchasing services, leasing of lands, trophy hunting (buffalo and elk), and buffalo sales. Many times we provide employment to individuals on a daily, weekly, and monthly basis or through contractual services. Occasionally, we provide employment through small grants for specific purposes/projects. We lease large areas of land for the buffalo to roam. We bring in dollars through buffalo sales at local auctions or sales. These funds are utilized by paying our annual lease payment to the Tribe or individuals and by funding small in-house projects (Mesteth, no date).

From the perspective of the National Park Service, there are 5 overarching reasons to run buffalo on the South Unit:

1. Establishing another large conservation herd of bison on the Great Plains landscape.
2. Protecting genetic diversity and genetic integrity of bison.
3. Restoring the link between native people and bison.
4. Restoring bison to its ecological role in the Great Plains.
5. Work toward Department of Interior's Bison Conservation Initiative for restoring bison to the Great Plains (Kenner, 2013).

Vision Statement

When managing buffalo on the South Unit, OST and NPS will:

- Abide by the laws and regulations of the NPS and help achieve the grandeur of a national park.
- Achieve a herd of more than 1000, free-roaming buffalo.
- Advance Department of Interior's vision of achieving additional large herds of buffalo on the Great Plains.
- Utilize traditional knowledge and cultural practices in the management of the buffalo.
- Ensure disease-free, healthy animals through proper animal husbandry and responsible range management, thereby ensuring adequate food, water, and space for the buffalo.
- Foster the relationship between the buffalo, the land, and the Lakota Oyate people.
- Generate income through creative management of our land and resources.

Goals and Strategies of this Feasibility Study

The goals and strategies for this feasibility study are as follows:

1. Enable OST and NPS to understand how to stock buffalo on the South Unit, how they could be managed, and what the logistical and staffing issues surrounding management of those buffalo would be.
2. Enable OST and NPS to understand the financial implications of running buffalo on the South Unit.
3. Enable OST and NPS to understand the cultural and social implications of running buffalo on the South Unit.
4. Enable OST and NPS to understand the relevance of the South Unit's buffalo herd to North America's restoration efforts.

Scope

This feasibility study was intended to examine the science (soils, water, vegetative production, carrying capacity, stocking rate) and financial implications (infrastructure costs, buffalo sales, marketing) for running buffalo on the South Unit. The document focuses on the best means of blending ecology and finance for running a successful buffalo program. With this effort a question has been asked: *If buffalo are to be run on the South Unit, how should that best be done?* The pages that follow attempt to answer that question.

Multiple other issues affect this unit's buffalo herd, as well as creation of the Tribal National Park. These issues were beyond the scope of this study, and they include the following:

1. Several tribal ranching families currently run cattle on South Unit range units. Establishing the TNP and/or running buffalo on the South Unit will likely displace them. This document does not address their plight, or finding replacement forage for them.

2. Those ranching families pay grazing fees to the Tribe. This document does not address issues and ramifications surrounding those grazing leases if tribally-owned buffalo are to replace cattle.

3. The possibility exists to create a buffalo program on the South Unit prior to legislation creating the TNP. This document does not address the ramifications of having one without the other.

4. Upon creation of the TNP, a potential economic windfall could arise for area communities and the Tribe. The TNP could serve as an economic engine creating such opportunities as eco-tourism, concessions, and accommodations for guests. This document does not address the economic implications surrounding such opportunities.

5. A new visitor center, driving tours, and other attractions could be included in the new TNP. This document does not address proper locations for those amenities.

6. The South Unit was formerly used as a bombing range by the U.S. Military. This document does not address safety issues surrounding unexploded ordinance for both buffalo and people.

7. The South Unit contains known fossils and artifacts, some of which are lying on the soil surface. This document does not address the preservation of those fossils and artifacts.

S.W.O.T. ANALYSIS (Strengths, Weaknesses, Opportunities, Threats)

This is an analysis of managing buffalo in the South Unit.

Opportunity	**Threats**
Creation first Tribal National Park	Drought
Strengthen tribal connection to buffalo	Loss of BNP surplus animals
Provide educational opportunities for Tribal and non-tribal members of the general public	Potential future loss of North Unit gate receipts
Buffalo hunting opportunities	Potential lost grazing lease income
Develop local sales of meat	Potential buffalo disease issues
Ecotourism – non consumptive uses	
Teach the history of the Lakota people	
Contribute to bison conservation and restoration in North America	
Further the Tribe's land stewardship and buffalo management capability	
Provide a stimulus for economic development on the reservation	
Opportunity to support Department of Interior's Bison Conservation Initiative	
Strengths	**Weakness**
Cultural commitment to buffalo program	Land leases, cost and control
Commitment of NGO's for conservation buffalo herd	Lack of infrastructure: fences, corrals, roads, etc.
Current gate receipts from BNP North Unit	Cost of new fencing
Hearty and healthy buffalo sourced from BNP	Lack of equipment for buffalo program
Job opportunities with NPS funding	Delay in building herd until harvestable
Native grazer restored to native prairie	Potential conflicts with allotted lands
Increased access to internal NPS funding	Lack of consensus within Tribe

III. Resource Summary

A. General Property Location and Description (Maps in Appendix)

The South Unit lies in the northwest corner of the Pine Ridge Reservation in Bennett and Shannon Counties, South Dakota. Elevation of these rangelands ranges from 2500 to nearly 4000 feet with average annual precipitation of 16 to 18 inches, which is highly variable in wet/dry cycles that can last multiple years. Average annual frost-free period ranges from 130 to 160 days. Soils vary widely in this rugged landscape dominated by erosive badlands soils mixed with highly productive grasslands and slopes ranging from flat to 90%. Vegetative productivity varies from no production on some soils to 2500 pounds per acre on nearby soils (Figure 1). Vegetation includes a mix of cool-season and warm-season grass, forbs, shrubs, and trees (USDA, 2013).

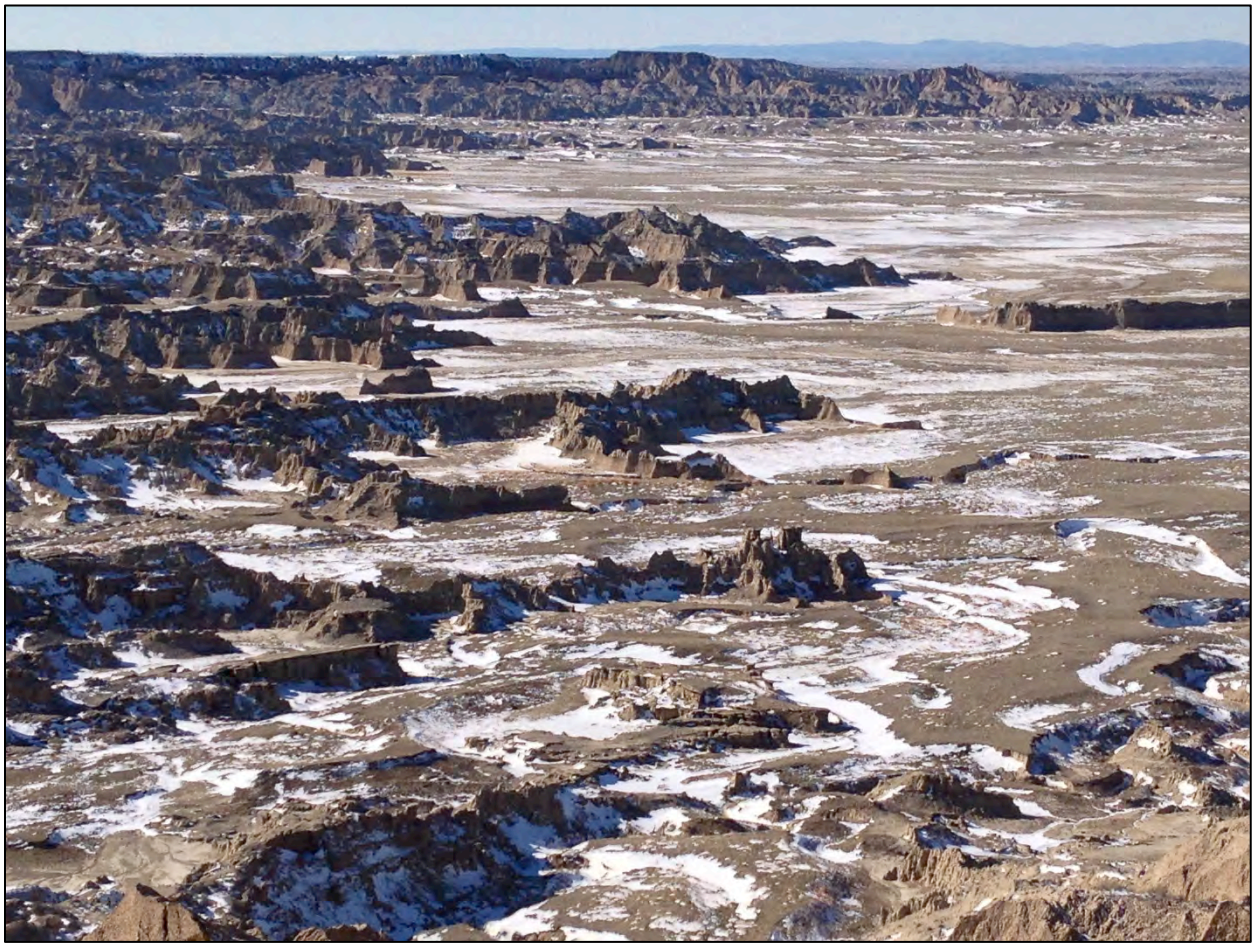


Figure 1: A photo of Range Unit 503, as seen from "The Slide" atop Cuny Table. Erosive and low-production badlands formations are to the left, while productive grasslands lie on the flats to the right. Photo taken February 2013.

B. Land Base

The South Unit's land base consists of roughly 133,300 acres of badlands formations, grassy tables, juniper-topped ridges, rolling grasslands, ephemeral streams, and wetlands. Such diversity of terrain provides habitat for swift fox, prairie dogs, rabbits, pronghorn, elk, raptors, and a variety of songbirds. Bighorn sheep also call the South Unit home, and they may be seen in the cliffs and tables. Figure 2 below shows an aerial photo of the South Unit.

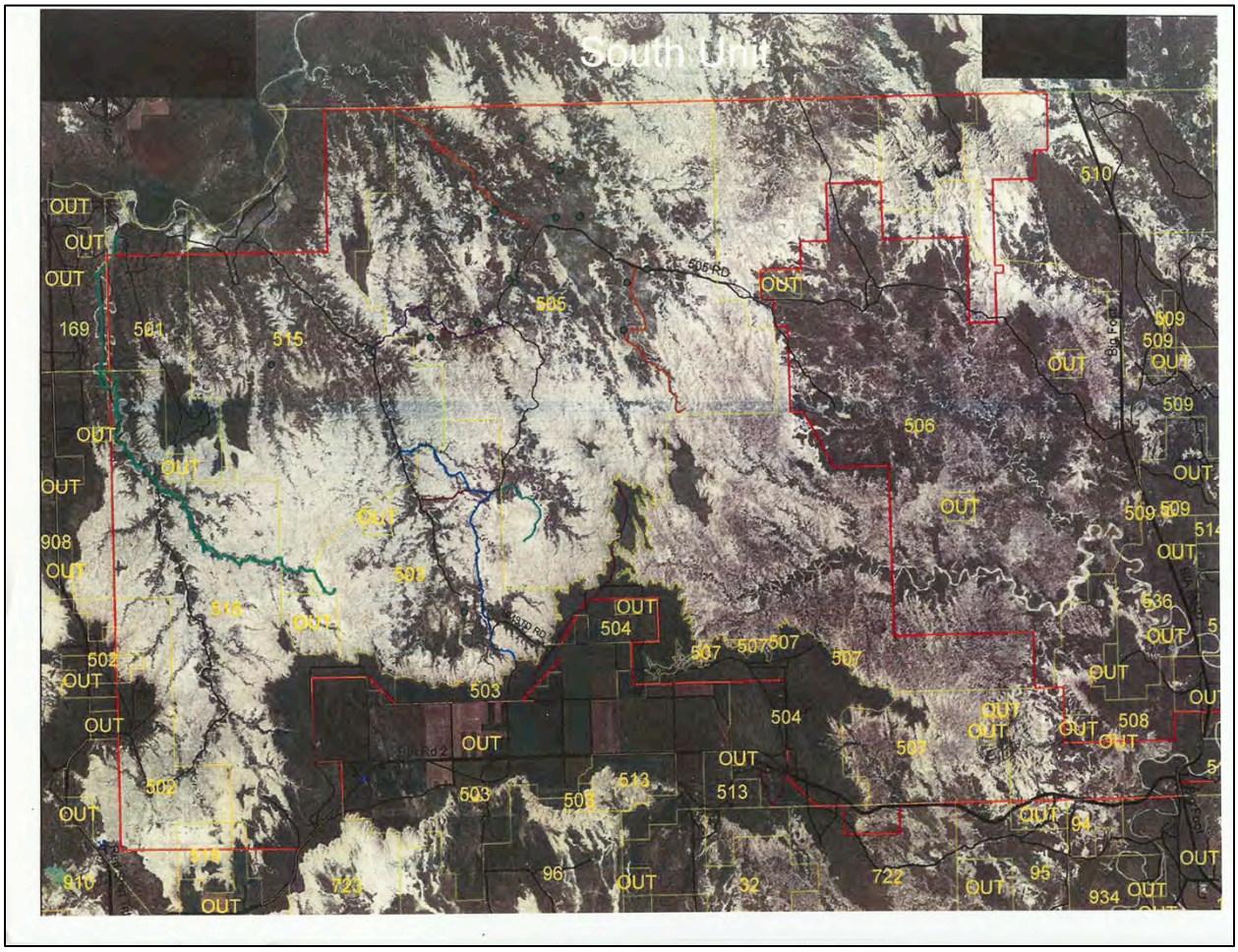


Figure 2: An aerial photo of the South Unit (without the Palmer Creek Unit, which lies to the east). In this roughly 100,000-acre area, badlands-type soils are seen as white colors. Production there is relatively low. Green areas feature the more productive soils, many of which lie outside the South Unit's boundary (shown by the red line). Map courtesy OSPRA.

The Bureau of Indian Affairs (BIA) divided the South Unit into *Range Units* (RUs) to facilitate livestock grazing. Boundaries of these 15 range units often follow topography, as tall badlands walls often make good fences for keeping cattle in the proper place. Some internal fencing controls movements of livestock between the various range units, but no buffalo-worthy fencing exists around the South Unit's perimeter. Those BIA range units may be seen in Figure 3 below.

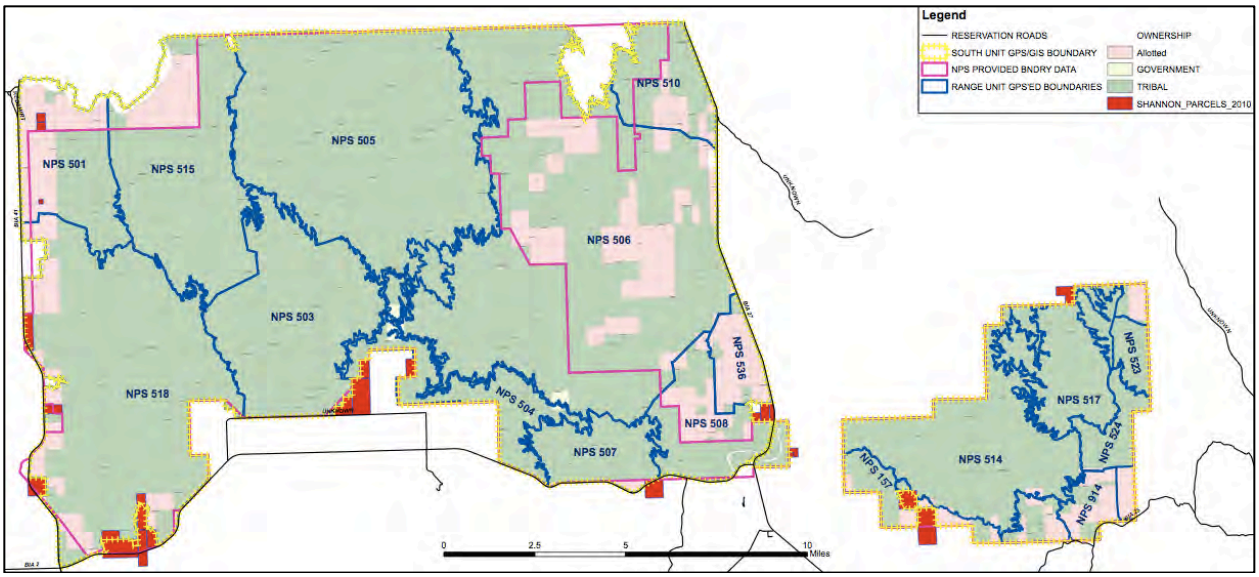


Figure 3: Map of the South Unit showing range unit numbers in blue, and blue lines also denote range unit boundaries. Those boundaries may be badlands walls or fences. The Palmer Creek Unit, to be included in the Tribal National Park, lies to the east. Buffalo may or may not be run in Palmer Creek. Note that RU 505 is managed by the OST Lands Office. Photos below will show portions of these range units to highlight terrain, soils, and vegetative productivity. Map courtesy BIA.

C. Land Base Description

A brief photo description of the South Unit's land base follows:

Figure 4: This photo, taken in RU 505, shows badlands soils. These highly erosive soils not only produce no vegetation, but they may be found over a large percentage of the South Unit. Buffalo are likely to utilize these areas minimally.

Figure 5: This photo, taken in RU 506, shows a flat containing silty clay soils capable of producing 1800 pounds per acre of production in normal precipitation years. These soils also compose a large percentage of the South Unit. Such soils form most of the grazeable acreage in the unit and should be attractive to buffalo. The predominant grass in this photo is Western wheatgrass, a desired species for the area.

Figure 6: Many South Unit soils also tend to flood frequently. This photo, taken in RU 503, shows snowmelt from a February storm spreading, pooling and slowly meandering across the flat landscape. The silty-clay soils drain poorly, resulting in low vegetative production. Buffalo will likely utilize these areas minimally.

Figure 7: This photo, taken in RU 506, shows rolling hills lying in the shoulders between rugged badlands and the bottom flatlands. The soils tend to be relatively low in production and compose a large percentage of the South Unit. Buffalo will likely utilize these areas to transition from one grazing area to another.

D. Rangelands (Detailed sheets in Appendices B and C)

The South Unit's rangelands contain a wide variety of soil types. For example, RU 518 in the southwest corner of the South Unit contains over 25 soil types alone. Vegetative productivity varies widely in these settings, and the rangelands provide mixed ability to feed grazing animals and provide cover. The large, open flats featured in Figure 5 above contain the bulk of the Unit's useful rangelands for buffalo forage, while several of the badlands soils offer little to no forage or cover. Appendices B and C offer detailed descriptions of soils, soil productivity, percentage of each soil within a range unit, and acres of each soil.

E. Rangeland Assessment

As part of this feasibility study, observations were made regarding health and performance of the rangelands. To be shared below, these observations relate mostly to the flatter, more productive areas of the South Unit, for they will compose the bulk of the grazeable acres for buffalo. While the rugged badlands soils provide some utility for buffalo, from the perspective of evaluating land performance and health for meeting the needs of the herd, these badlands soils become less interesting (this says nothing about their uniqueness, their beauty, their ruggedness, and their "coolness"). Simply put, when meeting the demands of a potential buffalo herd in the South Unit, more focus was placed on the more productive areas found there.

When assessing rangelands, the performance of four ecosystem processes is often evaluated. Those four are the **water cycle**, **mineral cycle**, **energy flow**, and **succession**. Each of these suggests the performance of land in a way that may be identified through qualitative indicators. Since the South Unit was toured in February 2013 (in the dormant season), no comprehensive evaluation of rangeland health was undertaken for this feasibility study, but observations were made to determine rangeland health. These observations are shared below and are broken by ecosystem process.

On the South Unit's flats (which, again, means excluding the erosive badlands soils), the **water cycle** appeared to be functional. Little bare ground was observed in these flats, minimal erosion occurred, and minimal plant pedestaling was found. The soils appeared ready to accept any precipitation falling from the sky (rather than allowing erosion-causing runoff). These were positive findings.

The **mineral cycle** was mixed. With this process, the speed of mineral cycling through the system is considered, and in some areas, minerals appeared to be cycling rapidly. Indicators of such cycling included rapid dung breakdown, the mixing of litter (old plant material lying on the soil surface) with soil, uniform litter distribution, and a good litter amount. In other areas, however, dung piles appeared to be aging, and litter appeared to be lying idly on the soil surface. In such settings, litter and dung appeared to be oxidizing by weathering, rather than decomposing biologically. In these areas, the mineral cycle was functioning slowly, and reductions in plant productivity may result. It is in the examination of the mineral cycle where the first suggestions that past grazing management by cattle has not been optimal. These indicators suggest a problem with grazing distribution, where cattle graze their favored areas repeatedly (often near water points) and neglect other grazeable areas of the range units. Should cattle be removed

from the South Unit and be replaced by buffalo, this same lingering near water is expected to continue.

Energy flow examines plants' ability to harvest solar energy and photosynthesize that energy into useful growth. In the South Unit, energy flow was varied. In some areas, plant vigor was high, where plants achieved tall stature, produced seed, and were firmly rooted to the soil surface, even in the dry year of 2012. The plant canopy was abundant (even in winter), where much sunlight energy was intercepted by living plant leaves, rather than striking the soil surface and lost. Plants here were also well distributed across the soil surface, and little opportunity for encroachment by noxious weeds existed. Conversely, other areas displayed reduced plant vigor, a minimal plant canopy, and reduced plant distribution. This imbalance in energy flow is further suggestion of poor grazing distribution within the range units. As examples, consider RU 501 (on the northwestern corner of the South Unit) and RU 506 (on the eastern side). On the 501, cattle tended to water from areas near the river and thus spent much time there grazing. Use by cattle (forage utilization, dung piles) appeared to be high there. Away from water in the more southerly reaches of the 501, use by cattle (reduced signs of grazing, fewer dung piles) was less, and more standing vegetation was observed. On the 506, cattle tended to linger on the eastern portion of the range unit near water, while the western portion of the unit appeared to receive little grazing. These, again, are indicators of a grazing distribution issue.

Within the **successional process**, a mix of grasses, forbs, shrubs, and trees was found across the grazed pastures. Some areas contained a mix of grasses, such as little bluestem, western wheatgrass, needle-grasses, and three-awn. The South Unit's heavy soils should be expected to support more western wheatgrass than OSPRA's grazing areas near Allen and Slim Buttes. Few noxious weeds were seen in the tours of the South and Palmer Units.

IV. Expansion Feasibility and Alternatives

A. Buffalo Feasibility Background

How many buffalo should call the South Unit home? The answer to this question depends on a few key variables. They are: 1) Number of grazeable acres available; 2) Stocking rate (acres required to feed a buffalo cow and her calf for a year); and 3) the grazing strategy. Each of these will be discussed below.

At the time of this writing, the actual acreage to be devoted to buffalo grazing in the Tribal National Park was unclear. Due to uncertainty surrounding the inclusion of various allotted land parcels (those owned by multiple tribal families and the OST within the TNP), no exact map of grazing acres may be generated. This uncertainty especially surrounds RU 506, that vast and productive parcel lying on the South Unit's eastern side. The 506, along with three other range units in this area, hosts large inclusions of allotted lands and large ranching operations. The 506 represents a large portion of the Unit's available grazeable acres and forage production, and without that range unit, the ideal herd size of the South Unit becomes greatly diminished. Through development of this feasibility analysis, different options and scenarios have been identified that would include the 506 and surrounding range units, as well as exclude the 506 and involve other range units to the east. Such inclusions are an attempt to increase the grazeable acres and thus the herd size for the South Unit. These scenarios and options will be presented below as alternatives, and there are four of them.

Note the Range Unit 505 is managed by the Tribal Lands Office. All figures concerning acres, grazeable acres, and stocking rate were provided courtesy BIA.

B. Proposed Alternatives for Buffalo Introduction to the South Unit

The four alternatives to be described below are named as follows:

- Alternative A: *The Stronghold Unit – Highway-to-Highway*
- Alternative B: *The Herding Alternative*
- Alternative C: *The Big Picture*
- Alternative D: *The Western Option*

1. Alternative A: *The Stronghold Unit – Highway-to-Highway*

The original idea of running buffalo in the South Unit involved creating a free-roaming herd of buffalo that drifted the landscape and grazed as they saw fit. The intent was to create a large space where buffalo could be buffalo, management would be minimal, and visitors could see them in this setting. That idea included utilizing all the range units in the Stronghold Unit of Badlands National Park *excluding* those in the Palmer Creek Unit. One large pasture would be available, with BIA Route 27 as the east boundary, BIA route 2 as the southern boundary (with the exception of private lands, homes, and builidings), BIA Route 41 as the western boundary, and the north boundary was the defined north boundary of the Pine Ridge Reservation. This configuration may be seen in Figure 8 below and is often known as "The Stronghold Area."

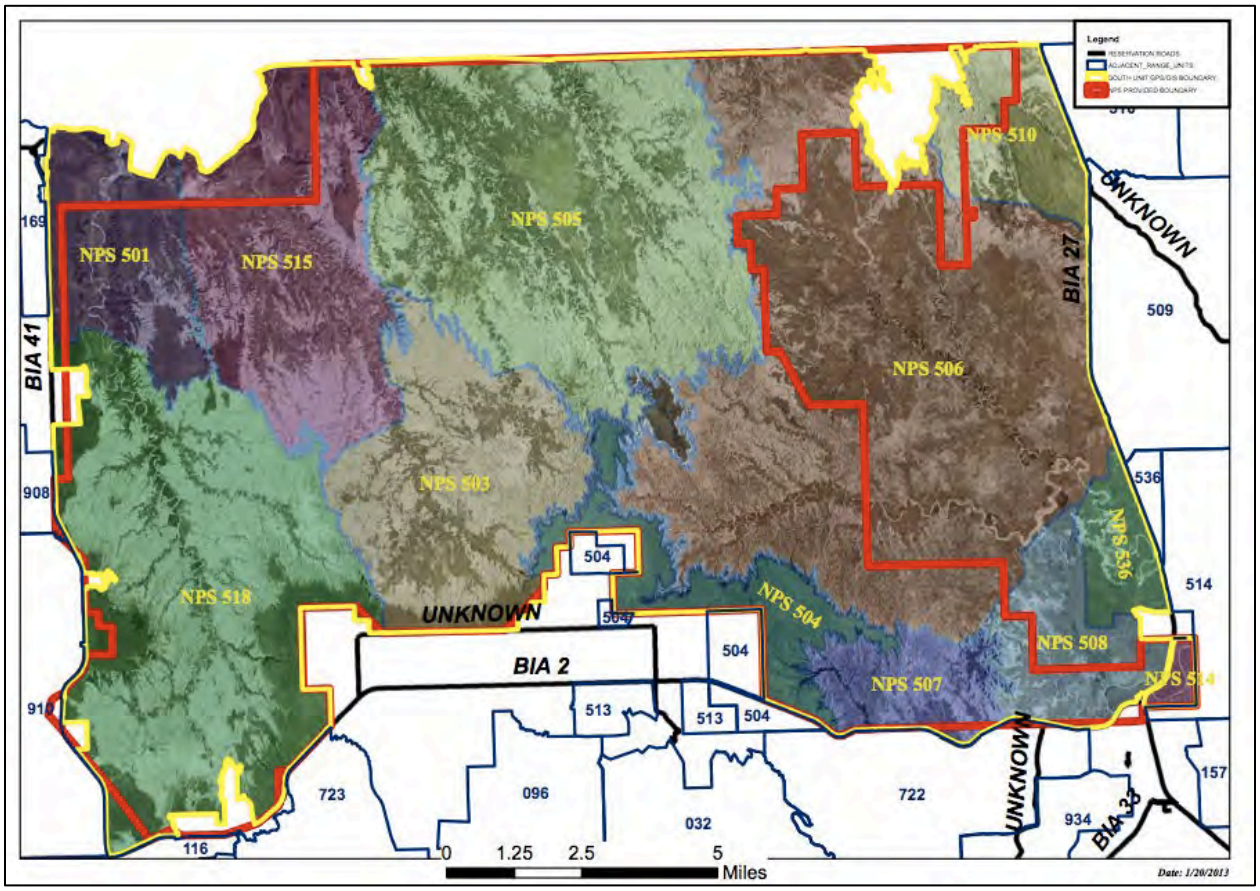


Figure 8: Map of Alternative A: The Stronghold Unit. This map shows the land base that composed the original idea of having a free-roaming herd of buffalo in the South Unit. Dark red line is the Tribal National Park boundary. The heavy yellow line is the originally-defined boundary for buffalo. Yellow print denotes specific range units. A version of this landscape is identified in this document as the preferred alternative. Map courtesy BIA.

Alternative A includes the following range units: 501, 503, 504, 505, 506, 507, 508, 510, 515, 518, and 536. Roughly 100,000 acres are involved in this scenario.

Alternative A: Quick facts	
Grazeable acres:	59,601
Year-round herd size (AUs):	1,072
Miles of fence required:	74

Implementing this alternative as defined by Figure 8 requires adjustment of boundaries, for homes, businesses, and churches lie within that heavy yellow line. A setback will be required between buffalo and these developments. Specifically, the grazeable portions of RUs 501, 515, and 518 should reflect the TNP boundary (the red line in the Figure above), rather than the actual range unit boundary. Further, altered boundaries will be required in RU 536 for more homes are found there. The grazeable acres, stocking rate, herd size, and management strategy for this alternative will be described in greater detail in the carrying capacity section below.

Alternative A, of the four shown in this document, presents the alternative that most delivers the values and objectives of running a large herd of free-roaming buffalo in the South Unit.

2. Alternative B: *The Herding Alternative*

As stated previously, RU 506 offers a high percentage of grazeable acres as well as good forage. However, due to the high concentration of allotted lands within the 506, OST may not include that RU, which led to the creation of Alternative B. Further, should the 506 be excluded, little reason exists to include the adjacent 510, 536, and portions of the 508. These exclusions greatly reduce acres available for grazing and also the buffalo herd size.

In an effort to include more acres from the potential loss of the 506, and thereby maintain the herd size to somewhere near 1000 head, additional areas were sought in the nearby Palmer Creek Unit. The Palmer Creek Unit lies to the east (see map in Figure 9 below) and contains abundant badlands formations. The Palmer also contains RU 514, which would offer some forage if the 506 is not included for buffalo.

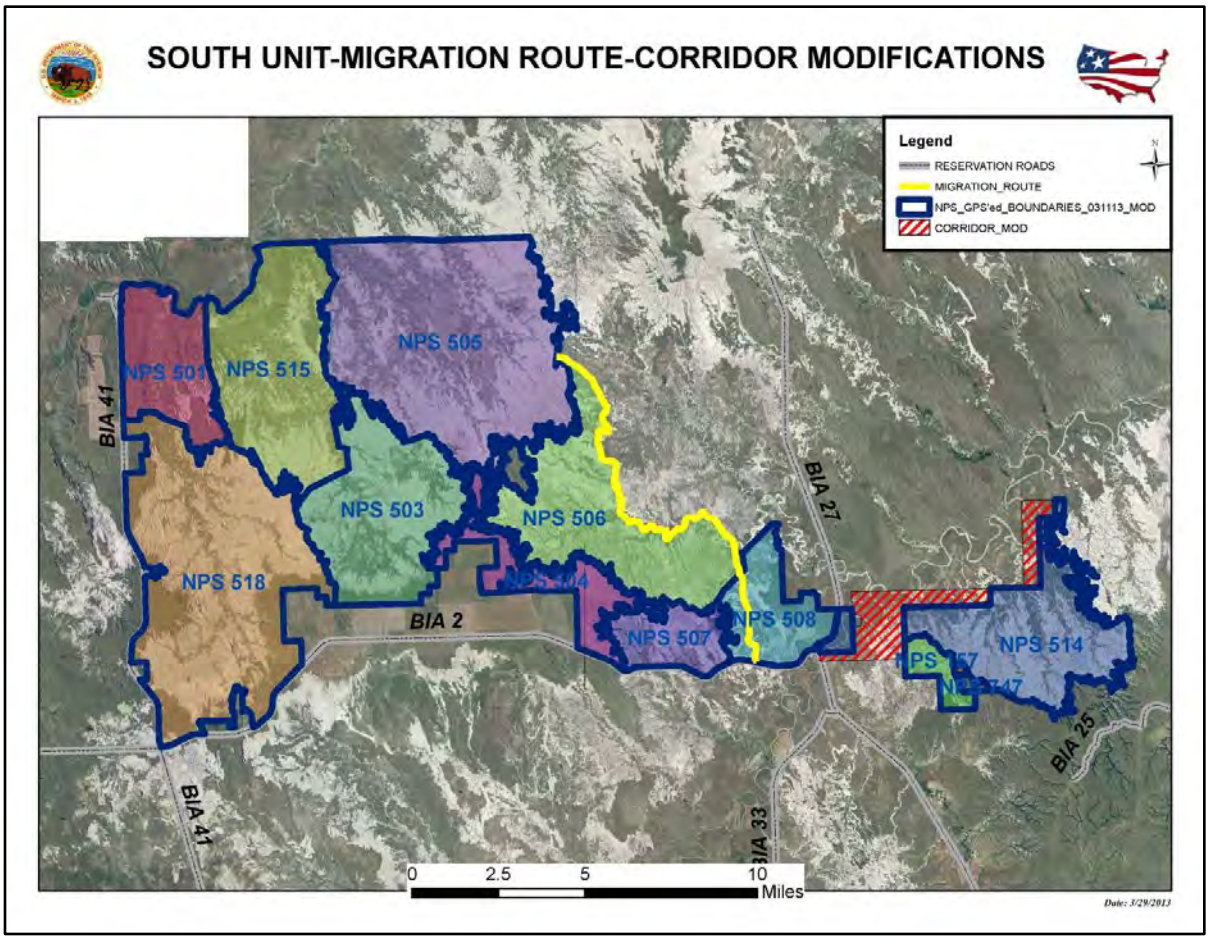


Figure 9: This map shows the land base of Alternative B. The alternative assumes the loss of most of the highly productive and desirable RU 506, as well as the adjacent 510, 536, and most of 508. The Palmer Creek Unit, lying to the southeast, offers some replacement acres and forage, and RU 514 is most attractive. A portion of 506 would need to be included under this alternative, for no viable means exists for buffalo to travel from the Palmer Creek Unit to the western reaches of the Stronghold Unit without creating a travel corridor. Under this alternative, buffalo must be herded from one grazing area to another. Map courtesy BIA.

Alternative B: Quick facts	
Grazeable acres:	41,607
Year-round herd size (AUs):	753
Miles of fence required:	79

Under Alternative B, buffalo would need to be herded to/from the Palmer Creek Unit to find fresh forage. Buffalo would travel from the 508 under BIA Route 27 and arrive at the Palmer's 514. Upon consuming the forage in the Palmer, they would be herded back to the Stronghold's larger grazing areas toward its northern and western sides.

In order for this alternative to work, a portion of the 506 would need to be included, for no means exists for buffalo to travel between the Palmer Creek Unit and the western reaches of the Stronghold (501, 503 515, 518). Specifically, due to terrain and badlands formations (see Figure 10), buffalo could not walk from the Palmer Unit through the 507 and 504, and eventually arrive at the 503. They would need to travel north through portions of the 508 and 506 to eventually reach a gate (called "Cottonwood Pass") in the 505 that would allow passage into the western reaches of the Stronghold. In essence, a travel corridor would need to be constructed to allow movements of buffalo through the widespread grazing areas of the Stronghold. This travel corridor was examined in February 2013. While difficult, buffalo could pass through this travel corridor and make the journey from Palmer to the western portions of the Stronghold if they were herded. The corridor is seen in Figure 9 above as a black line, which would require fencing.

Figure 10: The badlands wall on the boundary of RUs 507 and 504 that prevents buffalo from travelling east to west across the southern portion of the South Unit. This wall would require use of portions of the 506 for buffalo to reach the western Stronghold.

Creation of the travel corridor in RUs 508 and 506 would require fence construction along this entire length, totaling 11.4 miles. Fence construction would be difficult in these broken soils and rolling hills of both range units, but would be possible. An existing two-track road could be utilized for portions of fence construction, but much of the fence would be built in somewhat rough terrain.

When the travel corridor was examined in February 2013, cattle grazed the 506 in winter months. Utilization of the 506 appeared to be concentrated toward the eastern portion of the range unit, where they were also given protein supplement. Cattle minimally utilized the western portions of the 506 where this travel corridor would be constructed, so disruptions to existing livestock operations may be few. That being said, the only viable route for the corridor's fence would be through some allotted lands, which would affect multiple tribal members and perhaps the tribe itself.

Implementing Alternative B would also require fencing in the Palmer's RU 514. Costs for all associated fencing will be described below.

Grazeable acres, stocking rates, and herd size for this alternative will be described below in the carrying capacity section of this document.

3. Alternative C: *The Big Picture*

A third alternative would combine the highway-to-highway (Alternative A) idea with the Palmer Creek Unit's RU 514. This alternative would create the largest number of acres with the largest possible herd size. A free-roaming buffalo herd could travel the Stronghold, but could also find forage in the Palmer's 514 when they chose. They would travel under BIA Route 27 to reach the Palmer Creek Unit as described in Alternative B above. Figure 11 below shows the land base of Alternative C.

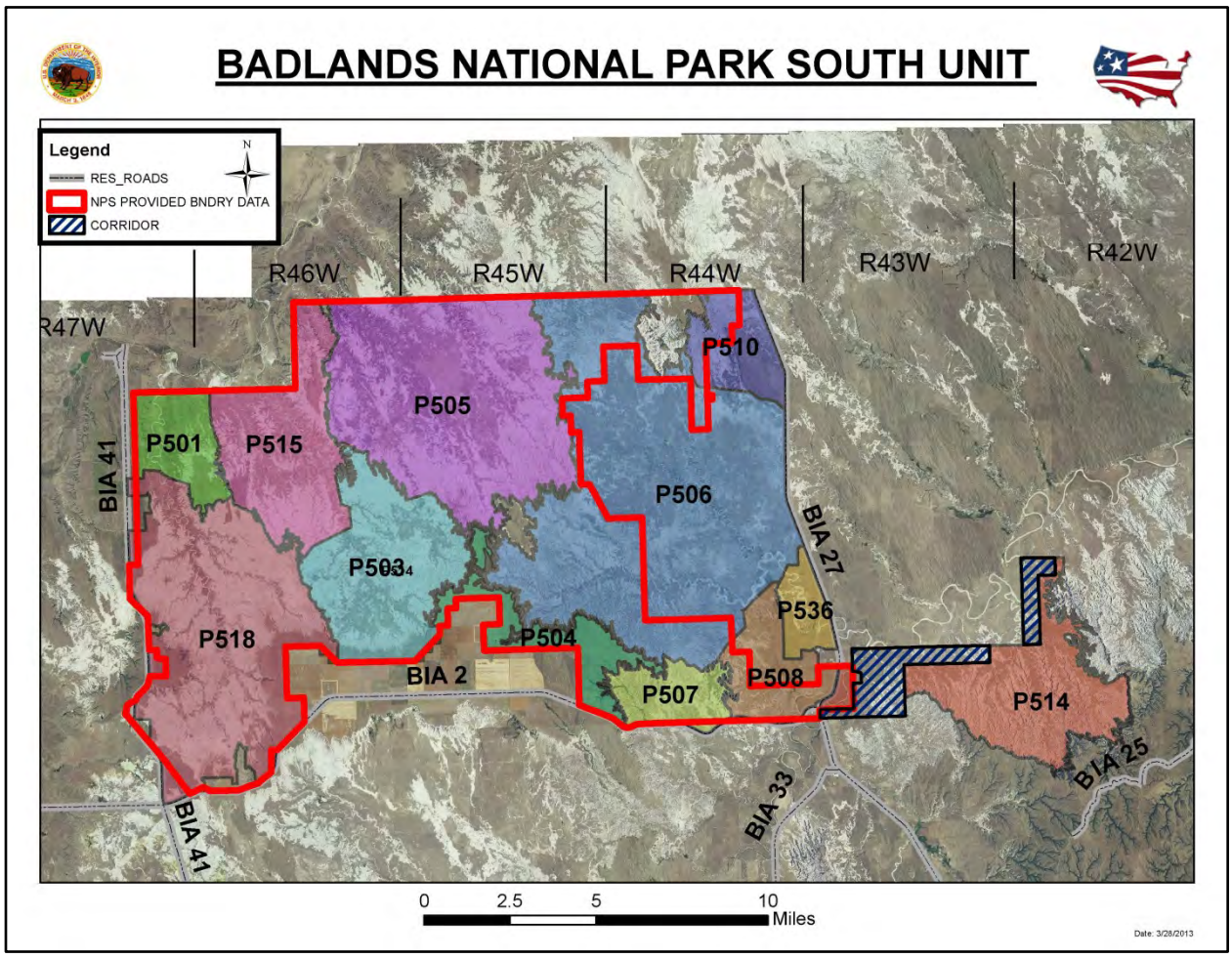


Figure 11: Map showing acreage of Alternative C. This alternative combines the original idea of the Stronghold (Alternative A) and adds RU 514 of the Palmer Creek Unit. Buffalo would walk under a bridge on BIA Route 27at Cottonwood Creek to reach the Palmer. Map courtesy BIA.

Alternative C: Quick facts	
Grazeable acres:	63,325
Year-round herd size (AUs):	1,156
Miles of fence required:	88

Alternative C presents the largest idea of combining all lands of the Tribal National Park with utilizing almost all of the range units available for grazing buffalo. In this alternative, buffalo would be free to graze the Stronghold as they saw fit. They would access the same bridge under BIA Route 27 as specified in Alternative B, yet no one can be certain they will cross under this bridge on their own. They may need to be herded under the highway to access Palmer Creek's 514.

Alternative C also requires the most fencing to implement. The entirety of the Stronghold must be fenced, and fence must be added to the northern side of Palmer Creek's 514. Further, the corridor linking the two grazing areas must also be constructed.

Grazeable acres, stocking rates, and herd size for this alternative will be described below in the carrying capacity section of this document.

4. Alternative D: *The Western Option - Only the Western Portions of the Stronghold*

A fourth and final alternative includes using only the western portions of the Stronghold (specifically, RUs 501, 518, 515, 503, and 505). A map of this configuration may be seen in Figure 12 below.

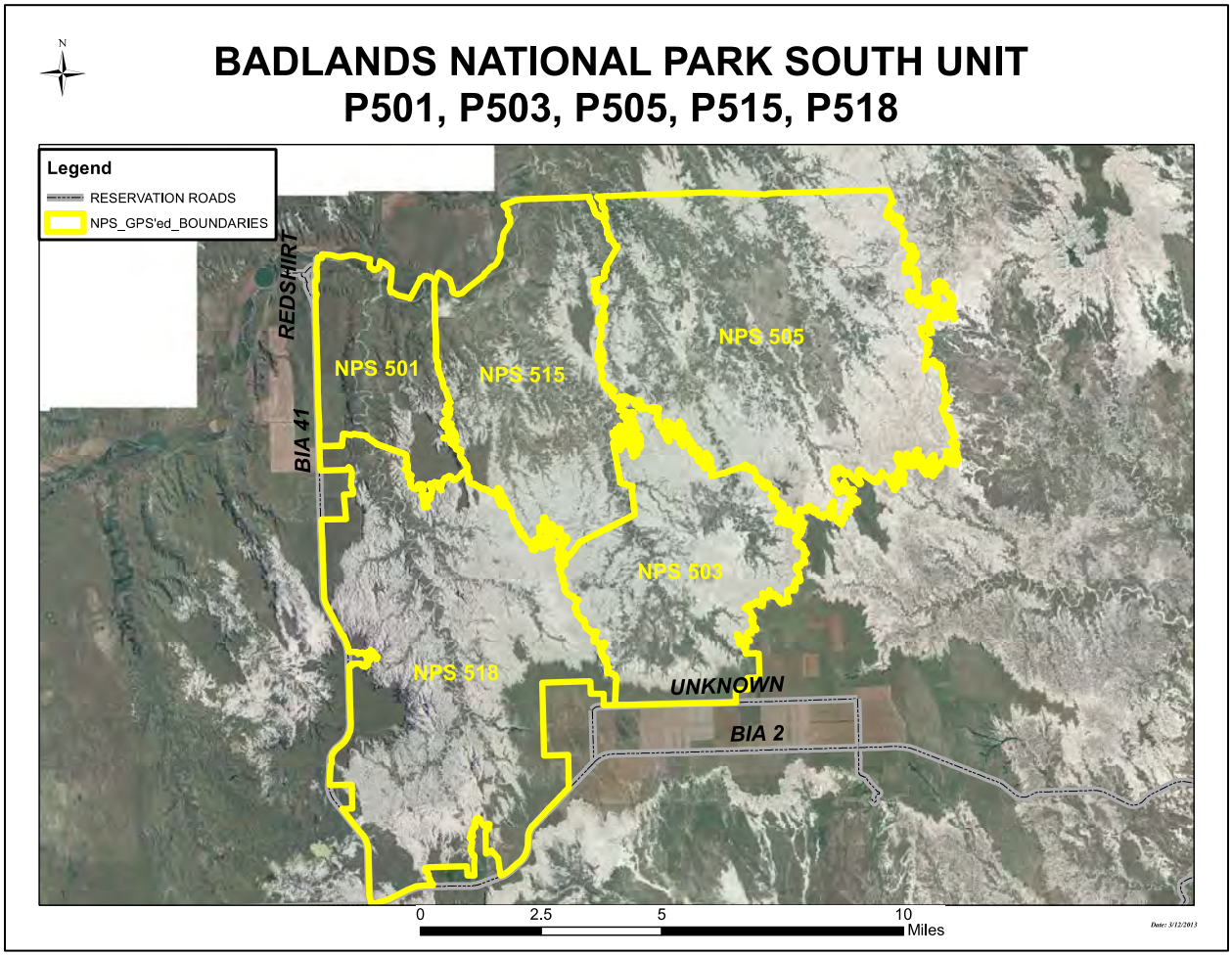


Figure 12: Map of alternative D, which utilizes only the western portions of the Stronghold. Should the 506 be excluded from buffalo grazing, then the low-producing eastern reaches of the South Unit may not be worth fencing. This alternative may deliver the concept of a free-roaming buffalo herd at smaller scale, but with much simpler implementation. Map courtesy BIA.

Alternative D: Quick facts	
Grazeable acres:	28,010
Year-round herd size (AUs):	485
Miles of fence required:	40

Alternative D arises with the potential exclusion of the 506 from buffalo grazing and the simple realization that the eastern portions of the Stronghold (RUs 504, 507, 508, 510, and 536) are small in acreage and low in vegetative production. Without the 506, those smaller range units may not be worth including for buffalo. Alternative D presents the scaled-back version of the free-roaming buffalo herd, with greatly reduced fencing costs. This alternative would be the cheapest and quickest to implement.

Alternative D has many ramifications for the visitor experience in the Tribal National Park. First, the visitor center is tentatively scheduled to be placed in the southeast portion of the Park, well away from the lands enclosed by Alternative D. Second, viewing buffalo in these range units may be more difficult due to terrain and remoteness. Third, corrals and buffalo handling facilities would be placed in remote settings, meaning access may be difficult.

Grazeable acres, stocking rates, and herd size for this alternative will be described below in the carrying capacity section of this document.

C. Carrying Capacity

Carrying capacity refers to the number of buffalo that may be run in a given grazing configuration in a certain amount of time. The number of buffalo in the South Unit is highly dependent on such factors as grazing strategy, rangeland health, stocking rate, ages of animals, stock flow, and financial needs of the organization. Note that the same piece of land may have different carrying capacities based on that important grazing strategy. For example, if animals are left alone in a pasture (a strategy often known as "set stocking"), then they often do not utilize all forage available in a pasture. Thus, the stocking rate, herd size, and therefore carrying capacity are less. Conversely, if animals are managed more intensively, the stocking rate, herd size, and therefore carrying capacity oftentimes may be increased.

Through conversations held regarding this feasibility analysis, general agreement seems to surround the notion that the buffalo herd in the South Unit should be "free roaming," minimally managed, and allowed to utilize the landscape as the individual animals choose. This, in essence, is a set-stocking strategy, and thus requires a conservative approach to herd size and carrying capacity.

D. Stocking Rate

Stocking rate is often expressed by the number of animals grazing an area in a certain amount of time. A common unit to express that combination of animals and time is the animal unit month (AUM), which is often defined as roughly 1000 pounds of forage consumed in a month by a buffalo cow and her calf. If 500 buffalo graze an area for a month, then 500 AUMs have been consumed. If they graze 2000 acres for this month, then their stocking rate is said to be 0.25 AUM/Acre. More commonly, stocking rate is expressed as the reciprocal of the AUM/Ac, which is the Ac/AUM. So, 0.25 *AUM/Ac* equals 4 *Ac/AUM*. Expressing stocking rates in acres per AUM is practiced by both OSPRA and BIA, so this analysis will feature stocking rates in that way.

E. Stocking Rate on the South Unit

BIA has done much work in recent years to determine the correct stocking rate for South Unit soils and range units. Their work is a combination of vegetative clipping data, combined with older Natural Resources Conservation Service (NRCS) stocking rate determination. BIA examines their vegetative data, as measured by production and plant species composition in a certain soil type, correlates these data with a recommended NRCS stocking rate, and arrives at a herd size per soil type. When all the soil types are combined, BIA arrives at a year-round herd size for a particular range unit (personal communication, Lionel Weston, Shawn Patton, Hayes Haas, BIA, February 27, 2013). BIA stocking rate figures will be used to determine correct herd size for each of the alternatives described above. BIA intends to be conservative when recommending stocking rates to ensure that rangeland health may be maintained and sufficient forage is allocated for wildlife. Further, BIA figures examine grazeable acres, and forage contributions of rugged badlands soils are discounted to ensure rangelands are not overstocked in this set-stocking scenario. For extensive analysis of stocking the South Unit, see Appendices B and C.

The figures below show stocking rates, herd sizes, and grazeable acres under each alternative.

1. Alternative A: Stocking rate by range unit, herd size, and grazeable acres.

Alternative A			
Range Unit	Ac/AUM	Year Round AUs	Grazeable Acres
501	3.7	24	1062
518	4.2	168	8489
515	4.4	105	5569
503	5.5	63	4185
505	5.8	125	8705
506	5.1	396	24220
507	2.6	31	959
508	3.4	62	2522
510	3.5	49	2052
536	3.1	49	1838
Totals:		**1072**	**59601**
Avg Ac/AUM	4.6		
Avg Ac/AU	55		

Under Alternative A, the herd size would be 1072 buffalo year-round. Alternative 1 also includes 59,601 grazeable acres, which is roughly 60% of the total acreage available. Note that RU 506 offers 33% of this alternative's total capacity.

2. Alternative B: Stocking rate, herd size, and grazeable acres.

Alternative B			
Range Unit	Ac/AUM	Year Round AUs	Grazeable Acres
501	3.7	24	1,062
518	4.2	168	8489
515	4.4	105	5569
503	5.5	63	4,185
505	5.8	125	8,705
Partial 506	5.1	132	8,073
507	2.6	31	959
Partial 508	3.4	21	841
514	3.7	84	3,724
Totals:		**753**	**41,607**
Avg Ac/AUM	4.5		
Avg Ac/AU	54		

In Alternative B, the herd size for "The Herding Alternative" would be reduced to 753 buffalo year-round. With loss of most of the 506 and inclusion of the Palmer Creek Unit's 514, grazeable acres would be 41,607. The 514 and partial use of the 506 would only replace about half of the AUMs offered by the 506.

3. Alternative C: Stocking rate, herd size, and grazeable acres.

Alternative C			
Range Unit	**Ac/AUM**	**Year Round AUs**	**Grazeable Acres**
501	3.6	24	1,062
518	4.2	168	8489
515	4.4	105	5569
503	5.5	63	4,185
505	5.8	125	8,705
506	5.1	396	24,220
507	2.6	31	959
508	3.4	62	2,522
510	3.5	49	2,052
536	3.1	49	1,838
514	3.7	84	3,724
Totals:		**1156**	**63,325**
Avg Ac/AUM	4.5		
Avg Ac/AU	54		

Alternative C offers the big picture alternative of including all of the Stronghold's range units, the 514 from the Palmer Unit, and the corridor between the two. Total herd size is 1156 buffalo year-round, with 63,325 grazeable acres. Note that the inclusion of the Palmer's 514 only increases the herd size by 84 head.

4. Alternative D: Stocking rate, herd size, and grazeable acres.

Alternative D			
Range Unit	**Ac/AUM**	**Year Round AUs**	**Grazeable Acres**
501	3.6	24	1,062
518	4.2	168	8489
515	4.4	105	5569
503	5.5	63	4,185
505	5.8	125	8,705
Totals:		**485**	**28,010**
Avg Ac/AUM	4.8		
Avg Ac/AU	58		

Alternative 4 offers the cheapest and simplest alternative to implement. In these western portions of the Stronghold, the herd size totals 485 buffalo year-round, with 28,010 grazeable acres.

F. Buffalo Introduction

Currently, no buffalo are present in the South Unit. In the mid-1980s, OST briefly ran buffalo in RU 505, with limited success due to escape. Under a new management proposal, the buffalo would have access to more range units and more forage, with the expectation that they would be less likely to have the desire to escape.

Buffalo herds in North America can be classified based on a spectrum from *conservation herds* to *production herds*. A *conservation herd* may be loosely defined as one that is free roaming (meaning utilizes few pastures), is rarely handled, possesses the wild characteristics of North America's ancient buffalo, is self-sustaining, and maintains genetic integrity and a natural age structure and sex ratio. These are herds that are not managed for production purposes By contrast, a *production herd* is often more intensively managed: the animals may be herded into different pastures to improve animal performance, rangeland health, and wildlife habitat; more specific culling and genetics management is practiced; and a much greater focus lies on financial wellbeing of the herd unit.

Such factors as herd size, landscape size, ecological interactions, human interactions, geography, health/genetics, and sociopolitical environment may be qualitatively evaluated to understand how a buffalo herd may be classified. Such factors, and the qualitative descriptions that accompany them, provide insight regarding how a herd contributes to various efforts to restore buffalo to North America.

Sanderson et al (2008) provide a qualitative scoring mechanism to evaluate how buffalo herds may contribute to ecological restoration of buffalo in North America (see the full matrix document in Appendix D). "Large" scores suggest the herd will contribute much to ecological restoration, while the "modest" and "small" scores suggest a smaller contribution based on each factor.

Externally, as restoration efforts of buffalo gain momentum, buffalo in the South Unit would be part of a large herd with genetics from Badlands National Park that may be in future demand. The OST has a financial, cultural, ecological, and political incentive to ensure that a herd in the South Unit remains genetically and functionally intact, for they are part of a unique restoration effort, and they represent a cultural success story for the tribe. Internally, maintaining such a herd not only provides healthy, grass-fed meat for tribal members, but the buffalo is an extension of the people, as Black Elk so ably put it in the opening pages of this document.

With that background, a South Unit buffalo herd would be self-sustaining, largely unmanaged, and generally viewed as a *conservation herd* rather than a *production herd*. Emphasis would be on allowing natural processes of selection and allowing for a more natural sex ratio and age class distribution via random culling through hunting, mobile harvest for slaughter, and shipment of surplus animals.

G. Target Herd Structures and Stocking Scenarios

Sample herd structures for each alternative are presented below. These structures assume a 1:1 bull to cow ratio (which often arises naturally in free-roaming, minimal handling situations). Conception rates are modeled in middle of the broad range experience by the North Unit of BNP, between 25% and 80%, depending on forage conditions. The number of anticipated annual surplus animals is shown, with an approximate value, which may be captured through the sale of hunts, meat, or the transfer of animals to OST's other herds, other tribes, or other conservation herds. A total head count is shown, comprising the animals that would be left on the South Unit each fall after roundup, when surplus animals have been shipped or harvested.

H. 5-year Stock Flow and Growth Strategy

Below each herd structure is a description of the stocking scenarios for supplying the South Unit with buffalo over a period of years with surplus animals from the North Unit. The assumption is that beginning in *Year 1*, approximately 180 head will be sent from the North Unit annually, evenly split among males and females of yearling age and older. Detailed sheets illustrating the introduction process for each Alternative are in Appendices D-G. These herd sheets show rough revenue estimates; detailed sales estimates, which result in slightly different revenues are shown in Appendices H-K.

1. Target Herd Structure: Alternative A

Alternative A: *The Stronghold Unit*							
From Highway to Highway							
Average Annual Production Projections at Capacity							
Biological Variables							
mature cow herd (3 yr+ breeding) =	330			cows/bull (2 yr+ bulls) =	1		
mature cow herd - weaning % =	70%			avg age mature cows culled =	15		
2yr female conception rate =	40%			avg age breeding bulls culled =	6		
% of female calves retained =	100%			bison acres available =	59,601		
% of male calves retained =	100%			anticipated acres/AU =	56		
AU's:	**available =**	**1,072**	**required =**	**1,072**	**AU's +/- =**	**0**	
Production Projections - annual averages							
Head Counts are in the Fall post Roundup							
	hd cnt		Annual Surplus	hd cnt	est wgt	$/lb	total
female calves =	116		f clvs to sell =	0	325	$1.90	$0
f clvs retained =	116		1.5 yr f to buy (-)or sell =	53	500	$1.90	$50,350
yrlg f to breed (1.5) =	63		2.5 yr open f to sell =	38	750	$1.50	$42,750
bred rplmn'ts (2.5's) =	25		3 yr+ cows to cull & sell =	25	1050	$1.05	$27,563
male calves =	116		m clvs to sell =	0	365	$2.10	$0
m calves retained =	116		1.5 yr m to buy (-) or sell =	50	605	$2.10	$63,525
yrlg bulls (1.5) =	66		2 yr+ bulls to cull & sell =	66	1250	$1.80	$148,500
mature bulls (2.5+) =	330		**Annual Surplus**	**232**	net value =		$332,688
AU Projections for Summer Following Roundup							
	hd cnt	AU's/hd	AU's Rqr'd		hd cnt	AU's/hd	AU's Rqr'd
3 yr+ cows =	330	1.00	330	2 yr+ bulls =	330	1.50	495
yearling females =	116	0.65	75	yearling males =	116	0.75	87
2yr females =	63	0.80	50	Calves =	232	0.15	35
Head Count in Summer:						**Total:**	**1,187**

- 720 head added over 4 years, 180 per year.
- Target herd size reached in *Year 5* after first introduction of buffalo.
- E.g., if animals were first added in 2015, no animals would need to be added in 2019, and the herd would be able to supply the surplus described above in 2020.
- A 5-year stocking scenario for this alternative is shown in Appendix D.
- AUs means animal units.

2. Target Herd Structure: Alternative B

Alternative B: *The Herding Alternative*								
Part of the Stronghold Unit + Palmer Creek Unit								
Average Annual Production Projections at Capacity								
Biological Variables								
mature cow herd (3 yr+ breeding) =	230			cows/bull (2 yr+ bulls) =	1			
mature cow herd - weaning % =	70%			avg age mature cows culled =	15			
2yr female conception rate =	40%			avg age breeding bulls culled =	6			
% of female calves retained =	100%			bison acres available =	41,607			
% of male calves retained =	100%			anticipated acres/AU =	55			
AU's:	**available =**	**753**	**required =**	**749**	**AU's +/- =**	**4**		
Production Projections - annual averages								
Head Counts are in the Fall post Roundup								
	hd cnt		Annual Surplus	hd cnt	est wgt	$/lb	total	
female calves =	81		f clvs to sell =	0	325	$1.90	$0	
f clvs retained =	81		1.5 yr f to buy (-)or sell =	36	500	$1.90	$34,200	
yrlg f to breed (1.5) =	45		2.5 yr open f to sell =	27	750	$1.50	$30,375	
bred rplmn'ts (2.5's) =	18		3 yr+ cows to cull & sell =	18	1050	$1.05	$19,845	
male calves =	81		m clvs to sell =	0	365	$2.10	$0	
m calves retained =	81		1.5 yr m to buy (-) or sell =	35	605	$2.10	$44,468	
yrlg bulls (1.5) =	46		2 yr+ bulls to cull & sell =	46	1250	$1.80	$103,500	
mature bulls (2.5+) =	230		**Annual Surplus**	**162**	net value =		$232,388	
AU Projections for Summer Following Roundup								
	hd cnt	AU's/hd	AU's Rqr'd		hd cnt	AU's/hd	AU's Rqr'd	
3 yr+ cows =	230	1.00	230	2 yr+ bulls =	230	1.50	345	
yearling females =	81	0.65	53	yearling males =	81	0.75	61	
2yr females =	45	0.80	36	Calves =	162	0.15	24	
Head Count in Summer:						**Total:**	**829**	

- 540 head added over 3 years, 180 per year.
- Target herd size reached in *Year 4* after first introduction of buffalo.
- E.g., if animals were first added in 2015, no animals would need to be added in 2018, and the herd would be able to supply the surplus described above in 2019.
- A 5-year stocking scenario for this alternative is shown in Appendix E.
- AUs means animal units.

3. Target Herd Structure: Alternative C

Alternative C: *The Big Idea*								
The Stronghold Unit + Palmer Creek Unit								
Average Annual Production Projections at Capacity								
Biological Variables								
mature cow herd (3 yr+ breeding) =	355			cows/bull (2 yr+ bulls) =	1			
mature cow herd - weaning % =	70%			avg age mature cows culled =	15			
2yr female conception rate =	40%			avg age breeding bulls culled =	6			
% of female calves retained =	100%			bison acres available =	63,325			
% of male calves retained =	100%			anticipated acres/AU =	55			
AU's:	**available =**	**1,156**		**required =**	**1,153**	**AU's +/- =**	**3**	
Production Projections - annual averages								
Head Counts are in the Fall post Roundup								
	hd cnt		Annual Surplus		hd cnt	est wgt	$/lb	total
female calves =	124		f clvs to sell =		0	325	$1.90	$0
f clvs retained =	124		1.5 yr f to buy (-)or sell =		56	500	$1.90	$53,200
yrlg f to breed (1.5) =	68		2.5 yr open f to sell =		41	750	$1.50	$46,125
bred rplmn'ts (2.5's) =	27		3 yr+ cows to cull & sell =		27	1050	$1.05	$29,768
male calves =	124		m clvs to sell =		0	365	$2.10	$0
m calves retained =	124		1.5 yr m to buy (-) or sell =		53	605	$2.10	$67,337
yrlg bulls (1.5) =	71		2 yr+ bulls to cull & sell =		71	1250	$1.80	$159,750
mature bulls (2.5+) =	355		**Annual Surplus**		**248**	net value =		$356,179
AU Projections for Summer Following Roundup								
	hd cnt	AU's/hd	AU's Rqr'd			hd cnt	AU's/hd	AU's Rqr'd
3 yr+ cows =	355	1.00	355	2 yr+ bulls =		355	1.50	533
yearling females =	124	0.65	81	yearling males =		124	0.75	93
2yr females =	68	0.80	54	Calves =		248	0.15	37
Head Count in Summer:							**Total:**	**1,274**

- 720 head added over 4 years, 180 per year.
- Target herd size reached in *Year 5* after first introduction of buffalo.
- E.g., if animals were first added in 2015, no animals would need to be added in 2019, and the herd would be able to supply the surplus described above in 2020.
- A 5-year stocking scenario for this alternative is shown in Appendix F.
- AUs means animal units.

4. Target Herd Structure: Alternative D

Alternative D: *The Western Option*								
The Western Portions of the Stronhold Unit								
Average Annual Production Projections at Capacity								
Biological Variables								
mature cow herd (3 yr+ breeding) =	150			cows/bull (2 yr+ bulls) =	1			
mature cow herd - weaning % =	70%			avg age mature cows culled =	15			
2yr female conception rate =	40%			avg age breeding bulls culled =	6			
% of female calves retained =	100%			bison acres available =	28,010			
% of male calves retained =	100%			anticipated acres/AU =	58			
AU's:	**available =**	**485**	**required =**	**489**	**AU's +/- =**	**-4**		
Production Projections - annual averages								
Head Counts are in the Fall post Roundup								
	hd cnt		Annual Surplus	hd cnt	est wgt	$/lb	total	
female calves =	53		f clvs to sell =	0	325	$1.90	$0	
f clvs retained =	53		1.5 yr f to buy (-)or sell =	23	500	$1.90	$21,850	
yrlg f to breed (1.5) =	30		2.5 yr open f to sell =	18	750	$1.50	$20,250	
bred rplmn'ts (2.5's) =	12		3 yr+ cows to cull & sell =	12	1050	$1.05	$13,230	
male calves =	53		m clvs to sell =	0	365	$2.10	$0	
m calves retained =	53		1.5 yr m to buy (-) or sell =	23	605	$2.10	$29,222	
yrlg bulls (1.5) =	30		2 yr+ bulls to cull & sell =	30	1250	$1.80	$67,500	
mature bulls (2.5+) =	150		**Annual Surplus**	**106**	net value =		$152,052	
AU Projections for Summer Following Roundup								
	hd cnt	AU's/hd	AU's Rqr'd		hd cnt	AU's/hd	AU's Rqr'd	
3 yr+ cows =	150	1.00	150	2 yr+ bulls =	150	1.50	225	
yearling females =	53	0.65	34	yearling males =	53	0.75	40	
2yr females =	30	0.80	24	Calves =	106	0.15	16	
Head Count in Summer:						**Total:**	**542**	

- 360 head added over 2 years, 180 per year.
- Target herd size reached in *Year 4* after first introduction of buffalo.
- E.g., if animals were first added in 2015, and no more animals were added in 2017, the herd would reach the target herd structure in the fall of 2018. Alternative D would be able to supply the surplus described above in 2018 for males and 2019 for the females.
- A 5-year stocking scenario for this alternative is shown in Appendix D.
- AUs means animal units.

I. Buffalo Infrastructure and Staffing

1. Fencing

Barbed-wire fencing intended for holding cattle may be found on the South Unit's perimeter, as well as in some internal locations for dividing individual range units. Based on findings from development of this feasibility study, it is recommended that all new buffalo fence be constructed for each alternative. Further, new corrals must be constructed based on NPS specifications to process the South Unit's herd.

Note: buffalo currently graze pastures to the north of the Stronghold. Those animals have been known to escape into the Stronghold, and the fence between the two grazing areas is a 4-wire barbed fence well past its useful life (Personal communications, Shawn Patton, Melvin Tippits, BIA, March 1, 2013). Thus, new fencing is recommended here to prevent mixing of the two herds.

New fencing will be required for each of the four alternatives. All fencing must be designed for the dual purpose of confining buffalo while allowing passage of the South Unit's migrating wildlife species. Badlands National Park specifications suggest the following wires and spacing (as measured from the ground up) to hold buffalo and be wildlife friendly (Figure 13):

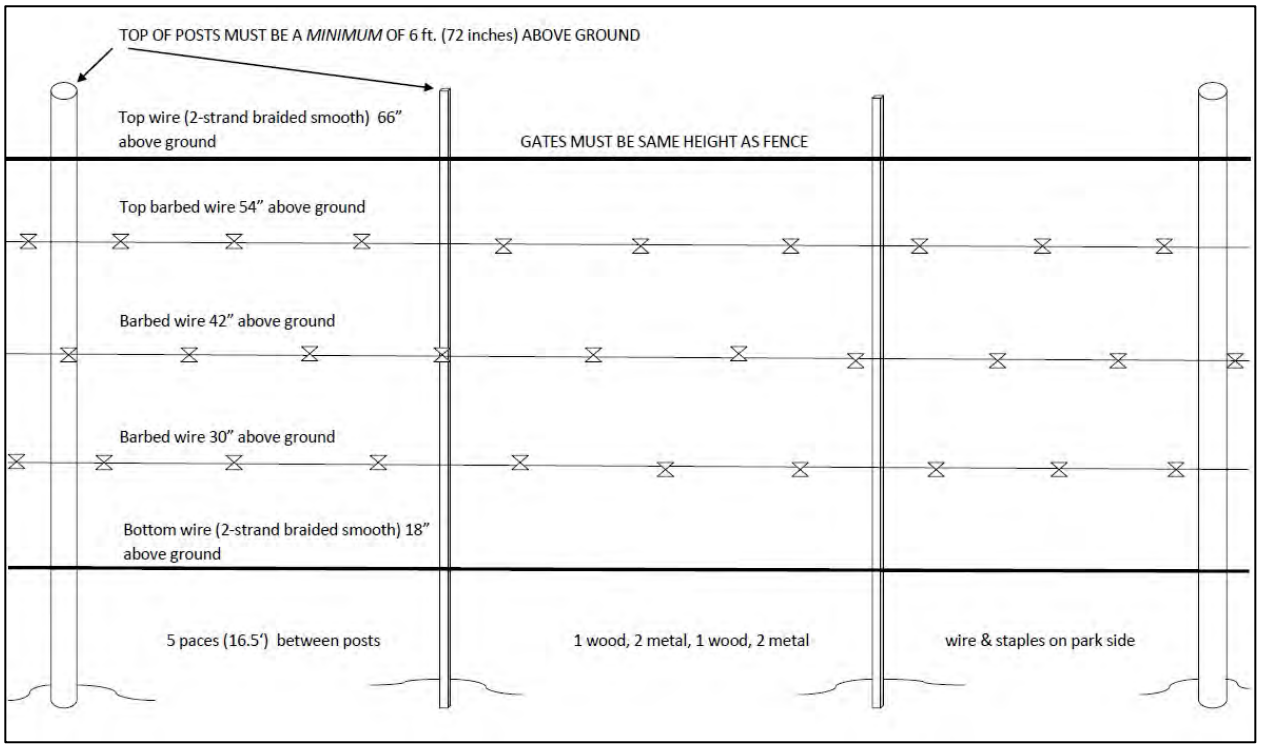


Figure 13: Badlands National Park fence specifications. Source: Kenner, B, 2011.

Cost for such fencing is $15,000 per mile, based on current North Unit fencing costs and specifications. For each alternative, costs of construction appear in Figure 14.

	Buffalo fence required for each alternative			
	A	B	C	D
Miles	73.5	78.2	87.2	40
Cost	$1,102,500	$1,173,000	$1,308,000	$600,000
Cost per mile	$15,000			

Figure 14: Miles and cost of fence for each alternative.

Alternative A assumes creating a new fence around the entire Stronghold. Alternative B requires slightly more fence because it requires construction of fence through the Range Unit 506/508 travel corridor, as well as construction of fence in the Palmer Creek Unit and its travel corridor. Alternative C requires the most fencing, for it encompasses the Stronghold, the Palmer Unit, and the corridor linking the two. Alternative D requires the least fence and utilizes badlands walls as the eastern boundary, which would require no fence. The financial documents found below display operations costs and capital expenditures relative to revenue for each of these alternatives. However, cost of fence per buffalo may be calculated as follows:

- Alternative A: $1,028 per head
- Alternative B: $1,558 per head
- Alternative C: $1,131 per head
- Alternative D: $1,237 per head

2. Corrals

No handling facilities exist in either the South or Palmer Units, so new corrals must be built.

Because corrals would likely lie within the TNP, they would therefore need to be built to National Park Service specifications. The actual location of the corrals would likely depend on which alternative is chosen. If Alternative A, C, or D is chosen, the corrals would likely be constructed in the vicinity of Cottonwood Pass (near the gate that leads between Range Units 505 and 506). If Alternative B is chosen, corrals would likely be located in Range Unit 507, which forms the travel corridor to the north, as well as the travel corridor to the Palmer Unit.

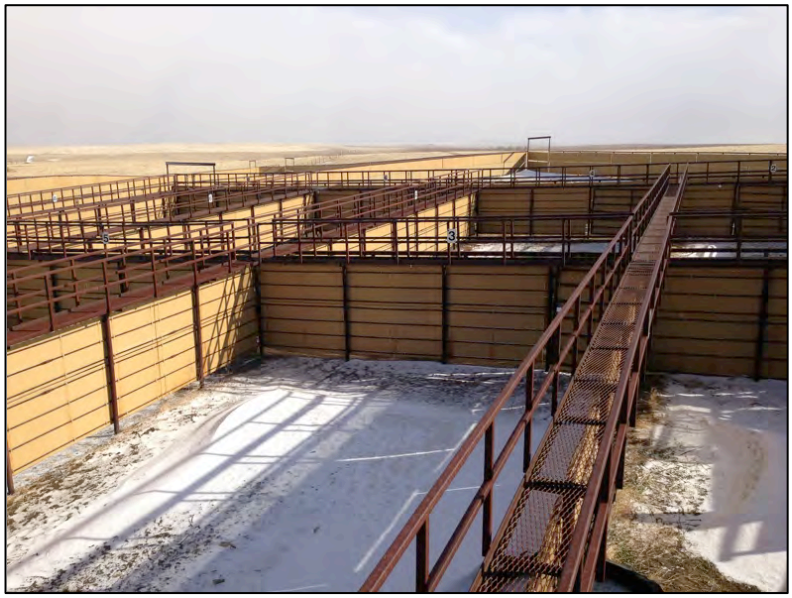


Figure 15: Photo of existing corrals in the North Unit.

Estimated cost of the corrals large enough to handle the South Unit's buffalo herd and meet NPS specifications is $500,000. This cost is comparable to constructing the existing corrals found at the North Unit (Figure 15).

3. Water

Stock water availability is mixed in the South Unit, depending on location. In the larger range units like the 505 and 506, satisfactory stock water was available in the form of ephemeral streams, wetlands, and reservoirs. Conversely, stock water is limited in areas like Range Unit 518 and portions of the 503. Further, implementation of each alternative will require fencing of the Cheyenne River in Range Units 501 and 515. This major water source will be lost to buffalo, and water in this productive part of the South Unit becomes limiting.

4. Current Equipment

No vehicles, ATVs, tools, and/or other capital equipment currently exits to run buffalo on the South Unit. It is intended that all such equipment be NPS property and funded via the Park budget.

5. Staffing

It is intended that the TNP have NPS base-funded staff to provide most of the expertise and workers for buffalo management, much like the North Unit. These could be positions such as a wildlife biologist with a bison technician at the minimum. Further, fence construction and maintenance crews will be required, which would require near and extended-term staffing and funding.

J. Buffalo Shipping and Receiving

Buffalo would be received at the corrals, which would vary in location based on which alternative is chosen. Ideally, there would be some type of gathering/receiving traps in the vicinity of the corral to be used as acclimation pens once the buffalo arrive from the North Unit. Having an acclimation period of a few weeks will make it easier to get the buffalo in the corrals in future years when they will need to be gathered every year or every other year.

Shipping would not be a major part of the buffalo operations, as most would be harvested in the field through a mobile processing unit or via hunting. It is important that trucks and trailers could get to the corrals, while semi-trailers would be advantageous but not mandatory. The most buffalo that would be moving in or out of the South unit would occur during the stocking phase which would last approximately 3-5 years if 180 to 200 surplus animals were brought annually from the North Unit

K. Buffalo Marketing

Buffalo marketing would largely follow the same paths as in other OST pastures. Animals would be marketed through a combination of hunts, field harvest for ceremonial uses, dispersal of surplus animals through a Share Cropping program, and some field harvest for slaughter. The

emphasis being on a free-roaming *conservation herd* rather than production would lead to less calves and weight gain each year and less harvest required to keep the herd in balance with the forage available.

V. BUFFALO FINANCIAL PLAN

A. General Description

Buffalo on the South Unit will be managed cooperatively through NPS and OST on the Tribal National Park. For the purpose of this feasibility study, the only revenues and expenses considered are those directly associated with the buffalo management and marketing. The infrastructure is assumed to be addressed by the overall South Unit management budget.

B. Revenues

Revenues to the South Unit buffalo program would come from the sale or donation of harvest animals, contribution of animals to a Share Cropper program, hunts of surplus bulls, and sales of market quality 2 and 3 year old animals through a mobile harvest operation such as Sustainable Harvest Alliance (SHA). Donation or contribution of animals would be considered *non-cash* revenues, and sales of animals would be considered *cash* revenues.

For the sake of discussion, we assume a scenario where 180 buffalo are introduced annually beginning in *Year 1*, and include cash and non-cash revenues in the calculations. None of the Alternatives would show any revenue for the first two years of introduction (*Years 1 and 2*). Alternatives A, B, and D will begin to show revenues in the *Year 3* of buffalo introduction, while Alternative C would not show any revenues until *Year 4* of buffalo introduction. After reaching the target herd size and a relatively stable economic status, Alternatives A and C would yield the highest revenues from buffalo operations, at $330,920 and $336,788, respectively, in *Year 6*. The table below (Figure 16) summarizes approximate timing and amount of steady state revenues.

Alternative	First Year of Revenue	Year Target Herd Reached	Year Economic Steady State Reached	Steady State Buffalo Revenue (Cash + Non-Cash)	Annual Buffalo Surplus (hd)
A	3	5	6	$330,920	253
B	3	4	5	$244,935	190
C	4	5	6	$336,788	260
D	3	4	5	$144,075	105

Figure 16: Estimated timing and total revenue (cash and non-cash) of buffalo surplus from the South Unit for each alternative, with introduction of 180 buffalo per year from the North Unit beginning in Year 1. "Steady State" refers to the target herd size.

Detailed multi-year revenue tables (*cash and non-cash*) for each alternative are shown in Appendices H-K.

C. Operating Expenses

Depending on the Alternative chosen, the buffalo in the South Unit would have almost no management to moderate management. Alternatives A and D would require the least amount of management, and therefore labor costs, since the buffalo would never have to be moved or

herded under Highway 27. Alternatives B and C would require more labor to herd the buffalo through a corridor to the Palmer Unit. The division of labor among the buffalo management entity and NPS, the land and infrastructure manager. is unclear. The expenses in the scenario described include all expenses directly related to managing and marketing the buffalo herd, but not the infrastructure associated with the buffalo.

The different alternatives would require different levels of seasonal labor to manage the buffalo. Estimated operating expenses are shown in the 5-year pro-forma Profit and Loss Statements in Appendix L.

The continued payment of BIA Range Leases in the Bison Conservation Area under any of the proposed alternatives is unclear at this time. The Range Leases in question are a significant economic contribution to the OST. The affected Range Leases would vary from approximately $100,000 annually for Alternative D to $260,000 for Alternative C. Further, some of those leases involve allotted lands, meaning OST and perhaps several individuals could be affected by alteration of these leases.

D. Capital Expenditures

The South Unit buffalo management entity would have minimal staff and likewise limited equipment needs. Two pickups and two ATVs should suffice, with one of the ATVs being a side-by-side UTV. A large stock trailer for the occasional hauling of buffalo would also be required, and a small trailer to move ATVs or the UTV would be necessary.

No water improvements would be considered, and the corrals and fences would be capital expenses through NPS, rather than the buffalo management entity.

E. Multi -Year Economic Contributions to the Oglala Sioux Tribe

Estimated annual contributions to OST are shown in Appendices L-O. The contribution can be classified as *cash* and *non-cash* benefits to OST. Cash benefits include buffalo sales, hunts, lease payments, and salaries associated with the South Unit Tribal National Park. Non-cash benefits include donated ceremonial or breeding animals and the value of buffalo inventory increases.

The table below (Figure 17) summarizes the Economic Contribution from each alternative when a steady state has been reached.

Alternative	Year Economic Steady State Reached	Total Economic Benefit (Cash)	Total Economic Benefit (Cash + Non-Cash)
A	6	$196,849	$416,537
B	5	$171,542	$330,552
C	6	$203,237	$422,404
D	5	$84,306	$212,001

Figure 17: Estimated Net Operating Income (Cash and Non-Cash) for each Alternative at Steady State.

VI. SUMMARY TABLE OF ALTERNATIVES

Comparison of South Unit Alternatives				
CRITERIA	**Stronghold Alternative A**	**Herding Alternative B**	**Big Picture Alternative C**	**West Alternative D**
Ecological				
Grazeable acres	59,601	41,607	63,325	28,010
Herd size	1072	753	1156	485
Capital				
Miles of fence required	74	79	88	40
Cost of fence @$15,000 per mile	$1,110,000	$1,185,000	$1,320,000	$600,000
Corral cost	$500,000	$500,000	$500,000	$500,000
Total fence/corral cost	$1,610,000	$1,685,000	$1,820,000	$1,100,000
Ease of fence construction, given terrain	Moderate	Difficult	Moderate	Moderate
Timing				
Year target herd size reached*	5	4	5	4
Financial				
Buffalo revenue (Cash & Non-cash, *Year 6*)	$330,920	$244,935	$336,788	$144,075
Cost of fence per buffalo	$1,028	$1,558	$1,131	$1,237
Cultural/Social/Visitors				
Ability to see buffalo from visitor center	Yes	Timing dependent	Yes	No
Buffalo used for education/outreach	Yes	Yes	Yes	Yes
Assuming buffalo first stocked in *Year 1				

Figure 18: A comparison of various attributes for each of the four alternatives shown in this document.

VII. RECOMMENDED ALTERNATIVE

Which Alternative should be chosen? This decision ultimately rests with the Tribe. OST must make this decision and must live with the consequences of that choice. This feasibility study was commissioned to help the Tribe make its choice by providing information on science of the landscape, financial implications of the buffalo herd, and the management strategy required to sustain that herd.

Ultimately, the choice of an alternative is about correlating the on-the-ground management strategy of buffalo with the vision, values, and objectives of the OST and NPS. To achieve the goals of running a free-roaming, minimally-managed buffalo herd numbering at least 1000 animals, the best alternative to choose is Alternative A.

VIII. APPENDICES

Appendix A: Maps

Figures 19 & 20: Maps of Badlands National Park area. (Source: badlands.national-park.com)

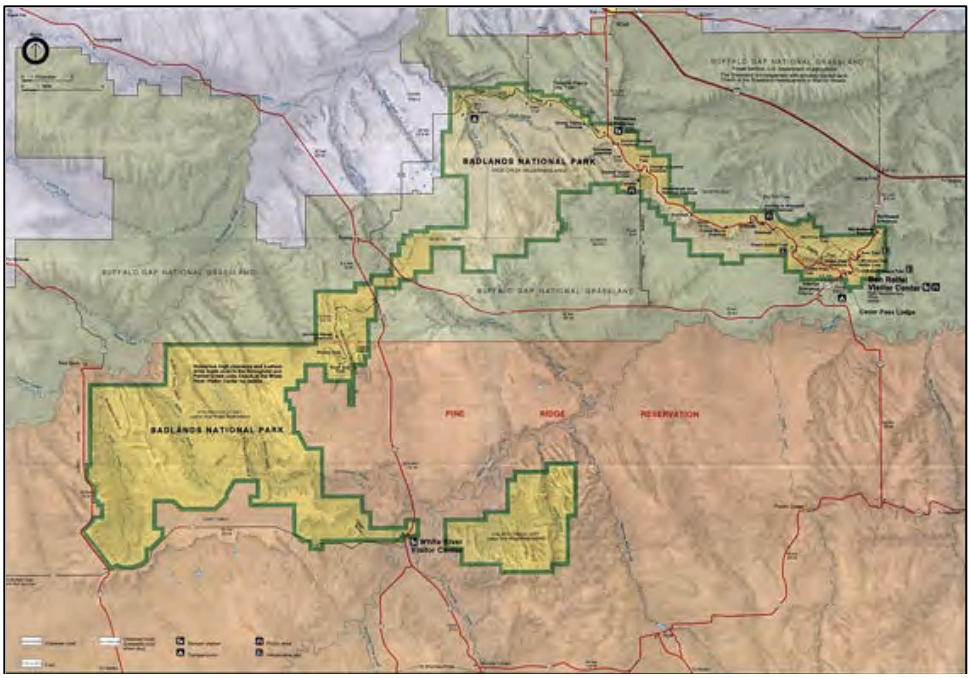


Figure 21: Map showing all range units in the South Unit. Map courtesy BIA.

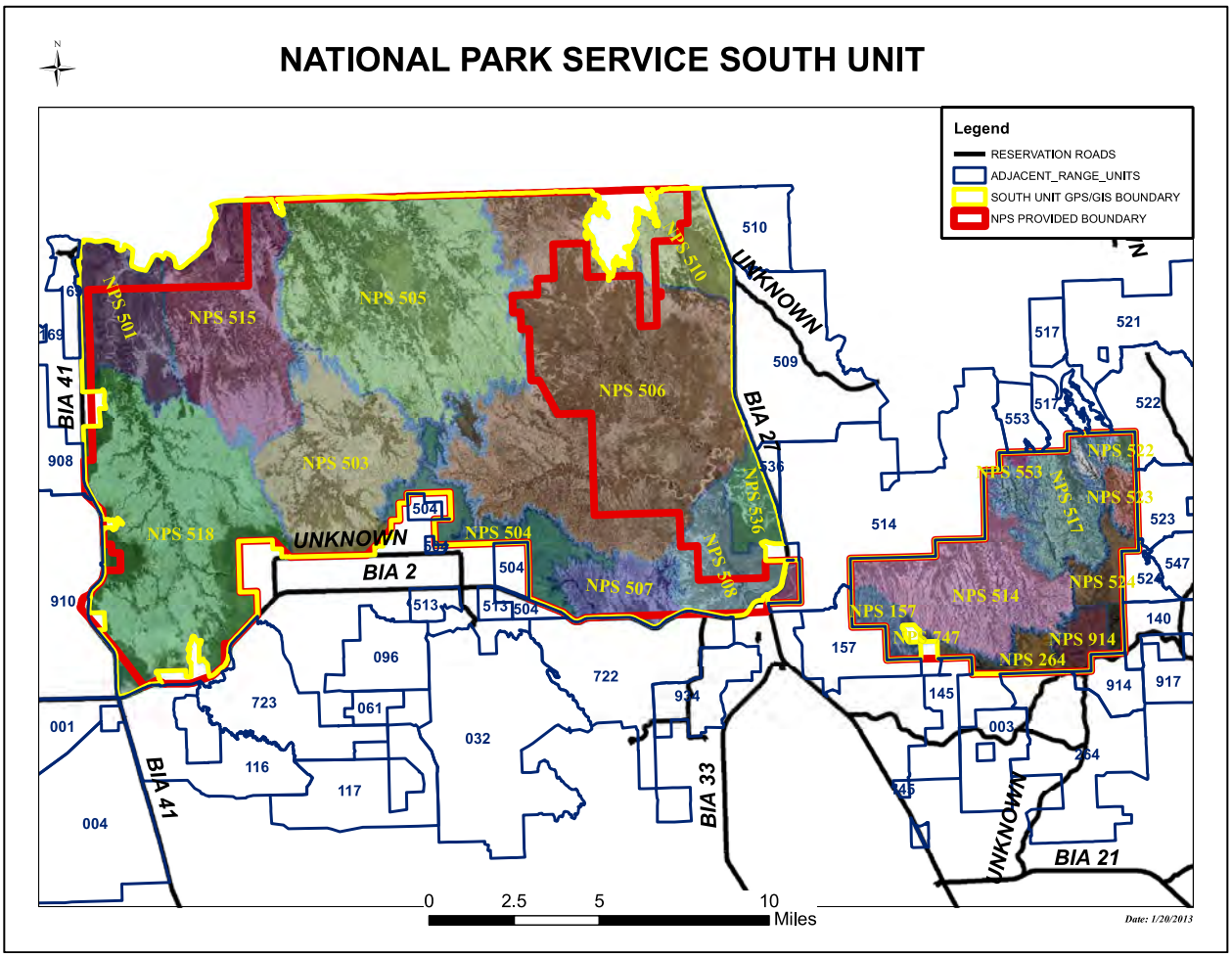
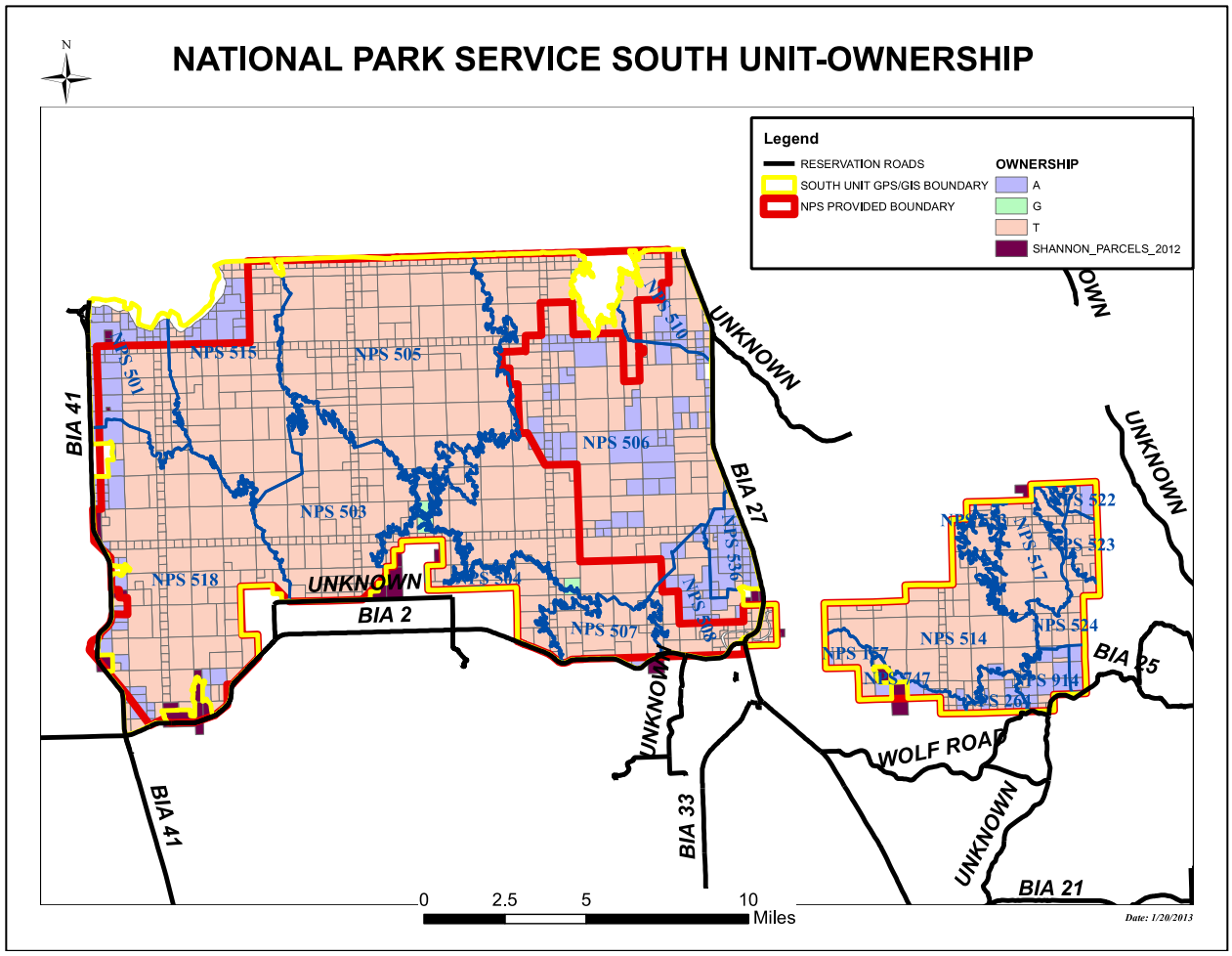


Figure 22: Map showing ownership of lands around the South Unit. Map courtesy BIA.



Appendix B: Acreages, Range Production, and Carrying Capacity

Much mention is made in this document regarding stocking rate and carrying capacity of the South Unit's range units. For this feasibility study, three different methods of calculating stocking rate were examined: 1) BIA methods, 2) NRCS Web Soil Survey, and 3) North Unit of Badlands National Park. Each will be reviewed in this appendix. Ultimately, the BIA's method of determining herd size and thus stocking rate was chosen for use in this document. This is due to the conservative nature of the process and that the South Unit's grazing management strategy will be set stocking, a strategy for which BIA's methodologies were designed. BIA utilizes much rangeland and vegetative production data to determine stocking rates, which well fit the strategy to be implemented.

BIA Method

The first method is used by BIA. BIA has done much work in recent years to determine the correct stocking rate for South Unit soils and range units. In 2005, vegetative productivity and soils data were studied, and vegetative clippings were taken to increase knowledge of production. BIA uses production and plant species composition to assign an overall condition class for a particular ecological site. Then, using standardized (and a bit old) NRCS stocking rate tables, a stocking rate is assigned to a particular soil type in a range unit. Once stocking rates and acres for each soil type in a range unit are known, BIA simply calculates the year-round buffalo herd size for that range unit. BIA assigns a 50% utilization rate for forage consumption in the South Unit.

BIA also removes productive contributions for certain soils. In particular, BIA assigns a level of production of 0 pounds per acre to "Breaks" soils (Br in the old NRCS soil map units (See Appendix C below)). For Badlands soils (Ba in the old map units), BIA discounts production to 25% of the NRCS-suggested production level. BIA's method of discounting also allows for determination of the number of grazeable acres by range unit. The intent of this exercise is to be as conservative with stocking rates as possible in these breaks and badlands soils.

Note that BIA was not overly happy with the 2005 vegetative production work that was done in the South Unit. The agency found that production figures sometimes tended to be well above/below what their own research suggested, which required further corrections to recommended stocking rate. The iterative process described here has resulted in conservative stocking rates that should work well for a set stocking grazing strategy.

RANGE UNIT	STOCKING RATE	GRAZEABLE ACRES	AUM's	YEARLONG AU'S
NPS 140	3.90	456.00	116.92	9.74
NPS 145	3.60	468.95	130.26	10.86
NPS 157	3.50	908.00	259.43	21.62
NPS 264	3.20	905.72	283.04	23.59
NPS 501	3.60	5,070.72	1,408.53	117.30
NPS 503	5.50	4,184.82	760.89	63.41
NPS 504	3.60	4,149.67	1,152.69	96.60
NPS 505	5.76	8,705.00	1,500.00	125.00
NPS 506	5.10	24,220.87	4,749.19	395.77
NPS 507	2.60	958.53	368.67	30.72
NPS 508	3.40	2,522.45	741.90	61.82
NPS 510	3.50	2,052.29	586.37	48.86
NPS 514	3.70	3,723.91	1,006.46	83.87
NPS 515	4.40	7,617.06	1,731.15	144.26
NPS 517	2.90	700.00	241.38	20.11
NPS 518	4.20	8,489.53	2,021.32	168.44
NPS 522	3.40	357.00	105.00	8.75
NPS 523	4.20	315.00	75.00	6.25
NPS 524	3.50	1,723.00	492.29	41.02
NPS 536	3.10	1,837.65	592.79	49.40
NPS 553	2.50	162.00	34.80	5.40
NPS 747	3.00	133.00	44.33	3.69
NPS 914	3.10	1,419.05	457.73	38.14
TOTALS		81,080.22	18,860.14	1,574.62

Figure 23: The output of BIA's stocking rates analysis for all units in the Tribal National Park. Data courtesy of BIA.

Several BIA representatives were quite helpful in explaining their methodology through phone calls, emails, and in-person conversations in February 2013, and we thank them for their patience and explanations.

Web Soil Survey Method

The second method utilized for determining stocking rates was NRCS's Web Soil Survey (WSS) (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm). NRCS performed vegetative production work in the South Unit in 2011, and their data have been incorporated into the WSS. Stocking rates and herd sizes may also be generated using this database. Using BIA's shape files for a given range unit, WSS provides vegetative productivity in pounds per acre for each soil type in the area of interest. For this analysis, only data from unfavorable precipitation years was examined, for in a set-stocking strategy, the best approach is to stock an area for dry years (this allows for a conservative stocking rate). Vegetative production data may be seen for all of the South Unit's range units below.

Second, in an effort to be conservative with stocking rate, production was set to zero for any area whose soil name contained the word "Badlands." These soils tended to occur on steeper slopes and had relatively low levels of vegetative production. Note that South Dakota NRCS personnel were contacted for this feasibility analysis regarding this discounting tactic (Sandy Huber, 2/18/13, Kent Cooley 2/19/13, Stan Boltz 2/20,27/13, and James Westerman 2/27/13). NRCS generally advised against the tactic, for the effort would likely discount production too much. Those badlands soils often do have productive contributions, and they should be considered. However, in an effort to be as conservative as possible for set stocking the unit, the practice was continued. This likely greatly reduced the South Unit's herd size and also resulted in *fewer* grazeable acres than BIA's analysis.

Third, once total production of all range units was known, a utilization rate was assigned. In this case 40% utilization was assigned (versus BIA's 50%). Total plant production was thus multiplied by 40%. This was called effective production, or that to be consumed by buffalo. The 40% utilization rate should also allow remaining forage for the Unit's wildlife, and for old plant material to fall to the soil surface where it is called litter. Litter helps cover the soil surface and prevent erosion.

Forth, daily consumption per head was assigned at 30 pounds per buffalo per day. Thus, the effective production was divided by 30 pounds. Note that no correction for animal unit equivalents was made with this calculation. That is, no corrections for metabolic weight (weaned calves will eat less forage each day than mature bulls). In an effort to be conservative, 30 pounds per day should allow much forage remaining behind for wildlife and to cover the soil.

Lastly, the grazing duration had to be figured in. The set stocking strategy called for year-round grazing, so the result of the last calculation was further divided by 365 days.

The result of this effort produced the herd size for the South Unit as may be seen in Figure 24 below.

		UNFAVORABLE PRECIPITATION YEAR					Badlands Soils Adjustment					
Range Unit	Calculated GIS Acres	Total forage Available (lbs)	Year-Round AUs	AUMs	ADAs	Ac/AUM	Grazeable Acres	Total forage Available (lbs)	Year-Round AUs	AUMs	ADAs	Ac/AUM
501	3426	3,418,195	125	1498	13	2.3	2,534.40	2,933,070	107	1286	15.2	2.0
518	11085	4,979,402	182	2183	6	5.1	2,597.50	2,065,703	75	905.5	10.5	2.9
515	6602	4,714,612	172	2067	9	3.2	3,464.70	3,319,421	121	1455	12.6	2.4
503	8519	4,333,841	158	1900	7	4.5	4,151.00	2,267,564	83	994	7.2	4.2
505	18757	11,349,565	415	4975	8	3.8	7,205.90	6,291,409	230	2758	11.5	2.6
506	27354	23,125,070	845	10137	11	2.7	17,637.50	16,637,696	608	7293	12.4	2.4
507	3681	2,265,315	83	993	8	3.7	834.00	762,782	28	334.4	12.0	2.5
508	4856	4,697,252	172	2059	13	2.4	3,061.30	3,691,303	135	1618	15.9	1.9
510	4375	4,347,303	159	1906	13	2.3	2,678.70	3,106,712	113	1362	15.3	2.0
536	2207	2,790,268	102	1223	17	1.8	1,810.50	2,535,681	93	1112	18.4	1.6
514	8578	4,075,060	149	1786	6	4.8	2,957.70	2,387,407	87	1047	10.6	2.8
Totals	99439		2561	30727			48,933.20		1680	20164		

Figure 24: Calculated herd sizes and stocking rates for major range units as produced by soil data in NRCS's Web Soil Survey. AUs are animal units, AUMs are animal unit months, ADAs are animal days per acre (a commonly-used stocking rate) and Ac/AUM (another commonly used-stocking rate).

When comparing BIA calculations to those derived from the WSS, BIA's grazeable acres tend to be higher, while stocking rate tends to be lower. The differences may be seen in Figure 25 below.

South Unit Stocking Rate Comparisons

	BIA	Web Soil Survey Calculations
Grazeable Acres	65,675	50,551
Stocking rate - Ac/AU	54	31
Herd size	1204	1593

Figure 25: A comparison of grazeable acres, stocking rate, and herd size using two different methods of calculation. Stocking rate is expressed here as acres per animal unit. Thus, using BIA's calculations, 54 acres are required to feed a buffalo cow and her calf for a year, while 31 acres are required (higher stocking rate) using the WSS method. Both efforts intend to be conservative with planned stocking of the South Unit.

The major differences between these methods rely largely on the use of NRCS methods. BIA uses older NRCS range site guides (through their "Range Tool" package) where a stocking rate is assigned based on condition of the area of interest. Using the WSS, a stocking rate may only be determined once the herd size has been calculated. Fundamentally, the two approaches are two different systems that produce two different results.

Because of its greater conservatism, BIA's initial stocking rates have been recommended in this document for initial stocking of the South Unit. When placing buffalo in a new area, a conservative approach that allows buffalo to learn their new home has merit.

Badlands National Park – North Unit Stocking Rates

The third comparable for determining stocking rate came from the nearby North Unit. This unit had been utilizing a set-stocking, free-roaming grazing strategy for many years, and utilizing those stocking rates and herd sizes as comparables may be instructive. Through conversations with NPS staff, the North Unit's 64,000 acres is intended to be stocked at 400 animals in dry years, 500 head in normal precipitation years, and up to 800 head in wet years. Assuming all

64,000 acres are grazeable, stocking rate would range from 160 Ac/AU in dry years to 80 Ac/AUM in wet years (personal communication, Eddie Childers, Badlands National Park, March 4, 2013).

Comparing these three approaches for stocking the South Unit leads to calculations seen in Figure 26 below.

Three comparables to calculate stocking rate and herd size on South Unit

	BIA	Web Soil Survey Calculations	BLNP North Unit
Stocking rate - Ac/AU	54	31	160
Herd size	1204	1593	315 - 410

Figure 26: Three comparables exist for determining stocking rates on the South Unit: BIA methods, web soil survey calculations, and the neighboring BLNP North Unit. Stocking rate here is expressed as number of acres required to feed a buffalo cow and her calf for one year (acres per animal unit). Herd size is the year-round number of buffalo on the Unit.

These figures show wide variation in stocking rate between the three comparables. Because of such discrepancy, a conservative approach is recommended in this document and the accompanying management plan to stock the South Unit. Further, monitoring is recommended to evaluate how buffalo graze the landscape. With the set-stocking strategy, buffalo will likely use some areas heavily, while other areas are grazed minimally. Only vegetative monitoring will determine the correct number of buffalo to be run on the South Unit as they are gradually placed there through time.

Vegetative production tables for the South and Palmer Units are shown below.

Data in these tables were taken from NRCS's Web Soil Survey. Columns include map unit code, map unit name (soil name), pounds of production in unfavorable years, acres in the select location (area of interest, or "AOI"), percentage of AOI involved in soil unit, and total production. Note that Web Soil Survey only allows an analysis area of 10,000 acres, so larger range units like the 506 had to be broking into more than one analysis unit.

It is highly recommended that grazing managers implement utilization monitoring techniques to determine how buffalo graze the South Unit. In particular, utilization mapping offers a quick, reliable, cheap, repeatable, and highly useful technique for determining how buffalo graze. Such mapping will provide the best picture regarding the proper herd size for the South Unit.

Effective 501 - Normal Precipitation Year

Map Unit	lap Unit Nam	Pounds/Acre	Acres in AOI	% of AOI	Total pounds
N464C	Kyle clay, 6 t	1820	5.1	0.10%	9,282
N656D	Pierre clay, t	1800	103.7	3.00%	186,660
N666E	Pierre-Sams	1655	59.9	1.70%	99,135
N711G	Samsil-Pierr	1390	761.8	22.20%	1,058,902
N814B	Swanboy cla	1295	213	6.20%	275,835
U020G	Badland	392	345.9	10.10%	135,593
U192G	Epping-Keot	1413	328.8	9.60%	464,594
U215F	Epping, moi	995	208.1	6.10%	207,060
U305A	Hoven silt lo	2148	8.1	0.20%	17,399
U315A	Interior loan	1550	19.3	0.60%	29,915
U325B	Interior loan	1797	286.2	8.40%	514,301
U348E	Jayem-Valer	2225	244.2	7.10%	543,345
U350C	Kadoka-Thir	1801	3.7	0.10%	6,664
U355C	Kadoka-Epp	1608	13.9	0.40%	22,351
U360F	Keota, thick	1366	8.4	0.20%	11,474
U495F	Vivian grave	1200	25.8	0.80%	30,960
U560F	Orella-Badla	966	22.8	0.70%	22,025
U740A	Tuthill-Jayer	2307	32.4	0.90%	74,747
U740C	Tuthill-Jayer	2335	304.2	8.90%	710,307
U745A	Manter, coo	2010	70.5	2.10%	141,705
U745B	Manter, coo	2046	333.6	9.70%	682,546
U820B	Wortman-W	1268	26.2	0.80%	33,222
					5,278,021

Effective 501 - Unfavorable Precipitation Year

Map Unit	lap Unit Nam	Pounds/Acre	Acres in AOI	% of AOI	Total pounds	BIA Adjustment[1]	% change	Graz Acres
N464C	Kyle clay, 6 t	1145	5.1	0.10%	5,840	5,840		5.1
N656D	Pierre clay, t	1145	103.7	3.00%	118,737	118,737		103.7
N666E	Pierre-Sams	1095	59.9	1.70%	65,591	65,591		59.9
N711G	Samsil-Pierr	989	761.8	22.20%	753,420	753,420		761.8
N814B	Swanboy cla	798	213	6.20%	169,974	169,974		213
U020G	Badland	205	345.9	10.10%	70,910	0		0
U192G	Epping-Keot	838	328.8	9.60%	275,534	0		0
U215F	Epping, moi	565	208.1	6.10%	117,577	0		0
U305A	Hoven silt lo	1450	8.1	0.20%	11,745	11,745		8.1
U315A	Interior loan	1010	19.3	0.60%	19,493	19,493		19.3
U325B	Interior loan	700	286.2	8.40%	200,340	200,340		286.2
U348E	Jayem-Valer	1695	244.2	7.10%	413,919	413,919		244.2
U350C	Kadoka-Thir	1029	3.7	0.10%	3,807	3,807		3.7
U355C	Kadoka-Epp	904	13.9	0.40%	12,566	12,566		13.9
U360F	Keota, thick	759	8.4	0.20%	6,376	0		0
U495F	Vivian grave	755	25.8	0.80%	19,479	19,479		25.8
U560F	Orella-Badla	646	22.8	0.70%	14,729	0		22.8
U740A	Tuthill-Jayer	1699	32.4	0.90%	55,048	55,048		32.4
U740C	Tuthill-Jayer	1731	304.2	8.90%	526,570	526,570		304.2
U745A	Manter, coo	1303	70.5	2.10%	91,862	91,862		70.5
U745B	Manter, coo	1329	333.6	9.70%	443,354	443,354		333.6
U820B	Wortman-W	814	26.2	0.80%	21,327	21,327		26.2
Subtotals for Soil Survey Area			3,425.80	100.00%	3,418,195	2,933,070	-0.1419243	2534.4

	Effective 518 - Normal Precipitation Year						Effective 518 - Unfavorable Precipitation Year								
	Map Unit	lap Unit Nam	Pounds/Acre	Acres in AOI	% of AOI	Total pounds	Map Unit	lap Unit Nam	Pounds/Acre	Acres in AOI	% of AOI	Total pounds	BIA Adjustment	% change	Graz Acres
518BottomSouth	U020G	Badland	392	2,090.30	32.40%		U020G	Badland	205	2,090.30	32.40%	428,512	0		0.00
518BottomSouth	U027F	Badland-Ore	481	1,217.00	18.90%		U027F	Badland-Ore	286	1,217.00	18.90%	348,062	0		0.00
518BottomSouth	U110A	Cedarpass si	1770	26.2	0.40%		U110A	Cedarpass si	960	26.2	0.40%	25,152	25152		26.20
518BottomSouth	U110B	Cedarpass si	1745	6.6	0.10%		U110B	Cedarpass si	945	6.6	0.10%	6,237	6237		6.60
518BottomSouth	U120A	Cedarpass-D	1792	28.5	0.40%		U120A	Cedarpass-D	1011	28.5	0.40%	28,814	28813.5		28.50
518BottomSouth	U125B	Cedarpass-Ir	1288	122.2	1.90%		U125B	Cedarpass-Ir	536	122.2	1.90%	65,499	65499.2		122.20
518BottomSouth	U165A	Denby silty (	1850	56	0.90%		U165A	Denby silty (	1120	56	0.90%	62,720	62720		56.00
518BottomSouth	U192G	Epping-Keot	1413	55.9	0.90%		U192G	Epping-Keot	838	55.9	0.90%	46,844	0		0.00
518BottomSouth	U195E	Mitchell-Epp	1570	7.3	0.10%		U195E	Mitchell-Epp	1005	7.3	0.10%	7,337	7336.5		7.30
518BottomSouth	U215F	Epping, moi	995	41.8	0.60%		U215F	Epping, moi	565	41.8	0.60%	23,617	0		0.00
518BottomSouth	U315A	Interior loan	1550	45.5	0.70%		U315A	Interior loan	1010	45.5	0.70%	45,955	45955		45.50
518BottomSouth	U325B	Interior loan	1797	608.4	9.40%		U325B	Interior loan	700	608.4	9.40%	425,880	425880		608.40
518BottomSouth	U335B	Interior, occ	1564	45.4	0.70%		U335B	Interior, occ	976	45.4	0.70%	44,310	44310.4		45.40
518BottomSouth	U340B	Interior, mo	1581	0.1	0.00%		U340B	Interior, mo	568	0.1	0.00%	57	56.8		0.10
518BottomSouth	U350B	Kadoka-Thir	1816	4.3	0.10%		U350B	Kadoka-Thir	1035	4.3	0.10%	4,451	4450.5		4.30
518BottomSouth	U355C	Kadoka-Eppi	1608	2.2	0.00%		U355C	Kadoka-Eppi	904	2.2	0.00%	1,989	1988.8		2.20
518BottomSouth	U360F	Keota, thick	1366	79	1.20%		U360F	Keota, thick	759	79	1.20%	59,961	0		0.00
518BottomSouth	U495F	Vivian grave	1200	5.1	0.10%		U495F	Vivian grave	755	5.1	0.10%	3,851	3850.5		5.10
518BottomSouth	U556C	Orella silt lo	1255	220.1	3.40%		U556C	Orella silt lo	810	220.1	3.40%	178,281	0		0.00
518BottomSouth	U560C	Orella-Badla	955	315.2	4.90%		U560C	Orella-Badla	605	315.2	4.90%	190,696	0		0.00
518BottomSouth	U560F	Orella-Badla	966	162.4	2.50%		U560F	Orella-Badla	646	162.4	2.50%	104,910	0		0.00
518BottomSouth	U565E	Orella-Interi	1160	1,278.50	19.80%		U565E	Orella-Interi	470	1,278.50	19.80%	600,895	0		0.00
518BottomSouth	U740C	Tuthill-Jayer	2335	13.6	0.20%		U740C	Tuthill-Jayer	1731	13.6	0.20%	23,542	23541.6		13.60
518BottomSouth	U802B	Whitewater	1559	6.9	0.10%		U802B	Whitewater	994	6.9	0.10%	6,859	6858.6		6.90
518BottomSouth	U805C	Whitewater	1371	14.9	0.20%		U805C	Whitewater	901	14.9	0.20%	13,425	13424.9		14.90
	Totals for Area of Interest			6,453.50	100.00%		Totals for Area of Interest			6,453.50	100.00%	2,747,853	766075.3	-0.7212095	993.20
518BottomNorth	N656D	Pierre clay, t	1800	64.8	1.40%		N656D	Pierre clay, t	1145	64.8	1.40%	74,196	74196		64.8
518BottomNorth	N666E	Pierre-Sams	1655	88.1	1.90%		N666E	Pierre-Sams	1095	88.1	1.90%	96,470	96469.5		88.1
518BottomNorth	N711G	Samsil-Pierr	1390	216.5	4.70%		N711G	Samsil-Pierr	989	216.5	4.70%	214,119	214118.5		216.5
518BottomNorth	N814B	Swanboy cla	1295	77.3	1.70%		N814B	Swanboy cla	798	77.3	1.70%	61,685	61685.4		77.3
518BottomNorth	U020G	Badland	392	1,573.60	34.00%		U020G	Badland	205	1,573.60	34.00%	322,588	0		0
518BottomNorth	U027F	Badland-Ore	481	712.2	15.40%		U027F	Badland-Ore	286	712.2	15.40%	203,689	0		0
518BottomNorth	U110A	Cedarpass si	1770	21.8	0.50%		U110A	Cedarpass si	960	21.8	0.50%	20,928	20928		21.8
518BottomNorth	U110B	Cedarpass si	1745	35.1	0.80%		U110B	Cedarpass si	945	35.1	0.80%	33,170	33169.5		35.1
518BottomNorth	U120A	Cedarpass-D	1792	18.2	0.40%		U120A	Cedarpass-D	1011	18.2	0.40%	18,400	18400.2		18.2
518BottomNorth	U125B	Cedarpass-Ir	1288	202.6	4.40%		U125B	Cedarpass-Ir	536	202.6	4.40%	108,594	108593.6		202.6
518BottomNorth	U165A	Denby silty (	1850	20.1	0.40%		U165A	Denby silty (	1120	20.1	0.40%	22,512	22512		20.1
518BottomNorth	U192G	Epping-Keot	1413	9.5	0.20%		U192G	Epping-Keot	838	9.5	0.20%	7,961	0		0
518BottomNorth	U195E	Mitchell-Epp	1570	5.2	0.10%		U195E	Mitchell-Epp	1005	5.2	0.10%	5,226	5226		5.2
518BottomNorth	U215F	Epping, moi	995	64.7	1.40%		U215F	Epping, moi	565	64.7	1.40%	36,556	0		0
518BottomNorth	U235B	Interior-Rive	1530	14.2	0.30%		U235B	Interior-Rive	394	14.2	0.30%	5,595	5594.8		14.2
518BottomNorth	U240A	Bridgeport l	2396	10.7	0.20%		U240A	Bridgeport l	1604	10.7	0.20%	17,163	17162.8		10.7
518BottomNorth	U315A	Interior loan	1550	67.2	1.50%		U315A	Interior loan	1010	67.2	1.50%	67,872	67872		67.2
518BottomNorth	U325B	Interior loan	1797	693.1	15.00%		U325B	Interior loan	700	693.1	15.00%	485,170	485170		693.1
518BottomNorth	U340B	Interior, mo	1581	12.5	0.30%		U340B	Interior, mo	568	12.5	0.30%	7,100	7100		12.5
518BottomNorth	U360F	Keota, thick	1366	22.5	0.50%		U360F	Keota, thick	759	22.5	0.50%	17,078	0		0
518BottomNorth	U556C	Orella silt lo	1255	88.2	1.90%		U556C	Orella silt lo	810	88.2	1.90%	71,442	0		0
518BottomNorth	U560F	Orella-Badla	966	62	1.30%		U560F	Orella-Badla	646	62	1.30%	40,052	0		0
518BottomNorth	U565E	Orella-Interi	1160	494.8	10.70%		U565E	Orella-Interi	470	494.8	10.70%	232,556	0		0
518BottomNorth	U740C	Tuthill-Jayer	2335	11	0.20%		U740C	Tuthill-Jayer	1731	11	0.20%	19,041	19041		11
518BottomNorth	U802B	Whitewater	1559	11.1	0.20%		U802B	Whitewater	994	11.1	0.20%	11,033	11033.4		11.1
518BottomNorth	U805C	Whitewater	1371	34.8	0.80%		U805C	Whitewater	901	34.8	0.80%	31,355	31354.8		34.8
518BottomNorth	Totals for Ar	4,631.10	100.00%	4631.8			Totals for Area of Interest			4,631.10	100.00%	2,231,549	1299627.5		1604.3
518RedShirtTable	U020G	Badland	392	600.1	13.70%		U020G	Badland	205	600.1	13.70%	123,021	0		0
518RedShirtTable	U027F	Badland-Ore	481	73	1.70%		U027F	Badland-Ore	286	73	1.70%	20,878	0		0
518RedShirtTable	U125B	Cedarpass-Ir	1288	31.1	0.70%		U125B	Cedarpass-Ir	536	31.1	0.70%	16,670	16669.6		31.1
518RedShirtTable	U192G	Epping-Keot	1413	0.5	0.00%		U192G	Epping-Keot	838	0.5	0.00%	419	0		0
518RedShirtTable	U205F	Fairburn-Ore	1294	170.4	3.90%		U205F	Fairburn-Ore	762	170.4	3.90%	129,845	129844.8		170.4
518RedShirtTable	U348E	Jayem-Valer	2225	14.8	0.30%		U348E	Jayem-Valer	1695	14.8	0.30%	25,086	25086		14.8
518RedShirtTable	U556C	Orella silt lo	1255	338.7	7.70%		U556C	Orella silt lo	810	338.7	7.70%	274,347	0		0
518RedShirtTable	U560F	Orella-Badla	966	101.4	2.30%		U560F	Orella-Badla	646	101.4	2.30%	65,504	0		0
518RedShirtTable	U565E	Orella-Interi	1160	182.2	4.20%		U565E	Orella-Interi	470	182.2	4.20%	85,634	0		0
518RedShirtTable	U755E	Valentine lo	1920	34.6	0.80%		U755E	Valentine lo	1500	34.6	0.80%	51,900	51900		34.6
518RedShirtTable	Aa	Lohmiller sil	3230	158.4	3.60%		Aa	Lohmiller sil	2405	158.4	3.60%	380,952	380952		158.4
518RedShirtTable	Ba	Badland-Der	1307	1.8	0.00%		Ba	Badland-Der	879	1.8	0.00%	1,582	0		0
518RedShirtTable	Br	Badland	382	22.5	0.50%		Br	Badland	261	22.5	0.50%	5,873	0		0
518RedShirtTable	EkE	Epping-Kadc	1916	6.1	0.10%		EkE	Epping-Kadc	1081	6.1	0.10%	6,594	6594.1		6.1
518RedShirtTable	Ht	Hisle-Swanb	1135	35	0.80%		Ht	Hisle-Swanb	670	35	0.80%	23,450	23450		35
518RedShirtTable	KbC	Kadoka-Eppi	2012	6.2	0.10%		KbC	Kadoka-Eppi	1168	6.2	0.10%	7,242	7241.6		6.2
518RedShirtTable	Lm	Interior silt l	2331	146.1	3.30%		Lm	Interior silt l	1773	146.1	3.30%	259,035	259035.3		146.1
518RedShirtTable	Mm	Mosher-Min	1594	98.2	2.20%		Mm	Mosher-Min	1100	98.2	2.20%	108,020	108020		98.2
518RedShirtTable	Sw	Swanboy cla	1341	25.2	0.60%		Sw	Swanboy cla	837	25.2	0.60%	21,092	21092.4		25.2
518RedShirtTable	TnA	Tuthill-Anse	2398	1.2	0.00%		TnA	Tuthill-Anse	1797	1.2	0.00%	2,156	2156.4		1.2
518RedShirtTable	TnC	Tuthill-Anse	2398	94.2	2.20%		TnC	Tuthill-Anse	1797	94.2	2.20%	169,277	169277.4		94.2
518RedShirtTable	TuA	Tuthill-Mant	2416	7	0.20%		TuA	Tuthill-Mant	1800	7	0.20%	12,600	12600		7
518RedShirtTable	TuB	Tuthill-Mant	2398	8.2	0.20%		TuB	Tuthill-Mant	1770	8.2	0.20%	14,514	14514		8.2
518RedShirtTable	TuC	Tuthill-Mant	2400	3.9	0.10%		TuC	Tuthill-Mant	1770	3.9	0.10%	6,903	6903		3.9
518RedShirtTable	U020G	Badland	385	142.1	3.20%		U020G	Badland	210	142.1	3.20%	29,841	0		0
518RedShirtTable	U027F	Badland-Ore	478	35.4	0.80%		U027F	Badland-Ore	295	35.4	0.80%	10,443	0		0
518RedShirtTable	U110A	Cedarpass si	1760	6.1	0.10%		U110A	Cedarpass si	1220	6.1	0.10%	7,442	7442		6.1
518RedShirtTable	U110B	Cedarpass si	1745	12	0.30%		U110B	Cedarpass si	1190	12	0.30%	14,280	14280		12
518RedShirtTable	U120A	Cedarpass-D	1742	24.7	0.60%		U120A	Cedarpass-D	1185	24.7	0.60%	29,270	29269.5		24.7
518RedShirtTable	U125B	Cedarpass-Ir	1266	182.7	4.20%		U125B	Cedarpass-Ir	612	182.7	4.20%	111,812	111812.4		182.7
518RedShirtTable	U205F	Fairburn-Ore	1214	11.7	0.30%		U205F	Fairburn-Ore	787	11.7	0.30%	9,208	9207.9		11.7
518RedShirtTable	U215F	Epping, moi	930	6.1	0.10%		U215F	Epping, moi	635	6.1	0.10%	3,874	3873.5		6.1
518RedShirtTable	U340B	Interior, mo	1576	125.2	2.90%		U340B	Interior, mo	693	125.2	2.90%	86,764	86763.6		125.2
518RedShirtTable	U348E	Jayem-Valer	2225	662.3	15.10%		U348E	Jayem-Valer	1695	662.3	15.10%	1,122,599	1122598.5		662.3
518RedShirtTable	U360F	Keota, thick	1581	4.5	0.10%		U360F	Keota, thick	997	4.5	0.10%	4,487	0		0
518RedShirtTable	U556C	Orella silt lo	1250	363.4	8.30%		U556C	Orella silt lo	810	363.4	8.30%	294,354	294354		363.4
518RedShirtTable	U560F	Orella-Badla	953	2.4	0.10%		U560F	Orella-Badla	662	2.4	0.10%	1,589	0		0
518RedShirtTable	U565E	Orella-Interi	1150	132.5	3.00%		U565E	Orella-Interi	520	132.5	3.00%	68,900	0		0
518RedShirtTable	U745B	Manter, coo	2108	62.2	1.40%		U745B	Manter, coo	1383	62.2	1.40%	86,023	86022.6		62.2
518RedShirtTable	U755E	Valentine lo	1920	253.2	5.80%		U755E	Valentine lo	1500	253.2	5.80%	379,800	379800		253.2
518RedShirtTable	Vs	Valentine sa	1935	170.3	3.90%		Vs	Valentine sa	1521	170.3	3.90%	259,026	259026.3		170.3
518RedShirtTable	Ww	Wortman-W	1444	15.4	0.40%		Ww	Wortman-W	974	15.4	0.40%	15,000	14999.6		15.4
				4373								0	0		0
518WestCuny	U020G	Badland	392	35	1.60%		U020G	Badland	205	35	1.60%	7,175	0		0
518WestCuny	U192G	Epping-Keot	1413	141.3	6.50%		U192G	Epping-Keot	838	141.3	6.50%	118,409	0		0
518WestCuny	U215F	Epping, moi	995	19.3	0.90%		U215F	Epping, moi	565	19.3	0.90%	10,905	0		0
518WestCuny	U340B	Interior, mo	1581	7.4	0.30%		U340B	Interior, mo	568	7.4	0.30%	4,203	4203.2		7.4
518WestCuny	U348E	Jayem-Valer	2225	329.7	15.10%		U348E	Jayem-Valer	1695	329.7	15.10%	558,842	558841.5		329.7
518WestCuny	U350A	Kadoka-Thir	1840	0.4	0.00%		U350A	Kadoka-Thir	1041	0.4	0.00%	416	416.4		0.4
518WestCuny	U350B	Kadoka-Thir	1816	178.5	8.20%		U350B	Kadoka-Thir	1035	178.5	8.20%	184,748	184747.5		178.5
518WestCuny	U350C	Kadoka-Thir	1801	1.7	0.10%		U350C	Kadoka-Thir	1029	1.7	0.10%	1,749	1749.3		1.7
518WestCuny	U355C	Kadoka-Eppi	1608	35.5	1.60%		U355C	Kadoka-Eppi	904	35.5	1.60%	32,092	32092		35.5
518WestCuny	U360F	Keota, thick	1366	68.4	3.10%		U360F	Keota, thick	759	68.4	3.10%	51,916	0		0
518WestCuny	U495F	Vivian grave	1200	26.5	1.20%		U495F	Vivian grave	755	26.5	1.20%	20,008	20007.5		26.5
518WestCuny	U615A	Savo-Tuthill	1860	175.3	8.00%		U615A	Savo-Tuthill	1063	175.3	8.00%	186,344	186343.9		175.3
518WestCuny	U740A	Tuthill-Jayer	2307	78.6	3.60%		U740A	Tuthill-Jayer	1699	78.6	3.60%	133,541	133541.4		78.6
518WestCuny	U740C	Tuthill-Jayer	2335	476.7	21.90%		U740C	Tuthill-Jayer	1731	476.7	21.90%	825,168	825167.7		476.7
518WestCuny	U745A	Manter, coo	2010	377.8	17.30%		U745A	Manter, coo	1303	377.8	17.30%	492,273	492273.4		377.8
518WestCuny	U745B	Manter, coo	2046	47.9	2.20%		U745B	Manter, coo	1329	47.9	2.20%	63,659	63659.1		47.9
518WestCuny	U745C	Manter, coo	2172	6.4	0.30%		U745C	Manter, coo	1384	6.4	0.30%	8,858	8857.6		6.4
518WestCuny	U755E	Valentine lo	1920	4.7	0.20%		U755E	Valentine lo	1500	4.7	0.20%	7,050	7050		4.7
518WestCuny	U820B	Wortman-W	1268	92.8	4.30%		U820B	Wortman-W	814	92.8	4.30%	75,539	75539.2		92.8
518WestCuny	Subtotals for	2,103.90	96.60%	2103.9			Subtotals for	2,103.90	96.60%			7,130,198	6249276.2	-0.123548	4575.8
														Total GA	7,173.30

503 Effective

Effective 503 - Normal Precipitation Year

Map Unit	lap Unit Nam	Pounds/Acre	Acres in AOI	% of AOI	Total pounds
U020G	Badland	392	1,857.10	21.80%	
U027F	Badland-Ore	481	1,000.80	11.70%	
U110A	Cedarpass si	1770	5.7	0.10%	
U120A	Cedarpass-D	1792	100	1.20%	
U165A	Denby silty c	1850	303.2	3.60%	
U192G	Epping-Keot	1413	13.1	0.20%	
U235B	Interior-Rive	1530	9	0.10%	
U315A	Interior loan	1550	49.6	0.60%	
U325B	Interior loan	1797	449.8	5.30%	
U335B	Interior, occ	1564	36.1	0.40%	
U340B	Interior, mo	1581	828.8	9.70%	
U350B	Kadoka-Thir	1816	15.5	0.20%	
U355C	Kadoka-Eppi	1608	11.7	0.10%	
U360F	Keota, thick	1366	40.4	0.50%	
U556C	Orella silt lo	1255	173.1	2.00%	
U560C	Orella-Badla	955	93.2	1.10%	
U560F	Orella-Badla	966	156.1	1.80%	
U565E	Orella-Interi	1160	2,554.20	30.00%	
U802B	Whitewater	1559	518.9	6.10%	
U805C	Whitewater	1371	270.3	3.20%	
U820B	Wortman-W	1268	25.5	0.30%	
UW	Water		7.3	0.10%	
Totals for Ar	8,519.30	100.00%			

Effective 503 - Unfavorable Precipitation Year

Map Unit	lap Unit Nam	Pounds/Acre	Acres in AOI	% of AOI	Total pounds	BIA Adjustment	% change	Graz.Acres
U020G	Badland	205	1,857.10	21.80%	380,706	0		0
U027F	Badland-Ore	286	1,000.80	11.70%	286,229	0		0
U110A	Cedarpass si	960	5.7	0.10%	5,472	5472		960
U120A	Cedarpass-D	1011	100	1.20%	101,100	101100		100
U165A	Denby silty c	1120	303.2	3.60%	339,584	339584		303
U192G	Epping-Keot	838	13.1	0.20%	10,978	0		0
U235B	Interior-Rive	394	9	0.10%	3,546	3546		9
U315A	Interior loan	1010	49.6	0.60%	50,096	50096		450
U325B	Interior loan	700	449.8	5.30%	314,860	314860		450
U335B	Interior, occ	976	36.1	0.40%	35,234	35233.6		36
U340B	Interior, mo	568	828.8	9.70%	470,758	470758.4		829
U350B	Kadoka-Thir	1035	15.5	0.20%	16,043	16042.5		15
U355C	Kadoka-Eppi	904	11.7	0.10%	10,577	10576.8		12
U360F	Keota, thick	759	40.4	0.50%	30,664	0		0
U556C	Orella silt lo	810	173.1	2.00%	140,211	140211		173
U560C	Orella-Badla	605	93.2	1.10%	56,386	0		0
U560F	Orella-Badla	646	156.1	1.80%	100,841	0		0
U565E	Orella-Interi	470	2,554.20	30.00%	1,200,474	0		0
U802B	Whitewater	994	518.9	6.10%	515,787	515786.6		519
U805C	Whitewater	901	270.3	3.20%	243,540	243540.3		270
U820B	Wortman-W	814	25.5	0.30%	20,757	20757		25
UW	Water		7.3	0.10%	0	0		0
Totals for Ar	8,519.30	100.00%			4,333,841	2267564.2	-0.4767772	4151

515 Effective

Effective 515 - Normal Precipitation Year

Map Unit	lap Unit Nam	Pounds/Acre	Acres in AOI	% of AOI	Total pounds
N542F	Samsil silty c	1418	178.2	2.70%	
N656B	Pierre clay, 3	1854	13.6	0.20%	
N656D	Pierre clay, 9	1800	23.8	0.40%	
N666E	Pierre-Sams	1655	1,526.40	23.10%	
N711G	Samsil-Pierr	1390	138.5	2.10%	
N814B	Swanboy cla	1295	57.3	0.90%	
U020G	Badland	392	405.2	6.10%	
U027F	Badland-Ore	481	779.2	11.80%	
U165A	Denby silty c	1850	169.2	2.60%	
U190D	Epping, moi	1550	26.4	0.40%	
U192G	Epping-Keot	1413	33.7	0.50%	
U215F	Epping, moi	995	198.9	3.00%	
U235B	Interior-Rive	1530	30.6	0.50%	
U325B	Interior loan	1797	819	12.40%	
U340B	Interior, mo	1581	36.8	0.60%	
U348E	Jayem-Valer	2225	21.7	0.30%	
U360F	Keota, thick	1366	12	0.20%	
U495F	Vivian grave	1200	4.4	0.10%	
U556C	Orella silt lo	1255	30.3	0.50%	
U560F	Orella-Badla	966	738.1	11.20%	
U565E	Orella-Interi	1160	951.7	14.40%	
U745C	Manter, coo	2172	1.1	0.00%	
U802B	Whitewater	1559	155.9	2.40%	
U805C	Whitewater	1371	199.9	3.00%	
U820B	Wortman-W	1268	49.9	0.80%	
Totals for Ar	6,601.80	100.00%			

Effective 515 - Unfavorable Precipitation Year

Map Unit	lap Unit Nam	Pounds/Acre	Acres in AOI	% of AOI	Total pounds	BIA Adjustment	% change	
N542F	Samsil silty c	994	178.2	2.70%	177,131	177130.8		178.2
N656B	Pierre clay, 3	1181	13.6	0.20%	16,062	16061.6		13.6
N656D	Pierre clay, 9	1145	23.8	0.40%	27,251	27251		23.8
N666E	Pierre-Sams	1095	1,526.40	23.10%	1,671,408	1671408		1526.4
N711G	Samsil-Pierr	989	138.5	2.10%	136,977	136976.5		138.5
N814B	Swanboy cla	798	57.3	0.90%	45,725	45725.4		57.3
U020G	Badland	205	405.2	6.10%	83,066	0		0
U027F	Badland-Ore	286	779.2	11.80%	222,851	0		0
U165A	Denby silty c	1120	169.2	2.60%	189,504	189504		169.2
U190D	Epping, moi	859	26.4	0.40%	22,678	22677.6		26.4
U192G	Epping-Keot	838	33.7	0.50%	28,241	0		0
U215F	Epping, moi	565	198.9	3.00%	112,379	0		0
U235B	Interior-Rive	394	30.6	0.50%	12,056	12056.4		30.6
U325B	Interior loan	700	819	12.40%	573,300	573300		819
U340B	Interior, mo	568	36.8	0.60%	20,902	20902.4		36.8
U348E	Jayem-Valer	1695	21.7	0.30%	36,782	36781.5		21.7
U360F	Keota, thick	759	12	0.20%	9,108	9108		12
U495F	Vivian grave	755	4.4	0.10%	3,322	3322		4.4
U556C	Orella silt lo	810	30.3	0.50%	24,543	0		0
U560F	Orella-Badla	646	738.1	11.20%	476,813	0		0
U565E	Orella-Interi	470	951.7	14.40%	447,299	0		0
U745C	Manter, coo	1384	1.1	0.00%	1,522	1522.4		1.1
U802B	Whitewater	994	155.9	2.40%	154,965	154964.6		155.9
U805C	Whitewater	901	199.9	3.00%	180,110	180109.9		199.9
U820B	Wortman-W	814	49.9	0.80%	40,619	40618.6		49.9
Totals for Area of Interest			6,601.80	100.00%	4,714,612	3319420.7	0	3464.7

	Effective 505 - Normal Precipitation Year					
	Map Unit	lap Unit Nam	Pounds/Acre	Acres in AOI	% of AOI	Total pounds
505 North	N464B	Kyle clay, 2 t	1820	19.1	0.20%	
505 North	N656D	Pierre clay, (	1800	11	0.10%	
505 North	N666E	Pierre-Sams	1655	41.3	0.40%	
505 North	N711G	Samsil-Pierr	1390	91.3	1.00%	
505 North	N814B	Swanboy cla	1295	4.1	0.00%	
505 North	U020G	Badland	392	1,160.60	12.10%	
505 North	U027F	Badland-Ore	481	1,097.80	11.50%	
505 North	U110A	Cedarpass si	1770	14.8	0.20%	
505 North	U110B	Cedarpass si	1745	33.4	0.30%	
505 North	U120A	Cedarpass-D	1792	23.8	0.20%	
505 North	U125B	Cedarpass-Ir	1288	520.2	5.40%	
505 North	U165A	Denby silty c	1850	197.9	2.10%	
505 North	U190D	Epping, moi	1550	51.1	0.50%	
505 North	U200F	Fairburn cla	1398	14.3	0.10%	
505 North	U215F	Epping, moi	995	855.2	8.90%	
505 North	U315A	Interior loan	1550	21	0.20%	
505 North	U325B	Interior loan	1797	813	8.50%	
505 North	U335B	Interior, occ	1564	40	0.40%	
505 North	U340B	Interior, mo	1581	185.5	1.90%	
505 North	U348E	Jayem-Valer	2225	34.5	0.40%	
505 North	U350B	Kadoka-Thir	1816	48.1	0.50%	
505 North	U355C	Kadoka-Eppi	1608	138.3	1.40%	
505 North	U360F	Keota, thick	1366	1,382.80	14.40%	
505 North	U510A	Thirtynine si	1784	6.3	0.10%	
505 North	U556C	Orella silt lo	1255	71.3	0.70%	
505 North	U560C	Orella-Badla	955	148.8	1.60%	
505 North	U560F	Orella-Badla	966	147.5	1.50%	
505 North	U565E	Orella-Interi	1160	846.4	8.80%	
505 North	U745C	Manter, coo	2172	4.2	0.00%	
505 North	U802B	Whitewater	1559	1,328.30	13.90%	
505 North	U805C	Whitewater	1371	189.1	2.00%	
505 North	U820B	Wortman-W	1268	26.6	0.30%	
505 North	UW	Water		18.6	0.20%	
	Totals for Ar	9,585.70	100.00%			
505 South	U020G	Badland	392	1,229.00	13.40%	
505 South	U027F	Badland-Ore	481	1,386.60	15.10%	
505 South	U110A	Cedarpass si	1770	4.9	0.10%	
505 South	U110B	Cedarpass si	1745	14	0.20%	
505 South	U120A	Cedarpass-D	1792	145.6	1.60%	
505 South	U125B	Cedarpass-Ir	1288	279.3	3.00%	
505 South	U165A	Denby silty c	1850	481.8	5.30%	
505 South	U190D	Epping, moi	1550	21.9	0.20%	
505 South	U192G	Epping-Keot	1413	5.5	0.10%	
505 South	U200F	Fairburn cla	1398	4.1	0.00%	
505 South	U215F	Epping, moi	995	30.2	0.30%	
505 South	U315A	Interior loan	1550	3.1	0.00%	
505 South	U325B	Interior loan	1797	904.8	9.90%	
505 South	U335B	Interior, occ	1564	73.4	0.80%	
505 South	U340B	Interior, mo	1581	443.7	4.80%	
505 South	U350A	Kadoka-Thir	1840	5.2	0.10%	
505 South	U350B	Kadoka-Thir	1816	2.1	0.00%	
505 South	U350C	Kadoka-Thir	1801	9.8	0.10%	
505 South	U360F	Keota, thick	1366	189.6	2.10%	
505 South	U556C	Orella silt lo	1255	550.3	6.00%	
505 South	U560C	Orella-Badla	955	236	2.60%	
505 South	U560F	Orella-Badla	966	235.9	2.60%	
505 South	U565E	Orella-Interi	1160	1,691.20	18.40%	
505 South	U802B	Whitewater	1559	674.8	7.40%	
505 South	U805C	Whitewater	1371	304	3.30%	
505 South	U820B	Wortman-W	1268	225.4	2.50%	
505 South	UW	Water		16.2	0.20%	
505 South	Totals for Ar	9,170.90	100.00%			

	Effective 505 - Unfavorable Precipitation Year							
	Map Unit	lap Unit Nam	Pounds/Acre	Acres in AOI	% of AOI	Total pounds	BIA Adjustment	% change
N464B	Kyle clay, 2 t	1145	19.1	0.20%	21,870	21869.5		19.1
N656D	Pierre clay, (	1145	11	0.10%	12,595	12595		11
N666E	Pierre-Sams	1095	41.3	0.40%	45,224	45223.5		41.3
N711G	Samsil-Pierr	989	91.3	1.00%	90,296	90295.7		91.3
N814B	Swanboy cla	798	4.1	0.00%	3,272	3271.8		4.1
U020G	Badland	205	1,160.60	12.10%	237,923	0		0
U027F	Badland-Ore	286	1,097.80	11.50%	313,971	0		0
U110A	Cedarpass si	960	14.8	0.20%	14,208	14208		14.8
U110B	Cedarpass si	945	33.4	0.30%	31,563	31563		33.4
U120A	Cedarpass-D	1011	23.8	0.20%	24,062	24061.8		23.8
U125B	Cedarpass-Ir	536	520.2	5.40%	278,827	0		0
U165A	Denby silty c	1120	197.9	2.10%	221,648	221648		197.9
U190D	Epping, moi	859	51.1	0.50%	43,895	43894.9		51.1
U200F	Fairburn cla	816	14.3	0.10%	11,669	11668.8		14.3
U215F	Epping, moi	565	855.2	8.90%	483,188	0		0
U315A	Interior loan	1010	21	0.20%	21,210	21210		21
U325B	Interior loan	700	813	8.50%	569,100	569100		813
U335B	Interior, occ	976	40	0.40%	39,040	39040		40
U340B	Interior, mo	568	185.5	1.90%	105,364	105364		185.5
U348E	Jayem-Valer	1695	34.5	0.40%	58,478	58477.5		34.5
U350B	Kadoka-Thir	1035	48.1	0.50%	49,784	49783.5		48.1
U355C	Kadoka-Eppi	904	138.3	1.40%	125,023	125023.2		138.3
U360F	Keota, thick	759	1,382.80	14.40%	1,049,545	0		0
U510A	Thirtynine si	1005	6.3	0.10%	6,332	6331.5		6.3
U556C	Orella silt lo	810	71.3	0.70%	57,753	0		0
U560C	Orella-Badla	605	148.8	1.60%	90,024	0		0
U560F	Orella-Badla	646	147.5	1.50%	95,285	0		0
U565E	Orella-Interi	470	846.4	8.80%	397,808	0		0
U745C	Manter, coo	1384	4.2	0.00%	5,813	5812.8		4.2
U802B	Whitewater	994	1,328.30	13.90%	1,320,330	1320330.2		1328.3
U805C	Whitewater	901	189.1	2.00%	170,379	170379.1		189.1
U820B	Wortman-W	814	26.6	0.30%	21,652	21652.4		26.6
UW	Water		18.6	0.20%	0	0		0
Totals for Ar	9,585.70	100.00%			6,017,128	3012804.2	-0.4992953	
U020G	Badland	205	1,229.00	13.40%	251,945	0		0.00
U027F	Badland-Ore	286	1,386.60	15.10%	396,568	0		0.00
U110A	Cedarpass si	960	4.9	0.10%	4,704	4704		4.90
U110B	Cedarpass si	945	14	0.20%	13,230	13230		14.00
U120A	Cedarpass-D	1011	145.6	1.60%	147,202	147201.6		145.60
U125B	Cedarpass-Ir	536	279.3	3.00%	149,705	0		0.00
U165A	Denby silty c	1120	481.8	5.30%	539,616	539616		481.80
U190D	Epping, moi	859	21.9	0.20%	18,812	18812.1		21.90
U192G	Epping-Keot	838	5.5	0.10%	4,609	0		0.00
U200F	Fairburn cla	816	4.1	0.00%	3,346	3345.6		4.10
U215F	Epping, moi	565	30.2	0.30%	17,063	0		0.00
U315A	Interior loan	1010	3.1	0.00%	3,131	3131		3.10
U325B	Interior loan	700	904.8	9.90%	633,360	633360		904.80
U335B	Interior, occ	976	73.4	0.80%	71,638	71638.4		73.40
U340B	Interior, mo	568	443.7	4.80%	252,022	252021.6		443.70
U350A	Kadoka-Thir	1041	5.2	0.10%	5,413	5413.2		5.20
U350B	Kadoka-Thir	1035	2.1	0.00%	2,174	2173.5		2.10
U350C	Kadoka-Thir	1029	9.8	0.10%	10,084	10084.2		9.80
U360F	Keota, thick	759	189.6	2.10%	143,906	0		0.00
U556C	Orella silt lo	810	550.3	6.00%	445,743	445743		550.30
U560C	Orella-Badla	605	236	2.60%	142,780	0		0.00
U560F	Orella-Badla	646	235.9	2.60%	152,391	0		0.00
U565E	Orella-Interi	470	1,691.20	18.40%	794,864	0		0.00
U802B	Whitewater	994	674.8	7.40%	670,751	670751.2		674.80
U805C	Whitewater	901	304	3.30%	273,904	273904		304.00
U820B	Wortman-W	814	225.4	2.50%	183,476	183475.6		225.40
UW	Water		16.2	0.20%	0			
Totals for Ar	9,170.90	100.00%			5,332,436	3278605	-0.3851581	7205.9

	Effective 506 - Normal Precipitation Year						Effective 506 - Unfavorable Precipitation Year								
	Map Unit	lap Unit Nam	Pounds/Acre	Acres in AOI	% of AOI	Total pounds	Map Unit	lap Unit Nam	Pounds/Acre	Acres in AOI	% of AOI	Total pounds	BIA Adjustment	% change	Grazeable Acres
506 Melvin's Route	U020G	Badland	392	256.2	2.80%		U020G	Badland	205	256.2	2.80%	52,521	0		0
506 Melvin's Route	U027F	Badland-Ore	481	396.3	4.40%		U027F	Badland-Ore	286	396.3	4.40%	113,342	0		0
506 Melvin's Route	U110A	Cedarpass si	1770	124.2	1.40%		U110A	Cedarpass si	960	124.2	1.40%	119,232	119232		124.2
506 Melvin's Route	U110B	Cedarpass si	1745	12.5	0.10%		U110B	Cedarpass si	945	12.5	0.10%	11,813	11812.5		12.5
506 Melvin's Route	U120A	Cedarpass-D	1792	13.9	0.20%		U120A	Cedarpass-D	1011	13.9	0.20%	14,053	14052.9		13.9
506 Melvin's Route	U125B	Cedarpass-Ir	1288	190.5	2.10%		U125B	Cedarpass-Ir	536	190.5	2.10%	102,108	0		0
506 Melvin's Route	U165A	Denby silty c	1850	81	0.90%		U165A	Denby silty c	1120	81	0.90%	90,720	90720		81
506 Melvin's Route	U190D	Epping, moi	1550	30.6	0.30%		U190D	Epping, moi	859	30.6	0.30%	26,285	26285.4		30.6
506 Melvin's Route	U205F	Fairburn-Ore	1294	1,718.50	18.90%		U205F	Fairburn-Ore	762	1,718.50	18.90%	1,309,497	1309497		1718.5
506 Melvin's Route	U235B	Interior-Rive	1530	237.1	2.60%		U235B	Interior-Rive	394	237.1	2.60%	93,417	93417.4		237.1
506 Melvin's Route	U240A	Bridgeport l	2396	7.3	0.10%		U240A	Bridgeport l	1604	7.3	0.10%	11,709	11709.2		7.3
506 Melvin's Route	U315A	Interior loan	1550	22.6	0.20%		U315A	Interior loan	1010	22.6	0.20%	22,826	22826		22.6
506 Melvin's Route	U325B	Interior loan	1797	227.3	2.50%		U325B	Interior loan	700	227.3	2.50%	159,110	159110		227.3
506 Melvin's Route	U335B	Interior, occ	1564	258.9	2.80%		U335B	Interior, occ	976	258.9	2.80%	252,686	252686.4		258.9
506 Melvin's Route	U340B	Interior, mo	1581	108.1	1.20%		U340B	Interior, mo	568	108.1	1.20%	61,401	61400.8		108.1
506 Melvin's Route	U342C	Interior, poc	1400	23.7	0.30%		U342C	Interior, poc	845	23.7	0.30%	20,027	20026.5		23.7
506 Melvin's Route	U556C	Orella silt lo	1255	26.7	0.30%		U556C	Orella silt lo	810	26.7	0.30%	21,627	21627		26.7
506 Melvin's Route	U560C	Orella-Badla	955	22.2	0.20%		U560C	Orella-Badla	605	22.2	0.20%	13,431	0		0
506 Melvin's Route	U560F	Orella-Badla	966	18.1	0.20%		U560F	Orella-Badla	646	18.1	0.20%	11,693	0		0
506 Melvin's Route	U565E	Orella-Interi	1160	477.3	5.20%		U565E	Orella-Interi	470	477.3	5.20%	224,331	0		0
506 Melvin's Route	U802B	Whitewater	1559	15.2	0.20%		U802B	Whitewater	994	15.2	0.20%	15,109	15108.8		15.2
506 Melvin's Route	U805C	Whitewater	1371	82.7	0.90%		U805C	Whitewater	901	82.7	0.90%	74,513	74512.7		82.7
506 Melvin's Route	U820B	Wortman-W	1268	10.2	0.10%		U820B	Wortman-W	814	10.2	0.10%	8,303	8302.8		10.2
506 Melvin's Route	Aa	Lohmiller sil	3230	26.3	0.30%		Aa	Lohmiller sil	2405	26.3	0.30%	63,252	63251.5		26.3
506 Melvin's Route	Ba	Badland-Der	1307	6.9	0.10%		Ba	Badland-Der	879	6.9	0.10%	6,065	0		0
506 Melvin's Route	Bk	Bankard loa	1970	12.3	0.10%		Bk	Bankard loa	1520	12.3	0.10%	18,696	4674		12.3
506 Melvin's Route	Br	Badland	382	25	0.30%		Br	Badland	261	25	0.30%	6,525	0		0
506 Melvin's Route	EkE	Epping-Kadc	1916	95.5	1.00%		EkE	Epping-Kadc	1081	95.5	1.00%	103,236	103235.5		95.5
506 Melvin's Route	Lm	Interior silt l	2331	238.4	2.60%		Lm	Interior silt l	1773	238.4	2.60%	422,683	422683.2		238.4
506 Melvin's Route	Os	Orella-Shale	1135	474.8	5.20%		Os	Orella-Shale	803	474.8	5.20%	381,264	0		0
506 Melvin's Route	U027F	Badland-Ore	478	32.7	0.40%		U027F	Badland-Ore	295	32.7	0.40%	9,647	0		0
506 Melvin's Route	U110A	Cedarpass si	1760	142.9	1.60%		U110A	Cedarpass si	1220	142.9	1.60%	174,338	174338		142.9
506 Melvin's Route	U120A	Cedarpass-D	1742	53.6	0.60%		U120A	Cedarpass-D	1185	53.6	0.60%	63,516	63516		53.6
506 Melvin's Route	U125B	Cedarpass-Ir	1266	193.1	2.10%		U125B	Cedarpass-Ir	612	193.1	2.10%	118,177	0		0
506 Melvin's Route	U165A	Denby silty c	1760	77.9	0.90%		U165A	Denby silty c	1220	77.9	0.90%	95,038	95038		77.9
506 Melvin's Route	U205F	Fairburn-Ore	1214	1,770.70	19.40%		U205F	Fairburn-Ore	787	1,770.70	19.40%	1,393,541	0		0
506 Melvin's Route	U235B	Interior-Rive	1530	148.3	1.60%		U235B	Interior-Rive	394	148.3	1.60%	58,430	58430.2		148.3
506 Melvin's Route	U315A	Interior loan	1580	17	0.20%		U315A	Interior loan	1055	17	0.20%	17,935	17935		17
506 Melvin's Route	U325B	Interior loan	1794	403.5	4.40%		U325B	Interior loan	720	403.5	4.40%	290,520	290520		403.5
506 Melvin's Route	U335B	Interior, occ	1532	102.4	1.10%		U335B	Interior, occ	1076	102.4	1.10%	110,182	110182.4		102.4
506 Melvin's Route	U340B	Interior, mo	1576	137.9	1.50%		U340B	Interior, mo	693	137.9	1.50%	95,565	95564.7		137.9
506 Melvin's Route	U556C	Orella silt lo	1250	28.1	0.30%		U556C	Orella silt lo	810	28.1	0.30%	22,761	0		0
506 Melvin's Route	U565E	Orella-Interi	1150	255.6	2.80%		U565E	Orella-Interi	520	255.6	2.80%	132,912	0		0
506 Melvin's Route	U802B	Whitewater	1474	103	1.10%		U802B	Whitewater	1046	103	1.10%	107,738	107738		103
506 Melvin's Route	U805C	Whitewater	1317	235	2.60%		U805C	Whitewater	905	235	2.60%	212,675	212675		235
506 Melvin's Route	U820B	Wortman-W	1265	111.7	1.20%		U820B	Wortman-W	799	111.7	1.20%	89,248	89248.3		111.7
506 Melvin's Route	UW	Water		2.2	0.00%		UW	Water		2.2	0.00%	0	0		0
506 Melvin's Route	Ww	Wortman-W	1444	49.7	0.50%		Ww	Wortman-W	974	49.7	0.50%	48,408	48407.8		49.7
506 Melvin's Route	Subtotals for	4,744.50	52.10%				Subtotals for Soil Survey Area			4,744.50	52.10%				
506 Melvin's Route	Totals for Ar	9,105.60	100.00%				Totals for Area of Interest			9,105.60	100.00%	6,872,105	4269765		4955.9
506 South	Aa	Lohmiller sil	3230	180.2	2.10%		Aa	Lohmiller sil	2405	180.2	2.10%	433,381	433381		180.2
506 South	Ba	Badland-Der	1307	1,778.70	20.30%		Ba	Badland-Der	879	1,778.70	20.30%	1,563,477	0		0
506 South	Br	Badland	382	118.1	1.30%		Br	Badland	261	118.1	1.30%	30,824	0		0
506 South	Cy	Denby silty c	1972	154.2	1.80%		Cy	Denby silty c	1226	154.2	1.80%	189,049	189049.2		154.2
506 South	EkE	Epping-Kadc	1916	20.9	0.20%		EkE	Epping-Kadc	1081	20.9	0.20%	22,593	22592.9		20.9
506 South	Gr	Nihill gravell	1215	22	0.30%		Gr	Nihill gravell	741	22	0.30%	16,302	16302		22
506 South	HhA	Haverson lo	2715	40	0.50%		HhA	Haverson lo	1815	40	0.50%	72,600	72600		40
506 South	HlA	Haverson lo	3105	46.6	0.50%		HlA	Haverson lo	2290	46.6	0.50%	106,714	106714		46.6
506 South	KaA	Kadoka silt l	2416	22.3	0.30%		KaA	Kadoka silt l	1521	22.3	0.30%	33,918	33918.3		22.3
506 South	KbC	Kadoka-Eppi	2012	118.1	1.30%		KbC	Kadoka-Eppi	1168	118.1	1.30%	137,941	137940.8		118.1
506 South	Lm	Interior silt l	2331	599.2	6.80%		Lm	Interior silt l	1773	599.2	6.80%	1,062,382	1062381.6		599.2
506 South	Os	Orella-Shale	1135	3,311.40	37.80%		Os	Orella-Shale	803	3,311.40	37.80%	2,659,054	2659054.2		3311.4
506 South	TuC	Tuthill-Mant	2400	89.4	1.00%		TuC	Tuthill-Mant	1770	89.4	1.00%	158,238	158238		89.4
506 South	U110A	Cedarpass si	1760	31	0.40%		U110A	Cedarpass si	1220	31	0.40%	37,820	37820		31
506 South	U125B	Cedarpass-Ir	1266	16.5	0.20%		U125B	Cedarpass-Ir	612	16.5	0.20%	10,098	10098		16.5
506 South	U205F	Fairburn-Ore	1214	868.8	9.90%		U205F	Fairburn-Ore	787	868.8	9.90%	683,746	0		0
506 South	U315A	Interior loan	1580	2.6	0.00%		U315A	Interior loan	1055	2.6	0.00%	2,743	2743		2.6
506 South	U325B	Interior loan	1794	944.2	10.80%		U325B	Interior loan	720	944.2	10.80%	679,824	679824		944.2
506 South	U805C	Whitewater	1317	13.7	0.20%		U805C	Whitewater	905	13.7	0.20%	12,399	12398.5		13.7
506 South	UW	Water		9.6	0.10%		UW	Water		9.6	0.10%	0	0		0
506 South	W	Water		5.8	0.10%		W	Water		5.8	0.10%	0	0		0
506 South	Ww	Wortman-W	1444	358.2	4.10%		Ww	Wortman-W	974	358.2	4.10%	348,887	348886.8		358.2
506 South	Totals for Ar	8,752.70	100.00%				Totals for Area of Interest			8,752.70	100.00%	8,261,989	5983942.3		5970.5
506 North	U020G	Badland	392	133.5	1.40%		U020G	Badland	205	133.5	1.40%	27,368	0		0
506 North	U027F	Badland-Ore	481	42.6	0.40%		U027F	Badland-Ore	286	42.6	0.40%	12,184	0		0
506 North	U110A	Cedarpass si	1770	2.3	0.00%		U110A	Cedarpass si	960	2.3	0.00%	2,208	2208		2.3
506 North	U120A	Cedarpass-D	1792	23.1	0.20%		U120A	Cedarpass-D	1011	23.1	0.20%	23,354	23354.1		23.1
506 North	U125B	Cedarpass-Ir	1288	69.4	0.70%		U125B	Cedarpass-Ir	536	69.4	0.70%	37,198	37198.4		69.4
506 North	U165A	Denby silty c	1850	17.4	0.20%		U165A	Denby silty c	1120	17.4	0.20%	19,488	19488		17.4
506 North	U205F	Fairburn-Ore	1294	31.2	0.30%		U205F	Fairburn-Ore	762	31.2	0.30%	23,774	0		0
506 North	U325B	Interior loan	1797	42.6	0.40%		U325B	Interior loan	700	42.6	0.40%	29,820	29820		42.6
506 North	U335B	Interior, occ	1564	61.6	0.60%		U335B	Interior, occ	976	61.6	0.60%	60,122	60121.6		61.6
506 North	U340B	Interior, mo	1581	461.6	4.90%		U340B	Interior, mo	568	461.6	4.90%	262,189	262188.8		461.6
506 North	U355C	Kadoka-Eppi	1608	66.9	0.70%		U355C	Kadoka-Eppi	904	66.9	0.70%	60,478	60477.6		66.9
506 North	U556C	Orella silt lo	1255	155	1.60%		U556C	Orella silt lo	810	155	1.60%	125,550	125550		155
506 North	U560C	Orella-Badla	955	390.8	4.10%		U560C	Orella-Badla	605	390.8	4.10%	236,434	0		0
506 North	U560F	Orella-Badla	966	264.2	2.80%		U560F	Orella-Badla	646	264.2	2.80%	170,673	0		0
506 North	U565E	Orella-Interi	1160	551.3	5.80%		U565E	Orella-Interi	470	551.3	5.80%	259,111	0		0
506 North	U802B	Whitewater	1559	85.8	0.90%		U802B	Whitewater	994	85.8	0.90%	85,285	85285.2		85.8
506 North	U805C	Whitewater	1371	230.2	2.40%		U805C	Whitewater	901	230.2	2.40%	207,410	207410.2		230.2
506 North	U820B	Wortman-W	1268	109.2	1.10%		U820B	Wortman-W	814	109.2	1.10%	88,889	88888.8		109.2
506 North	Aa	Lohmiller sil	3230	63.9	0.70%		Aa	Lohmiller sil	2405	63.9	0.70%	153,680	153679.5		63.9
506 North	Ba	Badland-Der	1307	573.7	6.00%		Ba	Badland-Der	879	573.7	6.00%	504,282	0		0
506 North	Br	Badland	382	307.3	3.20%		Br	Badland	261	307.3	3.20%	80,205	0		0
506 North	Cy	Denby silty c	1972	347.2	3.70%		Cy	Denby silty c	1226	347.2	3.70%	425,667	425667.2		347.2
506 North	Lm	Interior silt l	2331	637.9	6.70%		Lm	Interior silt l	1773	637.9	6.70%	1,130,997	1130996.7		637.9
506 North	Mm	Mosher-Min	1594	45.9	0.50%		Mm	Mosher-Min	1100	45.9	0.50%	50,490	50490		45.9
506 North	Os	Orella-Shale	1135	2,872.70	30.30%		Os	Orella-Shale	803	2,872.70	30.30%	2,306,778	2306778.1		2872.7
506 North	Sw	Swanboy cla	1341	17.3	0.20%		Sw	Swanboy cla	837	17.3	0.20%	14,480	14480.1		17.3
506 North	U020G	Badland	385	10.1	0.10%		U020G	Badland	210	10.1	0.10%	2,121	0		0
506 North	U027F	Badland-Ore	478	5.8	0.10%		U027F	Badland-Ore	295	5.8	0.10%	1,711	0		0
506 North	U110A	Cedarpass si	1760	132.5	1.40%		U110A	Cedarpass si	1220	132.5	1.40%	161,650	161650		132.5
506 North	U120A	Cedarpass-D	1742	46.7	0.50%		U120A	Cedarpass-D	1185	46.7	0.50%	55,340	55339.5		46.7
506 North	U125B	Cedarpass-Ir	1266	24	0.30%		U125B	Cedarpass-Ir	612	24	0.30%	14,688	0		0
506 North	U165A	Denby silty c	1760	18.5	0.20%		U165A	Denby silty c	1220	18.5	0.20%	22,570	22570		18.5
506 North	U205F	Fairburn-Ore	1214	173.5	1.80%		U205F	Fairburn-Ore	787	173.5	1.80%	136,545	0		0
506 North	U325B	Interior loan	1794	298.6	3.10%		U325B	Interior loan	720	298.6	3.10%	214,992	214992		298.6
506 North	U335B	Interior, occ	1532	33.3	0.40%		U335B	Interior, occ	1076	33.3	0.40%	35,831	35830.8		33.3
506 North	U340B	Interior, mo	1576	106.5	1.10%		U340B	Interior, mo	693	106.5	1.10%	73,805	73804.5		106.5
506 North	U342C	Interior, poc	1380	5.4	0.10%		U342C	Interior, poc	880	5.4	0.10%	4,752	4752		5.4
506 North	U556C	Orella silt lo	1250	31.9	0.30%		U556C	Orella silt lo	810	31.9	0.30%	25,839	25839		31.9
506 North	U560C	Orella-Badla	945	13.3	0.10%		U560C	Orella-Badla	610	13.3	0.10%	8,113	0		0
506 North	U560F	Orella-Badla	953	2.1	0.00%		U560F	Orella-Badla	662	2.1	0.00%	1,390	0		0
506 North	U565E	Orella-Interi	1150	246.9	2.60%		U565E	Orella-Interi	520	246.9	2.60%	128,388	0		0
506 North	U802B	Whitewater	1474	321.3	3.40%		U802B	Whitewater	1046	321.3	3.40%	336,080	336079.8		321.3
506 North	U805C	Whitewater	1317	183	1.90%		U805C	Whitewater	905	183	1.90%	165,615	165615		183
506 North	U820B	Wortman-W	1265	80.9	0.90%		U820B	Wortman-W	799	80.9	0.90%	64,639	64639.1		80.9

Effective 510 - Normal Precipitation Year

	Map Unit	lap Unit Nam	Pounds/Acre	Acres in AOI	% of AOI	Total pounds
510	U020G	Badland	392	600.1	13.70%	
	U027F	Badland-Ore	481	73	1.70%	
	U125B	Cedarpass li	1288	31.1	0.70%	
	U192G	Epping-Keot	1413	0.5	0.00%	
	U205F	Fairburn-Ore	1294	170.4	3.90%	
	U348E	Jayem-Valer	2225	14.8	0.30%	
	U556C	Orella silt lo	1255	338.7	7.70%	
	U560F	Orella-Badla	966	101.4	2.30%	
	U565E	Orella-Interi	1160	182.2	4.20%	
	U755E	Valentine lo	1920	34.6	0.80%	
	Aa	Lohmiller sil	3230	158.4	3.60%	
	Ba	Badland-Der	1307	1.8	0.00%	
	Br	Badland	382	22.5	0.50%	
	EkE	Epping-Kadc	1916	6.1	0.10%	
	Ht	Hisle-Swanb	1135	35	0.80%	
	KbC	Kadoka-Eppi	2012	6.2	0.10%	
	Lm	Interior silt l	2331	146.1	3.30%	
	Mm	Mosher-Min	1594	98.2	2.20%	
	Sw	Swanboy cla	1341	25.2	0.60%	
	TnA	Tuthill-Anse	2398	1.2	0.00%	
	TnC	Tuthill-Anse	2398	94.2	2.20%	
	TuA	Tuthill-Mant	2416	7	0.20%	
	TuB	Tuthill-Mant	2398	8.2	0.20%	
	TuC	Tuthill-Mant	2400	3.9	0.10%	
	U020G	Badland	385	142.1	3.20%	
	U027F	Badland-Ore	478	35.4	0.80%	
	U110A	Cedarpass si	1760	6.1	0.10%	
	U110B	Cedarpass si	1745	12	0.30%	
	U120A	Cedarpass-C	1742	24.7	0.60%	
	U125B	Cedarpass-Ir	1266	182.7	4.20%	
	U205F	Fairburn-Ore	1214	11.7	0.30%	
	U215F	Epping, moi:	930	6.1	0.10%	
	U340B	Interior, mo	1576	125.2	2.90%	
	U348E	Jayem-Valer	2225	662.3	15.10%	
	U360F	Keota, thick	1581	4.5	0.10%	
	U556C	Orella silt lo	1250	363.4	8.30%	
	U560F	Orella-Badla	953	2.4	0.10%	
	U565E	Orella-Interi	1150	132.5	3.00%	
	U745B	Manter, coo	2108	62.2	1.40%	
	U755E	Valentine lo	1920	253.2	5.80%	
	Vs	Valentine sa	1935	170.3	3.90%	
	Ww	Wortman-W	1444	15.4	0.40%	
	Subtotals for		2,826.20	64.60%		
	Totals for Are		4,374.90	100.00%		

Effective 510 - Unfavorable Precipitation Year

Map Unit	lap Unit Nam	Pounds/Acre	Acres in AOI	% of AOI	Total pounds	BIA Adjustment	% change	Grazeable acres
U020G	Badland	205	600.1	13.70%	123,021	0		0
U027F	Badland-Ore	286	73	1.70%	20,878	0		0
U125B	Cedarpass-Ir	536	31.1	0.70%	16,670	0		0
U192G	Epping-Keot	838	0.5	0.00%	419	0		0
U205F	Fairburn-Ore	762	170.4	3.90%	129,845	0		0
U348E	Jayem-Valer	1695	14.8	0.30%	25,086	25086		14.8
U556C	Orella silt lo	810	338.7	7.70%	274,347	274347		338.7
U560F	Orella-Badla	646	101.4	2.30%	65,504	0		0
U565E	Orella-Interi	470	182.2	4.20%	85,634	0		0
U755E	Valentine lo	1500	34.6	0.80%	51900	51900		34.6
Aa	Lohmiller sil	2405	158.4	3.60%	380,952	380952		158.4
Ba	Badland-Der	879	1.8	0.00%	1,582	0		0
Br	Badland	261	22.5	0.50%	5,873	0		0
EkE	Epping-Kadc	1081	6.1	0.10%	6,594	6594.1		6.1
Ht	Hisle-Swanb	670	35	0.80%	23,450	23450		35
KbC	Kadoka-Eppi	1168	6.2	0.10%	7,242	7241.6		6.2
Lm	Interior silt l	1773	146.1	3.30%	259,035	259035.3		146.1
Mm	Mosher-Min	1100	98.2	2.20%	108,020	108020		98.2
Sw	Swanboy cla	837	25.2	0.60%	21,092	21092.4		25.2
TnA	Tuthill-Anse	1797	1.2	0.00%	2,156	2156.4		1.2
TnC	Tuthill-Anse	1797	94.2	2.20%	169,277	169277.4		94.2
TuA	Tuthill-Mant	1800	7	0.20%	12,600	12600		7
TuB	Tuthill-Mant	1770	8.2	0.20%	14,514	14514		8.2
TuC	Tuthill-Mant	1770	3.9	0.10%	6,903	6903		3.9
U020G	Badland	210	142.1	3.20%	29,841	0		0
U027F	Badland-Ore	295	35.4	0.80%	10,443	0		0
U110A	Cedarpass si	1220	6.1	0.10%	7,442	7442		6.1
U110B	Cedarpass si	1190	12	0.30%	14,280	14280		12
U120A	Cedarpass-C	1185	24.7	0.60%	29,270	29269.5		24.7
U125B	Cedarpass-Ir	612	182.7	4.20%	111,812	0		0
U205F	Fairburn-Ore	787	11.7	0.30%	9,208	0		0
U215F	Epping, moi:	635	6.1	0.10%	3,874	3873.5		6.1
U340B	Interior, mo	693	125.2	2.90%	86,764	86763.6		125.2
U348E	Jayem-Valer	1695	662.3	15.10%	1,122,599	1122598.5		662.3
U360F	Keota, thick	997	4.5	0.10%	4,487	0		0
U556C	Orella silt lo	810	363.4	8.30%	294,354	294354		363.4
U560F	Orella-Badla	662	2.4	0.10%	1,589	0		0
U565E	Orella-Interi	520	132.5	3.00%	68,900	0		0
U745B	Manter, coo	1383	62.2	1.40%	86,023	21505.65		62.2
U755E	Valentine lo	1500	253.2	5.80%	379,800	94950		253.2
Vs	Valentine sa	1521	170.3	3.90%	259,026	64756.575		170.3
Ww	Wortman-W	974	15.4	0.40%	15,000	3749.9		15.4
Subtotals for		2,826.20	64.60%					
Totals for Are		4,374.90	100.00%		4,347,303	3106712.425	-0.2853702	2678.7

Effective 507 - Normal Precipitation Year

Map Unit	lap Unit Nam	Pounds/Acre	Acres in AOI	% of AOI	Total pounds
U020G	Badland	392	1,020.60	27.70%	
U027F	Badland-Ore	481	41.4	1.10%	
U110A	Cedarpass si	1770	45.8	1.20%	
U110B	Cedarpass si	1745	3.7	0.10%	
U125B	Cedarpass-Ir	1288	108	2.90%	
U192G	Epping-Keot	1413	205	5.60%	
U195E	Mitchell-Epp	1570	5.5	0.10%	
U205F	Fairburn-Ore	1294	1,181.80	32.10%	
U215F	Epping, moi:	995	23	0.60%	
U325B	Interior loan	1797	96.5	2.60%	
U335B	Interior, occ	1564	133.4	3.60%	
U340B	Interior, mo	1581	51.8	1.40%	
U342C	Interior, poc	1400	45.9	1.20%	
U348E	Jayem-Valer	2225	0.5	0.00%	
U355C	Kadoka-Eppi	1608	52.7	1.40%	
U360F	Keota, thick	1366	7.7	0.20%	
U495F	Vivian grave	1200	2.8	0.10%	
U556C	Orella silt lo	1255	117.2	3.20%	
U560C	Orella-Badla	955	45	1.20%	
U560F	Orella-Badla	966	19.3	0.50%	
U565E	Orella-Interi	1160	115.5	3.10%	
U740C	Tuthill-Jayer	2335	0.1	0.00%	
U745B	Manter, coo	2046	33.6	0.90%	
U802B	Whitewater	1559	79	2.10%	
U805C	Whitewater	1371	92.3	2.50%	
Br	Badland	382	9.5	0.30%	
Lm	Interior silt l	2331	31.6	0.90%	
U020G	Badland	385	14.9	0.40%	
U110A	Cedarpass si	1760	1.3	0.00%	
U125B	Cedarpass-Ir	1266	63.2	1.70%	
U195E	Mitchell-Epp	1630	0.2	0.00%	
U205F	Fairburn-Ore	1214	1.5	0.00%	
U325B	Interior loan	1794	0.3	0.00%	
U335B	Interior, occ	1532	3.9	0.10%	
U340B	Interior, mo	1576	4.1	0.10%	
U342C	Interior, poc	1380	0.1	0.00%	
U495F	Vivian grave	1185	0.3	0.00%	
U556C	Orella silt lo	1250	14.9	0.40%	
U802B	Whitewater	1474	4.8	0.10%	
U805C	Whitewater	1317	2.1	0.10%	
Ww	Wortman-W	1444	0.4	0.00%	
Subtotals for		153.2	4.20%		
Totals for Are		3,681.40	100.00%		

Effective 507 - Unfavorable Precipitation Year

Map Unit	lap Unit Nam	Pounds/Acre	Acres in AOI	% of AOI	Total pounds	BIA Adjustment	% change	Grazeable Acres
U020G	Badland	205	1,020.60	27.70%	209,223	0		0.00
U027F	Badland-Ore	286	41.4	1.10%	11,840	0		0.00
U110A	Cedarpass si	960	45.8	1.20%	43,968	43968		45.80
U110B	Cedarpass si	945	3.7	0.10%	3,497	3496.5		3.70
U125B	Cedarpass-Ir	536	108	2.90%	57,888	0		0.00
U192G	Epping-Keot	838	205	5.60%	171,790	0		0.00
U195E	Mitchell-Epp	1005	5.5	0.10%	5,528	5527.5		5.50
U205F	Fairburn-Ore	762	1,181.80	32.10%	900,532	0		0.00
U215F	Epping, moi:	565	23	0.60%	12,995	0		0.00
U325B	Interior loan	700	96.5	2.60%	67,550	67550		96.50
U335B	Interior, occ	976	133.4	3.60%	130,198	130198.4		133.40
U340B	Interior, mo	568	51.8	1.40%	29,422	29422.4		51.80
U342C	Interior, poc	845	45.9	1.20%	38,786	38785.5		45.90
U348E	Jayem-Valer	1695	0.5	0.00%	848	847.5		0.50
U355C	Kadoka-Eppi	904	52.7	1.40%	47,641	47640.8		52.70
U360F	Keota, thick	759	7.7	0.20%	5,844	5844.3		7.70
U495F	Vivian grave	755	2.8	0.10%	2,114	2114		2.80
U556C	Orella silt lo	810	117.2	3.20%	94,932	94932		117.20
U560C	Orella-Badla	605	45	1.20%	27,225	0		0.00
U560F	Orella-Badla	646	19.3	0.50%	12,468	0		0.00
U565E	Orella-Interi	470	115.5	3.10%	54,285	0		0.00
U740C	Tuthill-Jayer	1731	0.1	0.00%	173	173.1		0.10
U745B	Manter, coo	1329	33.6	0.90%	44,654	44654.4		33.60
U802B	Whitewater	994	79	2.10%	78,526	78526		79.00
U805C	Whitewater	901	92.3	2.50%	83,162	83162.3		92.30
Br	Badland	261	9.5	0.30%	2,480	0		0.00
Lm	Interior silt l	1773	31.6	0.90%	56,027	56026.8		31.60
U020G	Badland	210	14.9	0.40%	3,129	0		0.00
U110A	Cedarpass si	1220	1.3	0.00%	1,586	1586		1.30
U125B	Cedarpass-Ir	612	63.2	1.70%	38,678	0		0.00
U195E	Mitchell-Epp	1005	0.2	0.00%	201	201		0.20
U205F	Fairburn-Ore	787	1.5	0.00%	1,181	1180.5		1.50
U325B	Interior loan	720	0.3	0.00%	216	216		0.30
U335B	Interior, occ	1076	3.9	0.10%	4,196	4196.4		3.90
U340B	Interior, mo	693	4.1	0.10%	2,841	2841.3		4.10
U342C	Interior, poc	880	0.1	0.00%	88	88		0.10
U495F	Vivian grave	745	0.3	0.00%	224	223.5		0.30
U556C	Orella silt lo	810	14.9	0.40%	12,069	12069		14.90
U802B	Whitewater	1046	4.8	0.10%	5,021	5020.8		4.80
U805C	Whitewater	905	2.1	0.10%	1,901	1900.5		2.10
Ww	Wortman-W	974	0.4	0.00%	390	389.6		0.40
Subtotals for		153.2	4.20%					
Totals for Are		3,681.40	100.00%		2,265,315	762782.1	-0.6632777	834.00

Effective 508 - Normal Precipitation Year

Map Unit	lap Unit Nam	Pounds/Acre	Acres in AOI	% of AOI	Total pounds
U020G	Badland	392	221.2	4.60%	
U110A	Cedarpass si	1770	194.7	4.00%	
U110B	Cedarpass si	1745	106.4	2.20%	
U120A	Cedarpass-C	1792	15.7	0.30%	
U125B	Cedarpass-Ir	1288	395.1	8.10%	
U165A	Denby silty c	1850	0.6	0.00%	
U190D	Epping, moi:	1550	32	0.70%	
U192G	Epping-Keot	1413	15	0.30%	
U195E	Mitchell-Epp	1570	14.3	0.30%	
U205F	Fairburn-Ore	1294	252.5	5.20%	
U215F	Epping, moi:	995	16.1	0.30%	
U235B	Interior-Rive	1530	55.1	1.10%	
U240A	Bridgeport lo	2396	133.6	2.80%	
U315A	Interior loan	1550	3	0.10%	
U325B	Interior loan	1797	171.4	3.50%	
U340B	Interior, mo	1581	55	1.10%	
U348E	Jayem-Valer	2225	29	0.60%	
U355C	Kadoka-Eppi	1608	154.2	3.20%	
U360F	Keota, thick	1366	7.9	0.20%	
U495F	Vivian grave	1200	78	1.60%	
U510A	Thirtynine si	1784	10.5	0.20%	
U556C	Orella silt lo	1255	83.6	1.70%	
U560F	Orella-Badla	966	59.4	1.20%	
U565E	Orella-Interi	1160	45.7	0.90%	

Effective 508 - Unfavorable Precipitation Year

Map Unit	lap Unit Nam	Pounds/Acre	Acres in AOI	% of AOI	Total pounds	BIA Adjustment	% change	Grazeable acres
U020G	Badland	205	221.2	4.60%	45,346	0		0
U110A	Cedarpass si	960	194.7	4.00%	186,912	186912		194.7
U110B	Cedarpass si	945	106.4	2.20%	100,548	100548		106.4
U120A	Cedarpass-C	1011	15.7	0.30%	15,873	15872.7		15.7
U125B	Cedarpass-Ir	536	395.1	8.10%	211,774	0		0
U165A	Denby silty c	1120	0.6	0.00%	672	672		0.6
U190D	Epping, moi:	859	32	0.70%	27,488	27488		32
U192G	Epping-Keot	838	15	0.30%	12,570	0		0
U195E	Mitchell-Epp	1005	14.3	0.30%	14,372	14371.5		14.3
U205F	Fairburn-Ore	762	252.5	5.20%	192,405	0		0
U215F	Epping, moi:	565	16.1	0.30%	9,097	0		0
U235B	Interior-Rive	394	55.1	1.10%	21,709	21709.4		55.1
U240A	Bridgeport lo	1604	133.6	2.80%	214,294	214294.4		133.6
U315A	Interior loan	1010	3	0.10%	3,030	3030		3
U325B	Interior loan	700	171.4	3.50%	119,980	119980		171.4
U340B	Interior, mo	568	55	1.10%	31,240	31240		55
U348E	Jayem-Valer	1695	29	0.60%	49,155	49155		29
U355C	Kadoka-Eppi	904	154.2	3.20%	139,397	139396.8		154.2
U360F	Keota, thick	759	7.9	0.20%	5,996	5996.1		7.9
U495F	Vivian grave	755	78	1.60%	58,890	58890		78
U510A	Thirtynine si	1005	10.5	0.20%	10,553	10552.5		10.5
U556C	Orella silt lo	810	83.6	1.70%	67,716	67716		83.6
U560F	Orella-Badla	646	59.4	1.20%	38,372	0		0
U565E	Orella-Interi	470	45.7	0.90%	21,479	0		0

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Effective 536 - Normal Precipitation Year

Map Unit	lap Unit Nam	Pounds/Acre	Acres in AOI	% of AOI	Total pounds
Aa	Lohmiller sil	3230	14	0.60%	
AvE	Anselmo-Va	2225	92.6	4.20%	
Ba	Badland-Der	1307	170.5	7.70%	
Bk	Bankard loa	1970	37	1.70%	
Br	Badland	382	130	5.90%	
Cy	Denby silty c	1972	50.6	2.30%	
EhF	Epping-Kadc	1932	0.1	0.00%	
Er	Epping-Rock	1350	95.9	4.30%	
Gr	Nihill gravell	1215	52.6	2.40%	
HhA	Haverson lo	2715	131	5.90%	
HlA	Haverson lo	3105	26	1.20%	
KbC	Kadoka-Eppi	2012	22.4	1.00%	
Lm	Interior silt l	2331	302.5	13.70%	
Mm	Mosher-Min	1594	144	6.50%	
Os	Orella-Shale	1135	2.7	0.10%	
RaA	Richfield-Alt	2412	0	0.00%	
TnC	Tuthill-Anse	2398	21.9	1.00%	
TuA	Tuthill-Mant	2416	291.4	13.20%	
TuB	Tuthill-Mant	2398	17.5	0.80%	
TuC	Tuthill-Mant	2400	64.3	2.90%	
U325B	Interior loan	1794	332.9	15.10%	
U348E	Jayem-Valer	2225	4.7	0.20%	
Vs	Valentine sa	1935	30.9	1.40%	
W	Water		3	0.10%	
Ww	Wortman-W	1444	168.5	7.60%	
Totals for Ar		2,206.90	100.00%		

Effective 536 - Unfavorable Precipitation Year

Map Unit	lap Unit Nam	Pounds/Acre	Acres in AOI	% of AOI	Total pounds	BIA Adjustment	% Change	Grazeable Acres
Aa	Lohmiller sil	2405	14	0.60%	33,670	33670		14
AvE	Anselmo-Va	1695	92.6	4.20%	156,957	156957		92.6
Ba	Badland-Der	879	170.5	7.70%	149,870	0		0
Bk	Bankard loa	1520	37	1.70%	56,240	56240		37
Br	Badland	261	130	5.90%	33,930	0		0
Cy	Denby silty c	1226	50.6	2.30%	62,036	62035.6		50.6
EhF	Epping-Kadc	1091	0.1	0.00%	109	0		0
Er	Epping-Rock	737	95.9	4.30%	70,678	0		0
Gr	Nihill gravell	741	52.6	2.40%	38,977	38976.6		52.6
HhA	Haverson lo	1815	131	5.90%	237,765	237765		131
HlA	Haverson lo	2290	26	1.20%	59,540	59540		26
KbC	Kadoka-Eppi	1168	22.4	1.00%	26,163	26163.2		22.4
Lm	Interior silt l	1773	302.5	13.70%	536,333	536332.5		302.5
Mm	Mosher-Min	1100	144	6.50%	158,400	158400		144
Os	Orella-Shale	803	2.7	0.10%	2,168	2168.1		2.7
RaA	Richfield-Alt	1530	0	0.00%	0	0		0
TnC	Tuthill-Anse	1797	21.9	1.00%	39,354	39354.3		21.9
TuA	Tuthill-Mant	1800	291.4	13.20%	524,520	524520		291.4
TuB	Tuthill-Mant	1770	17.5	0.80%	30,975	30975		17.5
TuC	Tuthill-Mant	1770	64.3	2.90%	113,811	113811		64.3
U325B	Interior loan	720	332.9	15.10%	239,688	239688		332.9
U348E	Jayem-Valer	1695	4.7	0.20%	7,967	7966.5		4.7
Vs	Valentine sa	1521	30.9	1.40%	46,999	46998.9		30.9
W	Water		3	0.10%	0	0		3
Ww	Wortman-W	974	168.5	7.60%	164,119	164119		168.5
Totals for Area of Interest			2,206.90	100.00%	2,790,268	2535680.7	-0.091241	1810.5

Effective 514 - Normal Precipitation Year

Map Unit	lap Unit Nam	Pounds/Acre	Acres in AOI	% of AOI	Total pounds
U020G	Badland	392	3,763.30	43.90%	
U027F	Badland-Ore	481	7.6	0.10%	
U100F	Canyon, mo	1173	25.4	0.30%	
U110A	Cedarpass si	1770	18.7	0.20%	
U110B	Cedarpass si	1745	76.5	0.90%	
U120A	Cedarpass-D	1792	124.1	1.40%	
U125B	Cedarpass-Ir	1288	286.2	3.30%	
U165A	Denby silty c	1850	44.9	0.50%	
U195E	Mitchell-Epp	1570	90.7	1.10%	
U205F	Fairburn-Ore	1294	35.1	0.40%	
U215F	Epping, moi	995	12.4	0.10%	
U325B	Interior loan	1797	913.7	10.70%	
U335B	Interior, occ	1564	194.5	2.30%	
U340B	Interior, mo	1581	311.5	3.60%	
U355C	Kadoka-Eppi	1608	243.1	2.80%	
U360F	Keota, thick	1366	20.5	0.20%	
U556C	Orella silt lo	1255	281.8	3.30%	
U560C	Orella-Badla	955	51	0.60%	
U560F	Orella-Badla	966	23.3	0.30%	
U565E	Orella-Interi	1160	1,414.90	16.50%	
U805C	Whitewater	1371	503.6	5.90%	
U820B	Wortman-W	1268	117.5	1.40%	
UW	Water		4	0.00%	
U020G	Badland	385	1.8	0.00%	
U110B	Cedarpass si	1745	0.3	0.00%	
U165A	Denby silty c	1760	0.3	0.00%	
U325B	Interior loan	1794	1.5	0.00%	
U340B	Interior, mo	1576	2.4	0.00%	
U556C	Orella silt lo	1250	3.6	0.00%	
U805C	Whitewater	1317	1.8	0.00%	
U820B	Wortman-W	1265	1.8	0.00%	
Subtotals for	13.4	0.20%			
Totals for Ar	8,577.90	100.00%			

Effective 514 - Unfavorable Precipitation Year

Map Unit	lap Unit Nam	Pounds/Acre	Acres in AOI	% of AOI	Total pounds	BIA Adjustment	% Change	Grazeable Acres
U020G	Badland	205	3,763.30	43.90%	771,477	0		0.00
U027F	Badland-Ore	286	7.6	0.10%	2,174	0		0.00
U100F	Canyon, mo	671	25.4	0.30%	17,043	17043.4		25.40
U110A	Cedarpass si	960	18.7	0.20%	17,952	17952		18.70
U110B	Cedarpass si	945	76.5	0.90%	72,293	72292.5		76.50
U120A	Cedarpass-D	1011	124.1	1.40%	125,465	125465.1		124.10
U125B	Cedarpass-Ir	536	286.2	3.30%	153,403	0		0.00
U165A	Denby silty c	1120	44.9	0.50%	50,288	50288		44.90
U195E	Mitchell-Epp	1005	90.7	1.10%	91,154	91153.5		90.70
U205F	Fairburn-Ore	762	35.1	0.40%	26,746	0		0.00
U215F	Epping, moi	565	12.4	0.10%	7,006	0		0.00
U325B	Interior loan	700	913.7	10.70%	639,590	639590		913.70
U335B	Interior, occ	976	194.5	2.30%	189,832	189832		194.50
U340B	Interior, mo	568	311.5	3.60%	176,932	176932		311.50
U355C	Kadoka-Eppi	904	243.1	2.80%	219,762	219762.4		243.10
U360F	Keota, thick	759	20.5	0.20%	15,560	0		0.00
U556C	Orella silt lo	810	281.8	3.30%	228,258	228258		281.80
U560C	Orella-Badla	605	51	0.60%	30,855	0		0.00
U560F	Orella-Badla	646	23.3	0.30%	15,052	0		0.00
U565E	Orella-Interi	470	1,414.90	16.50%	665,003	0		0.00
U805C	Whitewater	901	503.6	5.90%	453,744	453743.6		503.60
U820B	Wortman-W	814	117.5	1.40%	95,645	95645		117.50
UW	Water		4	0.00%	0	0		0.00
U020G	Badland	210	1.8	0.00%	378	0		0.00
U110B	Cedarpass si	1190	0.3	0.00%	357	357		0.30
U165A	Denby silty c	1220	0.3	0.00%	366	366		0.30
U325B	Interior loan	720	1.5	0.00%	1,080	1080		1.50
U340B	Interior, mo	693	2.4	0.00%	1,663	1663.2		2.40
U556C	Orella silt lo	810	3.6	0.00%	2,916	2916		3.60
U805C	Whitewater	905	1.8	0.00%	1,629	1629		1.80
U820B	Wortman-W	799	1.8	0.00%	1,438	1438.2		1.80
Subtotals for	13.4	0.20%						
Totals for Area of Interest			8,577.90	100.00%	4,075,060	2387406.9	-0.4141419	2,957.70

Appendix C: NRCS Soil Map Unit Conversions

When examining soils in the South Unit in 2011, NRCS renamed and reconfigured previous soil complexes. To fully compare data from the Web Soil Survey and its vegetative production figures to the BIA stocking rate guides, these conversion tables must be used to translate between older and newer NRCS soil map units. (Source: James Westerman, South Dakota NRCS.)

Badlands National Park Conversion Legend and Correlation Notes
March 22, 2011

NON-MLRA			MLRA		
AREA	MUSYM	MUNAME	MUSYM	MUNAME	CORRELATION NOTES
SD113	AvE	Anselmo-Valentine complex, 5 to 20 percent slopes	U348E	Jayem-Valentine, dry complex, 6 to 20 percent slopes	Anselmo & Valentine are typic-ustic; recorrelate to aridic-ustic
SD071	Ba	Badland			
SD113	Br	Badland			
SD605	Bb	Badland	U020G	Badland	
SD113	Ba	Badland-Denby-Interior complex, 0 to 90 percent slopes	U027G	Badland-Orella, moist complex, 6 to 40 percent slopes	Original map unit included more landscapes than could be described in one unit; most areas have been remapped as one of these units
			U125B	Cedarpass-Interior-Badland complex, 0 to 6 percent slopes, flooded	
SD113	Bk	Bankard loamy sand, 0 to 3 percent slopes	U035A	Pathfinder loamy sand, 0 to 3 percent slopes, rarely flooded	Bankard is ustic-aridic; recorrelate to aridic-ustic; should look at increasing flooding frequency (occas)
SD605	BfA	Beckton silt loam, 0 to 4 percent	U040B	Beckton silt loam, 0 to 4 percent slopes	
SD605	BlA	Blackpipe clay loam, 0 to 2 percent slopes	U050A	Blackpipe clay loam, 0 to 2 percent slopes	Areas mapped as Blackpipe on pleistocene terraces have been observed to be fine-loamy (Recluse)
SD605	BlB	Blackpipe clay loam, 2 to 6 percent slopes	U050B	Blackpipe clay loam, 2 to 6 percent slopes	
SD605	BnC	Blackpipe-Norrest complex, 6 to 12 percent slopes	U060C	Blackpipe-Norrest complex, 6 to 9 percent slopes	Slopes adjusted to fit within normal breaks
SD605	BoB	Blackpipe-Wortman complex, 1 to 6 percent slopes	U070B	Blackpipe-Wortman complex, 1 to 6 percent slopes	
SD071	BwC	Blackpipe-Wortman silt loams, 3 to 9 percent slopes	U070C	Blackpipe-Wortman complex, 6 to 9 percent slopes	Change to complex to fit into catena with U070B
SD605	Ca	Cactusflat silty clay			
SD071	CaA	Cactusflat silty clay, 0 to 3 percent slopes	U080A	Cactusflat silty clay, 0 to 3 percent slopes	
SD605	Cb	Cactusflat-Weta complex	U085A	Cactusflat-Weta complex, 0 to 2 percent slopes	
SD071	CbB	Cactusflat-Weta complex, 1 to 6 percent slopes	U085B	Cactusflat-Weta complex, 2 to 6 percent slopes	
SD113	CaF	Canyon-Oglala complex, 18 to 40 percent slopes	U095F	Canyon, moist-Oglala complex, 15 to 40 percent slopes	Canyon is currently ustic-aridic; recorrelate to aridic-ustic
SD113	Cc	Canyon-Rock outcrop complex, 18 to 40 percent slopes	U100F	Canyon, moist-Rock outcrop-Oglala complex, 15 to 40 percent slopes	There is 15% Oglala in original data; possible combination with U095F
SD071	CeA	Cedarpass silt loam, 0 to 3 percent slopes			
SD605	CeA	Cedarpass silty clay loam, 0 to 3 percent slopes	U110A	Cedarpass silt loam, 0 to 3 percent slopes	All Cedarpass observed in field has silt loam or loam surface

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NON-MLRA			MLRA		
AREA	MUSYM	MUNAME	MUSYM	MUNAME	CORRELATION NOTES
SD605	CfA	Cedarpass-Denby complex, 0 to 3 percent slopes	U120A	Cedarpass-Denby complex, 0 to 3 percent slopes	
SD071	CfA	Cedarpass-Denby complex, 0 to 4 percent slopes			
SD605	Ch	Cedarpass-Interior-Badland complex	U125B	Cedarpass-Interior-Badland complex, 0 to 6 percent slopes, flooded	Added flooding phase to name
SD605	ClF	Colby silt loam, 9 to 40 percent slopes			Combined with U195E due to low acre count
SD605	CmC	Colby-Norka silt loams, 6 to 15 percent slopes	U365D	Thirtynine-Colby, cool silt loams, 9 to 15 percent slopes	
SD605	CuD	Conata-Hisle complex, 6 to 25 percent slopes	U145E	Conata-Hisle complex, 6 to 25 percent slopes	
SD605	DmA	Denby silty clay, 0 to 3 percent slopes	U165A	Denby silty clay, 0 to 3 percent slopes	Some polygons of Cy were remapped as U120A based on field obs and photo interp
SD113	Cy	Denby silty clay, 0 to 4 percent slopes			
SD113	EhF	Epping-Kadoka association, 9 to 40 percent slopes	U190E	Epping-Kadoka silt loams, 9 to 25 percent slopes	No discernible difference from photo interp between these units
SD113	EkE	Epping-Kadoka silt loams, 9 to 18 percent slopes			
SD113	Te	Epping-Mitchell silt loams, 9 to 30 percent slopes	U195E	Mitchell, moist-Epping silt loams, 9 to 30 percent slopes	Mitchell is currently ustic-aridic; from photo interp it appears more deep soil in these areas than shallow
SD113	Er	Epping-Rock outcrop complex, 9 to 40 percent slopes	U215F	Epping-Badland complex, 9 to 40 percent slopes	Badland outcrop
SD605	FaE	Fairburn clay loam, 9 to 40 percent slopes	U200F	Fairburn clay loam, 9 to 40 percent slopes	
SD605	FhE	Fairburn-Badland complex, 9 to 40 percent slopes	U215F	Epping-Badland complex, 9 to 40 percent slopes	Only 41 acres of FhE in BNP
SD113	HlA	Haverson loam, 0 to 3 percent slopes, occasionally flooded	U235A	Rockypoint loam, 0 to 3 percent slopes, occasionally flooded	Haverson is ustic-aridic; recorrelate to aridic-ustic
SD113	HhA	Haverson loam, 0 to 3 percent slopes, rarely flooded	U240A	Rockypoint loam, 0 to 3 percent slopes, rarely flooded	U235A and U240A could be combined
SD113	HoA	Haverson silty clay loam, 0 to 3 percent slopes	U235A	Rockypoint loam, 0 to 3 percent slopes, occasionally flooded	Only 37 acres in BNP
SD605	HpB	Hisle silt loam, 0 to 6 percent slopes	U265B	Hisle silt loam, 0 to 6 percent slopes	
SD113	Hv	Hoven silt loam, 0 to 1 percent slopes	U305A	Hoven silt loam, 0 to 1 percent slopes, occasionally ponded	Depressional wetland

Badlands National Park Conversion Legend and Correlation Notes
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NON-MLRA			MLRA		CORRELATION NOTES
AREA	MUSYM	MUNAME	MUSYM	MUNAME	
SD071	In	Interior loam		Interior loam, 0 to 3 percent slopes, occasionally flooded	
SD605	In	Interior loam	U315A		
SD071	Io	Interior loam, channeled		Interior loams, channeled, 0 to 6 percent slopes, flooded	More complex than previously described; various flooding levels
SD605	Io	Interior loam, channeled	U325B		
			U110A	Cedarpass silt loam, 0 to 3 percent slopes	Original map unit occurred on two different landforms and was remapped accordingly
			U315A	Interior loam, 0 to 3 percent slopes, occasionally flooded	
SD113	Lm	Interior silt loam, 0 to 3 percent slopes	U340B	Interior, moderately deep-Cedarpass silt loams, 0 to 6 percent slopes, flooded	Proposed new unit
SD071	IsB	Interior-Cedarpass-Badland complex, 0 to 6 percent slopes	U125B	Cedarpass-Interior-Badland complex, 0 to 6 percent slopes, flooded	Not a significant difference between this unit and U125B
SD605	IrB	Interior-Cedarpass-Denby complex, 0 to 6 percent slopes			
SD071	Iv	Interior-Denby-Cedarpass complex, 0 to 3 percent slopes	U335B	Interior-Cedarpass-Denby complex, 0 to 6 percent slopes, flooded	Map units are essentially the same
SD605	JaC	Jayem fine sandy loam, 3 to 9 percent slopes	U345C	Jayem fine sandy loam, 3 to 9 percent slopes	
SD113	KaA	Kadoka silt loam, 0 to 3 percent slopes	U350A	Kadoka silt loam, 0 to 3 percent slopes	
SD113	KaB	Kadoka silt loam, 3 to 5 percent slopes	U350B	Kadoka silt loam, 3 to 6 percent slopes	
SD113	KaC	Kadoka silt loam, 5 to 9 percent slopes	U350C	Kadoka silt loam, 6 to 9 percent slopes	
SD113	KbC	Kadoka-Epping silt loams, 3 to 9 percent slopes	U355C	Kadoka-Epping silt loams, 3 to 9 percent slopes	
SD113	KeA	Keith silt loam, 0 to 3 percent slopes	U510A	Thirtynine silt loam, 0 to 2 percent slopes	Keith is southern NE loess derived series; Thirtynine is better local fit
SD113	KeB	Keith silt loam, 3 to 5 percent slopes	U510B	Thirtynine silt loam, 2 to 6 percent slopes	
SD113	KhD	Keith-Colby silt loams, 9 to 12 percent slopes	U365C	Thirtynine-Colby, cool silt loams, 6 to 9 percent slopes	Both soils are loess derivatives, however there is no good replacement for Colby in this area; slopes are adjusted to fit normal breaks
SD113	KhE	Keith-Colby silt loams, 12 to 18 percent slopes	U365D	Thirtynine-Colby, cool silt loams, 9 to 15 percent slopes	
SD113	KuC	Keith-Ulysses silt loams, 5 to 9 percent slopes	U380C	Thirtynine-Ulysses, cool silt loams, 6 to 9 percent slopes	Both soils are loess derivatives; no good replacement for Ulysses in this area
SD605	KtA	Kyle clay, 0 to 1 percent slopes	N465A	Kyle clay, terrace, 0 to 1 percent slopes	Kent Cooley thinks the soils in this map unit need to be reevaluated (they have stratified/coarser substrata not consistent with Kyle)
SD605	KyA	Kyle clay, 0 to 3 percent slopes	N464A	Kyle clay, 0 to 3 percent slopes	

Badlands National Park Conversion Legend and Correlation Notes
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NON-MLRA			MLRA		
AREA	MUSYM	MUNAME	MUSYM	MUNAME	CORRELATION NOTES
SD605	KyB	Kyle clay, 3 to 6 percent slopes	N464B	Kyle clay, 3 to 6 percent slopes	
SD605	KyC	Kyle clay, 6 to 9 percent slopes	N464C	Kyle clay, 6 to 9 percent slopes	
SD605	LaB	Larvie clay, 0 to 4 percent slopes	U405A	Larvie clay, 0 to 3 percent slopes	
SD605	LaD	Larvie clay, 6 to 15 percent slopes	U405D	Larvie clay, 6 to 15 percent slopes	
SD605	LhC	Larvie-Hisle complex, 0 to 9 percent slopes	U420C	Larvie-Hisle complex, 0 to 9 percent slopes	
SD605	Lo	Lohmiller silty clay	N500A	Lohmiller silty clay, 0 to 3 percent slopes, rarely flooded	
SD113	Aa	Lohmiller silty clay loam, channeled, 0 to 2 percent slopes	U315A	Interior loam, 0 to 3 percent slopes, occasionally flooded	Depending on photo interpretation, the original Aa map unit has been remapped as one of these in the BNP; all polygons occur on White River formation deposits and no Lohmiller was observed in the field
			U325B	Interior loams, channeled, 0 to 6 percent slopes, flooded	
			U335B	Interior-Cedarpass-Denby complex, 0 to 6 percent slopes, flooded	
			U340B	Interior, moderately deep-Cedarpass silt loams, 0 to 6 percent slopes, flooded	
SD605	MoE	Midway silty clay loam, 15 to 40 percent slopes	N542F	Samsil silty clay loam, 15 to 40 percent slopes	Midway is ustic-aridic; recorrelate to aridic-ustic; field obs show a lot more than Samsil in this unit in the BNP
SD071	M-W	Miscellaneous water	U-MW	Miscellaneous water	
SD113	Mm	Mosher-Minatare complex, 0 to 6 percent slopes	U490B	Mosher-Minatare complex, 0 to 6 percent slopes	Question whether the components are valid in this unit; only in the South Unit of BNP
SD113	Gr	Nihill gravelly loam, 2 to 30 percent slopes	U495F	Vivian gravelly loam, dry, 6 to 40 percent slopes	Nihill is ustic-aridic; recorrelate to closest available series; question whether the map unit composition is correct; only in the South Unit of BNP
SD605	NgA	Norka silt loam, 0 to 2 percent slopes	U510A	Thirtynine silt loam, 0 to 2 percent slopes	Thirtynine is better series fit from a geomorphic view
SD605	NgB	Norka silt loam, 2 to 6 percent slopes	U510B	Thirtynine silt loam, 2 to 6 percent slopes	
SD071	NpD	Norka-Colby silt loams, 6 to 15 percent slopes	U365D	Thirtynine-Colby, cool silt loams, 9 to 15 percent slopes	See comments on previous page
SD605	NhA	Norka-Weta silt loams, 0 to 3 percent slopes	U520A	Thirtynine-Weta silt loams, 0 to 3 percent slopes	Thirtynine is better series fit from a geomorphic view
SD605	NkD	Norrest silty clay loam, 6 to 15 percent slopes	U525D	Norrest silty clay loam, 6 to 15 percent slopes	
SD071	NrC	Norrest-Wanblee complex, 2 to 9 percent slopes	U530C	Norrest-Wanblee complex, 2 to 9 percent slopes	

Badlands National Park Conversion Legend and Correlation Notes
March 22, 2011

NON-MLRA			MLRA		
AREA	MUSYM	MUNAME	MUSYM	MUNAME	CORRELATION NOTES
SD605	NuA	Nunn loam, 0 to 2 percent slopes	U535A	Nuncho loam, 0 to 2 percent slopes	
SD605	NuB	Nunn loam, 2 to 6 percent slopes	U535B	Nuncho loam, 2 to 6 percent slopes	
SD605	NuC	Nunn loam, 6 to 12 percent slopes			Nunn is CO series; recorrelate to Nuncho in northern GP
SD071	NuD	Nunn loam, 8 to 15 percent slopes	U535D	Nuncho loam, 6 to 15 percent slopes	
SD605	NvA	Nunn-Beckton complex, 0 to 3 percent slopes	U540A	Nuncho-Beckton complex, 0 to 3 percent slopes	
SD605	NvC	Nunn-Beckton complex, 3 to 9 percent slopes	U540C	Nuncho-Beckton complex, 3 to 9 percent slopes	Nunn is CO series; recorrelate to Nuncho in northern GP
SD113	OcE	Oglala-Canyon loams, 9 to 18 percent slopes	U545E	Oglala-Canyon, moist loams, 9 to 25 percent slopes	Canyon is currently ustic-aridic; recorrelate to aridic-ustic; map unit is somewhat similar to U095F
			U802C	Whitewater-Denby silty clays, 1 to 6 percent slopes	Proposed new unit; original map unit did not fit the areas mapped
SD113	OeC	Orella clay, 0 to 9 percent slopes	U555C	Orella clay, moist, 1 to 9 percent slopes	Orella is currently ustic-aridic, recorrelate to aridic-ustic in BNP; may wind up correlating out of the BNP legend
SD605	ObE	Orella-Badland complex, 9 to 45 percent slopes	U560F	Orella, moist-Badland complex, 9 to 45 percent slopes	See comments about Orella
SD605	OeE	Orella-Interior-Badland complex, 0 to 25 percent slopes	U565E	Orella, moist-Interior, moderately deep-Badland complex, 0 to 25 percent slopes, flooded	See comments about Orella; Interior, mod deep is a variant of Interior identified in this update; this unit occurs at the head ends of drainages where the depth to bedrock is generally <40"
SD071	OrE	Orella-Rock outcrop complex, 3 to 45 percent slopes	U560F	Orella, moist-Badland complex, 9 to 45 percent slopes	Rock outcrop is Chadron formation claystone (badland)
SD113	Os	Orella-Shale outcrop complex, 3 to 18 percent slopes	U560F	Orella, moist-Badland complex, 9 to 45 percent slopes	
SD113	PeC	Pierre clay, 3 to 9 percent slopes	N656B	Pierre clay, 2 to 6 percent slopes	Adjusted slopes based on MLRA 60A template
SD605	PeD	Pierre clay, 6 to 15 percent slopes	N656D	Pierre clay, 6 to 15 percent slopes	
SD113	PsE	Pierre-Samsil clays, 9 to 25 percent slopes	N666E	Pierre-Samsil clays, 6 to 25 percent slopes	
SD605	RaB	Razor silty clay, 2 to 6 percent slopes	U585B	Pierre silty clay, 2 to 6 percent slopes	It appears Razor and Midway were mapped on a different part of either Pierre shale or Chadron fm; it is a low-chroma, high value shaly/claystone-like material
SD605	RaC	Razor silty clay, 6 to 9 percent slopes	U585C	Pierre silty clay, 6 to 9 percent slopes	
SD605	RbD	Razor-Midway complex, 6 to 15 percent slopes	U605D	Pierre-Samsil complex, 6 to 15 percent slopes	

Badlands National Park Conversion Legend and Correlation Notes
March 22, 2011

NON-MLRA			MLRA		CORRELATION NOTES
AREA	MUSYM	MUNAME	MUSYM	MUNAME	
SD113	RaA	Richfield-Altvan silt loams, 0 to 3 percent slopes	U615A	Savo-Altvan silt loams, 0 to 3 percent slopes	
SD113	RaB	Richfield-Altvan silt loams, 3 to 5 percent slopes	U615B	Savo-Altvan silt loams, 3 to 6 percent slopes	Richfield is KS/loess-derived series; Savo is better local fit
SD113	ReB	Rosebud-Canyon loams, 5 to 9 percent slopes	U635B	Rosebud-Canyon, moist loams, 2 to 6 percent slopes	See previous comments about Canyon; all polys examined in BNP have slopes less than or equal to 6%
SD605	SbF	Samsil clay, 25 to 40 percent slopes	N700F	Samsil clay, 25 to 40 percent slopes	The difference between this map unit and N542F are rather nebulous
SD605	ScE	Samsil-Pierre clays, 15 to 25 percent slopes	N706E	Samsil-Pierre clays, 9 to 25 percent slopes	Changed lower slope limit based on spatial analysis
SD605	SdF	Samsil-Rock outcrop complex, 25 to 75 percent slopes			
SD113	Ss	Samsil-Shale outcrop complex, 3 to 40 percent slopes	N712G	Samsil-Rock outcrop complex, 6 to 60 percent slopes	Samsil max slope is 60 (think this is a good upper limit for unit)
SD605	SeA	Satanta loam, 0 to 2 percent slopes	U700A	Recluse loam, 0 to 2 percent slopes	
SD605	SeB	Satanta loam, 2 to 6 percent slopes	U700B	Recluse loam, 2 to 6 percent slopes	
SD605	SeC	Satanta loam, 6 to 9 percent slopes	U700C	Recluse loam, 6 to 9 percent slopes	Satanta is southwestern KS/southern GP series; Recluse established to replace Satanta in the northern plains
SD605	SgA	Satanta-Beckton complex, 0 to 3 percent slopes	U705A	Recluse-Beckton complex, 0 to 3 percent slopes	
SD605	SmA	Savo silt loam, 0 to 2 percent slopes	U710A	Savo silt loam, 0 to 2 percent slopes	
SD113	Sw	Swanboy clay, 0 to 6 percent slopes	N814B	Swanboy clay, 0 to 6 percent slopes	Overmapped in BNP
SD113	KyB	Swanboy clay, 3 to 5 percent slopes	N464B	Kyle clay, 2 to 6 percent slopes	
SD113	TnA	Tuthill-Anselmo fine sandy loams, 0 to 3 percent slopes	U740A	Tuthill-Jayem fine sandy loams, 0 to 3 percent slopes	
SD113	TnC	Tuthill-Anselmo fine sandy loams, 3 to 9 percent slopes	U740C	Tuthill-Jayem fine sandy loams, 3 to 9 percent slopes	See previous comments about Anselmo
SD113	TuA	Tuthill-Manter fine sandy loams, 0 to 3 percent slopes	U745A	Manter, cool-Tuthill fine sandy loams, 0 to 3 percent slopes	Major components are listed at 40% each, so reordered; Manter is CO series, no good northern plains equivalents; slopes are changed to fit local breaks
SD113	TuB	Tuthill-Manter fine sandy loams, 3 to 5 percent slopes	U745B	Manter, cool-Tuthill fine sandy loams, 3 to 6 percent slopes	
SD113	TuC	Tuthill-Manter fine sandy loams, 5 to 9 percent slopes	U745C	Manter, cool-Tuthill fine sandy loams, 6 to 9 percent slopes	
SD605	VbD	Valent loamy fine sand, 6 to 25 percent slopes	U755E	Valentine loamy fine sand, dry, 6 to 25 percent slopes	These units could be combined as they are on the same landforms (Valentine is typically fine or loamy fine sand)
SD113	Vs	Valentine sand, 3 to 30 percent slopes	U756E	Valentine sand, dry, 3 to 30 percent slopes	
SD605	WaA	Wanblee silt loam, 0 to 4 percent slopes	U780B	Wanblee silt loam, 0 to 4 percent slopes	

Badlands National Park Conversion Legend and Correlation Notes
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NON-MLRA			MLRA		CORRELATION NOTES
AREA	MUSYM	MUNAME	MUSYM	MUNAME	
SD605	WbB	Wanblee-Wortman silt loams, 0 to 4 percent slopes	U820B	Wortman-Wanblee silt loams, 0 to 6 percent slopes	Split the difference between this map unit and Shannon unit Ww
SD071	W	Water			
SD113	W	Water			
SD605	W	Water	UW	Water	
SD605	WkA	Whitewater clay, 0 to 3 percent slopes	U800A	Whitewater clay, 0 to 3 percent slopes	Lab data has SIC surface
SD605	WoB	Whitewater-Orella clays, 3 to 9 percent slopes	U805C	Whitewater-Orella clays, 3 to 9 percent slopes	Possibly SIC surfaces
SD605	WwB	Wortman silt loam, 0 to 6 percent slopes	U810B	Wortman silt loam, 0 to 6 percent slopes	
SD113	Ww	Wortman-Wanblee silt loams, 0 to 6 percent slopes	U820B	Wortman-Wanblee silt loams, 0 to 6 percent slopes	Am not sure what the rationale for having map units WaA, WbB, and WwB in the same legend was

Scenario: Alternative A, The Stronghold Unit — **FEMALES**

Post Roundup Age & Sex	Stocking Goal Long Term	First Year of Stocking Year: 1 year born	# head	Change # head	Year End Inventory	Year: 2 year born	# head	Change # head	Year End Inventory	Year: 3 year born	# head	Change # head	Year End Inventory	Year: 4 year born	# head	Change # head	Year End Inventory	Year: 5 year born	# head	Change # head	Year End Inventory	Year: 6 year born	# head	Change # head	Year End Inventory
		-3+			30	-3+	60		90	-3+	150		180	-3+	240		270	-3+	351		323	-3+	364		336
3 yr.+ Female	330	transfer in:		30				30				30				30									
		transfer out:																		28				28	
2 yr. Female	63	-2			30	-2	30		60	-2	30		60	-2	51		81	-2	83		41	-2	69		27
		transfer in:		30				30				30				30									
		transfer out:																		42				42	
1 yr. Female	116	-1			30	-1	0		30	-1	21		51	-1	53		83	-1	84		69	-1	123		65
		transfer in:		30				30				30				30									
		transfer out:																		15				58	
Calf Female	116	1	0		0	2	21		21	3	53		53	4	84		84	5	123		123	6	127		127
		transfer in:																							
Total Females	625	transfer out:																							
Total Head	**1187**	**Estimated Calving %**			70%	**Estimated Calving %**			70%	# **Estimated Calving %**			70%	**Estimated Calving %**			70%	**Estimated Calving %**			70%	**Estimated Calving %**			70%

NOTES:	Target Herd Structure Reached in year 5
	360 Added

Scenario: Alternative A, The Stronghold Unit — **MALES**

Post Roundup Age & Sex	Stocking Goal Long Term	First Year of Stock Year: 1 year born	# head	Change # head	Year End Inventory	Year: 2 year born	# head	Change # head	Year End Inventory	Year: 3 year born	# head	Change # head	Year End Inventory	Year: 4 year born	# head	Change # head	Year End Inventory	Year: 5 year born	# head	Change # head	Year End Inventory	Year: 6 year born	# head	Change # head	Year End Inventory
		-2+			45	-2+	90		135	-2+	180		195	-2+	261		266	-2+	354		304	-2+	333		263
2 yr. + Male	330	transfer in:		45				45				45				45									
		transfer out:										30				40				50				70	
1 yr. Male	116	-1			45	-1	0		45	-1	21		66	-1	53		88	-1	84		29	-1	123		68
		transfer in:		45				45				45				45									
		transfer out:														10				55				55	
Calf Male	116	1	0		0	2	21		21	3	53		53	4	84		84	5	123		123	6	127		127
		transfer in:																							
Total Males	562	transfer out:																							
Total Head	**1187**																								

NOTES:	Target Herd Structure Reached in year 5
	360 Added

Scenario: Alternative B, The Herding Alternative — **FEMALES**

Post Roundup Age & Sex	Stocking Goal Long Term	First Year of Stocking Year: 1 year born	# head	Change # head	Year End Inventory	Year: 2 year born	# head	Change # head	Year End Inventory	Year: 3 year born	# head	Change # head	Year End Inventory	Year: 4 year born	# head	Change # head	Year End Inventory	Year: 5 year born	# head	Change # head	Year End Inventory	Year: 6 year born	# head	Change # head	Year End Inventory
		-3+			30	-3+	60		90	-3+	150		180	-3+	240		225	-3+	256		231	-3+	252		227
3 yr.+ Female	230	transfer in:		30				30				30													
		transfer out:														15				25				25	
2 yr. Female	45	-2			30	-2	30		60	-2	30		60	-2	51		31	-2	53		21	-2	42		10
		transfer in:		30				30				30													
		transfer out:														20				32				32	
1 yr. Female	81	-1			30	-1	0		30	-1	21		51	-1	53		53	-1	84		42	-1	90		48
		transfer in:		30				30				30													
		transfer out:																		42				42	
Calf Female	81	1	0		0	2	21		21	3	53		53	4	84		84	5	90		90	6	88		88
		transfer in:																							
Total Females	437	transfer out:																							
Total Head	**829**	**Estimated Calving %**			70%	**Estimated Calving %**			70%	# **Estimated Calving %**			70%	**Estimated Calving %**			70%	**Estimated Calving %**			70%	**Estimated Calving %**			70%

NOTES: Target Herd Structure reached in Year 4

270 Added

Scenario: Alternative B, The Herding Alternative — **MALES**

Post Roundup Age & Sex	Stocking Goal Long Term	First Year of Stocking Year: 1 year born	# head	Change # head	Year End Inventory	Year: 2 year born	# head	Change # head	Year End Inventory	Year: 3 year born	# head	Change # head	Year End Inventory	Year: 4 year born	# head	Change # head	Year End Inventory	Year: 5 year born	# head	Change # head	Year End Inventory	Year: 6 year born	# head	Change # head	Year End Inventory
2 yr. + Male	230	-2+			45	-2+	90		135	-2+	180		185	-2+	251		181	-2+	234		184	-2+	228		178
		transfer in:		45				45				45													
		transfer out:										40				70				50				50	
1 yr. Male	81	-1			45	-1	0		45	-1	21		66	-1	53		53	-1	84		44	-1	90		50
		transfer in:		45				45				45													
		transfer out:																		40				40	
Calf Male	81	1	0		0	2	21		21	3	53		53	4	84		84	5	90		90	6	88		88
		transfer in:																							
Total Males	392	transfer out:																							
Total Head	**829**																								

NOTES: Target Herd Structure reached in Year 4

270 Added

Appendix F: Multi-Year Stocking Strategies for South Unit Alternative C - (*Years 1 - 6*)

Scenario: Alternative C, The Big Idea — **FEMALES**

Post Roundup Age & Sex	Stocking Goal Long Term	First Year of Stocking Year: 1 year born	# head	Change # head	Year End Inventory	Year: 2 year born	# head	Change # head	Year End Inventory	Year: 3 year born	# head	Change # head	Year End Inventory	Year: 4 year born	# head	Change # head	Year End Inventory	Year: 5 year born	# head	Change # head	Year End Inventory	Year: 6 year born	# head	Change # head	Year End Inventory
		-3+			30	-3+	60		90	-3+	150		180	-3+	240		270	-3+	351		316	-3+	364		324
3 yr.+ Female	355	transfer in:		30				30				30				30									
		transfer out:																		35				40	
2 yr. Female	68	-2			30	-2	30		60	-2	30		60	-2	51		81	-2	83		48	-2	74		34
		transfer in:		30				30				30				30									
		transfer out:																		35				40	
1 yr. Female	124	-1			30	-1	0		30	-1	21		51	-1	53		83	-1	84		74	-1	123		78
		transfer in:		30				30				30				30									
		transfer out:																		10				45	
Calf Female	124	1	0		0	2	21		21	3	53		53	4	84		84	5	123		123	6	127		127
		transfer in:																							
Total Females	671	transfer out:																							
Total Head	**1274**	**Estimated Calving %**			70%	**Estimated Calving %**			70%	# **Estimated Calving %**			70%	**Estimated Calving %**			70%	**Estimated Calving %**			70%	**Estimated Calving %**			70%

NOTES:	Target Herd Structure beginning in Year 5
	360 Added

Scenario: Alternative C, The Big Idea — **MALES**

Post Roundup Age & Sex	Stocking Goal Long Term	First Year of Stocking Year: 1 year born	# head	Change # head	Year End Inventory	Year: 2 year born	# head	Change # head	Year End Inventory	Year: 3 year born	# head	Change # head	Year End Inventory	Year: 4 year born	# head	Change # head	Year End Inventory	Year: 5 year born	# head	Change # head	Year End Inventory	Year: 6 year born	# head	Change # head	Year End Inventory
2 yr. + Male	355	-2+			45	-2+	90		135	-2+	180		225	-2+	291		286	-2+	384		324	-2+	368		308
		transfer in:		45				45				45				45									
		transfer out:														50				60				60	
1 yr. Male	124	-1			45	-1	0		45	-1	21		66	-1	53		98	-1	84		44	-1	123		48
		transfer in:		45				45				45				45									
		transfer out:																		40				75	
Calf Male	124	1	0		0	2	21		21	3	53		53	4	84		84	5	123		123	6	127		127
		transfer in:																							
Total Males	603	transfer out:																							
Total Head	**1274**																								

NOTES:	Target Herd Structure beginning in Year 5
	360 Added

Scenario: Alternative D, The Western Option — **FEMALES**

Post Roundup Age & Sex	Stocking Goal Long Term	First Year of Stocking Year: 1 year born	# head	Change # head	Year End Inventory	Year: 2 year born	# head	Change # head	Year End Inventory	Year: 3 year born	# head	Change # head	Year End Inventory	Year: 4 year born	# head	Change # head	Year End Inventory	Year: 5 year born	# head	Change # head	Year End Inventory	Year: 6 year born	# head	Change # head	Year End Inventory
		-3+			30	-3+	60		90	-3+	150		135	-3+	150		135	-3+	150		135	-3+	153		138
3 yr.+ Female	150	transfer in:		30				30																	
		transfer out:										15				15				15				15	
2 yr. Female	30	-2			30	-2	30		60	-2	30		15	-2	21		15	-2	53		18	-2	53		18
		transfer in:		30				30																	
		transfer out:										15				6				35				35	
1 yr. Female	53	-1			30	-1	0		30	-1	21		21	-1	53		53	-1	53		53	-1	53		53
		transfer in:		30				30																	
		transfer out:										0				0				0				0	
Calf Female	53	1	0		0	2	21		21	3	53		53	4	53		53	5	53		53	6	53		53
		transfer in:																							
Total Females	286	transfer out:																							
Total Head	**542**	**Estimated Calving %**			70%	**Estimated Calving %**			70%	# **Estimated Calving %**			70%	**Estimated Calving %**			70%	**Estimated Calving %**			70%	**Estimated Calving %**			70%

NOTES: Target Herd Structure reached in Year 4

180 Added

Scenario: Alternative D, The Western Option — **MALES**

Post Roundup Age & Sex	Stocking Goal Long Term	First Year of Stocking Year: 1 year born	# head	Change # head	Year End Inventory	Year: 2 year born	# head	Change # head	Year End Inventory	Year: 3 year born	# head	Change # head	Year End Inventory	Year: 4 year born	# head	Change # head	Year End Inventory	Year: 5 year born	# head	Change # head	Year End Inventory	Year: 6 year born	# head	Change # head	Year End Inventory
2 yr. + Male	150	-2+			45	-2+	90		135	-2+	180		152	-2+	153		125	-2+	153		125	-2+	152		122
		transfer in:		45				45																	
		transfer out:										28				28				28				30	
1 yr. Male	53	-1			45	-1	0		45	-1	21		1	-1	53		28	-1	53		28	-1	53		28
		transfer in:		45				45																	
		transfer out:										20				25				25				25	
Calf Male	53	1	0		0	2	21		21	3	53		53	4	53		53	5	53		53	6	53		53
		transfer in:																							
Total Males	256	transfer out:																							
Total Head	**542**																								

NOTES: Target Herd Structure reached in Year 4

180 Added

Appendix H: Multi-Year Sales Summary for South Unit Alternative A - (*Years 3 - 6*): First Revenue in *Year 3*

SOUTH UNIT	Alternative A:																							
Buffalo Sales Projections	*Stronghold*	Buffalo first stockedin year "1"																						
2013-2018	*Unit*	**3**						**4**						**5**						**6**				
	Fall Weight	Sold	Transfer/ Given	Note	Price	Cash Total	Non-Cash	Sold	Transfer/ Given	Note	Price	Cash Total	Non-Cash	Sold	Transfer/ Given	Note	Price	Cash Total	Non-Cash	Sold	Transfer/ Given	Note	Price	Cash Total	Non-Cash
South Unit Females																									
Cull cows Harvest	1050			WIBC	$ 1.05	$ -	$ -			WIBC	$ 1.05	$ -	$ -	13		WIBC	$ 1.05	$ 14,333	$ -	13		WIBC	$ 1.05	$ 14,333	$ -
Cull cows Share Crop	1050			ShareCrp	$ 1.05	$ -	$ -			ShareCrp	$ 1.05	$ -	$ -		15	ShareCrp	$ 1.05	$ -	$ 16,538		15	ShareCrp	$ 1.05	$ -	$ 16,538
Cull cows Ceremonies	1050			Wakes	$ 1.05	$ -	$ -			Wakes	$ 1.05	$ -	$ -			Wakes	$ 1.05	$ -	$ -			Wakes	$ 1.05	$ -	$ -
2 yo Females Sold	750			WIBC	$ 1.50	$ -	$ -			WIBC	$ 1.50	$ -	$ -			WIBC	$ 1.50	$ -	$ -			WIBC	$ 1.50	$ -	$ -
2 yo Females ShareCrop	750			ShareCrp	$ 1.50	$ -	$ -			ShareCrp	$ 1.50	$ -	$ -		42	ShareCrp	$ 1.50	$ -	$ 47,250		42	ShareCrp	$ 1.50	$ -	$ 47,250
Yrlg Females (Sell/Donate)	500			Surplus	$ 1.90	$ -	$ -			Surplus	$ 1.90	$ -	$ -			Surplus	$ 1.90	$ -	$ -	30	28	Surplus	$ 1.90	$ 28,500	$ 26,600
Calf Females	325																								
South Unit Males																									
Trophy Bulls Non-Tribal	1700		7	Hunt	$ 1.80	$ -	$ 21,420		7	Hunt	$ 1.80	$ -	$ 21,420		7	Hunt	$ 1.80	$ -	$ 21,420		8	Hunt	$ 1.80	$ -	$ 24,480
Trophy Bulls Tribal	1700		7	Hunt	$ 1.50	$ -	$ 17,850		7	Hunt	$ 1.50	$ -	$ 17,850		7	Hunt	$ 1.50	$ -	$ 17,850		8	Hunt	$ 1.50	$ -	$ 20,400
Mgmt Bulls Non-Tribal (3+)	1350		8	Hunt	$ 1.35	$ -	$ 14,580		7	Hunt	$ 1.35	$ -	$ 12,758		7	Hunt	$ 1.35	$ -	$ 12,758		8	Hunt	$ 1.35	$ -	$ 14,580
Mgmt Bulls Tribal (3+)	1350		8	Hunt	$ 1.00	$ -	$ 10,800		7	Hunt	$ 1.00	$ -	$ 9,450		7	Hunt	$ 1.00	$ -	$ 9,450		8	Hunt	$ 1.00	$ -	$ 10,800
Slaughter Bulls (3+)	1350			WIBC	$ 1.14	$ -	$ -			WIBC	$ 1.14	$ -	$ -			WIBC	$ 1.14	$ -	$ -			WIBC	$ 1.14	$ -	$ -
Sun Dance Bulls (2-3+ yrs)	1350			SunDance	$ 1.80	$ -	$ -			SunDance	$ 1.80	$ -	$ -			SunDance	$ 1.80	$ -	$ -			SunDance	$ 1.80	$ -	$ -
2 yo Bulls Harvest	850			WIBC	$ 1.80	$ -	$ -	12		WIBC	$ 1.80	$ 18,360	$ -	4		WIBC	$ 1.80	$ 6,120	$ -	20		WIBC	$ 1.80	$ 30,600	$ -
2 yo Bulls ShareCrop	850			ShareCrp	$ 1.80	$ -	$ -			ShareCrp	$ 1.80	$ -	$ -		18	ShareCrp	$ 1.80	$ -	$ 27,540		18	ShareCrp	$ 1.80	$ -	$ 27,540
Yrlg Bulls (Sell/Donate)	600			Surplus	$ 2.10	$ -	$ -	5	5	Surplus	$ 2.10	$ 6,300	$ 6,300	30	25	Surplus	$ 2.10	$ 37,800	$ 31,500	30	25	Surplus	$ 2.10	$ 37,800	$ 31,500
Calf Bulls	365																								
Total Sold/Given:		0	30		**Totals:**	$ -	$ 64,650	17	33		**Totals:**	$ 24,660	$ 67,778	47	128		**Totals:**	$ 58,253	$184,305	93	160		**Totals:**	$ 111,233	$ 219,688
		Total:	30			**Cash**	**Non-Cash**	**Total:**	50			**Cash**	**Non-Cash**	**Total:**	175			**Cash**	**Non-Cash**	**Total:**	253			**Cash**	**Non-Cash**
TOTAL VALUE Created:					**Value Created:**		**$ 64,650**				**Value Created:**		**$ 92,438**				**Value Created:**		**$242,558**				**Value Created:**		**$ 330,920**

Appendix I: Multi-Year Sales Summary for South Unit Alternative B - (*Years 3 - 6*): First Revenue in *Year 3*

SOUTH UNIT	Alternative B:																							
Buffalo Sales Projections	*Herding*	Buffalo first stockedin year "1"																						
2013-2018	*Alternative*	**3**						**4**						**5**						**6**				
	Fall Weight	Sold	Transfer/ Given	Note	Price	Cash Total	Non-Cash	Sold	Transfer/ Given	Note	Price	Cash Total	Non-Cash	Sold	Transfer/ Given	Note	Price	Cash Total	Non-Cash	Sold	Transfer/ Given	Note	Price	Cash Total	Non-Cash
South Unit Females																									
Cull cows Harvest	1050			WIBC	$ 1.05	$ -	$ -	5		WIBC	$ 1.05	$ 5,513	$ -	10		WIBC	$ 1.05	$ 11,025	$ -	10		WIBC	$ 1.05	$ 11,025	$ -
Cull cows Share Crop	1050			ShareCrp	$ 1.05	$ -	$ -		10	ShareCrp	$ 1.05	$ -	$ 11,025		15	ShareCrp	$ 1.05	$ -	$ 16,538		15	ShareCrp	$ 1.05	$ -	$ 16,538
Cull cows Ceremonies	1050			Wakes	$ 1.05	$ -	$ -			Wakes	$ 1.05	$ -	$ -			Wakes	$ 1.05	$ -	$ -			Wakes	$ 1.05	$ -	$ -
2 yo Females Sold	750			WIBC	$ 1.50	$ -	$ -			WIBC	$ 1.50	$ -	$ -			WIBC	$ 1.50	$ -	$ -			WIBC	$ 1.50	$ -	$ -
2 yo Females ShareCrop	750			ShareCrp	$ 1.50	$ -	$ -		20	ShareCrp	$ 1.50	$ -	$ 22,500		32	ShareCrp	$ 1.50	$ -	$ 36,000		32	ShareCrp	$ 1.50	$ -	$ 36,000
Yrlg Females (Sell/Donate)	500			Surplus	$ 1.90	$ -	$ -			Surplus	$ 1.90	$ -	$ -	22	20	Surplus	$ 1.90	$ 20,900	$ 19,000	22	20	Surplus	$ 1.90	$ 20,900	$ 19,000
Calf Females	325																								
South Unit Males																									
Trophy Bulls Non-Tribal	1700		8	Hunt	$ 1.80	$ -	$ 24,480		10	Hunt	$ 1.80	$ -	$ 30,600		5	Hunt	$ 1.80	$ -	$ 15,300		5	Hunt	$ 1.80	$ -	$ 15,300
Trophy Bulls Tribal	1700		8	Hunt	$ 1.50	$ -	$ 20,400		10	Hunt	$ 1.50	$ -	$ 25,500		5	Hunt	$ 1.50	$ -	$ 12,750		5	Hunt	$ 1.50	$ -	$ 12,750
Mgmt Bulls Non-Tribal (3+)	1350		8	Hunt	$ 1.35	$ -	$ 14,580		10	Hunt	$ 1.35	$ -	$ 18,225		5	Hunt	$ 1.35	$ -	$ 9,113		5	Hunt	$ 1.35	$ -	$ 9,113
Mgmt Bulls Tribal (3+)	1350		8	Hunt	$ 1.00	$ -	$ 10,800		10	Hunt	$ 1.00	$ -	$ 13,500		5	Hunt	$ 1.00	$ -	$ 6,750		5	Hunt	$ 1.00	$ -	$ 6,750
Slaughter Bulls (3+)	1350			WIBC	$ 1.14	$ -	$ -			WIBC	$ 1.14	$ -	$ -			WIBC	$ 1.14	$ -	$ -			WIBC	$ 1.14	$ -	$ -
Sun Dance Bulls (2-3+ yrs)	1350			SunDance	$ 1.80	$ -	$ -			SunDance	$ 1.80	$ -	$ -			SunDance	$ 1.80	$ -	$ -			SunDance	$ 1.80	$ -	$ -
2 yo Bulls Harvest	850	8		WIBC	$ 1.80	$ 12,240	$ -	18		WIBC	$ 1.80	$ 27,540	$ -	18		WIBC	$ 1.80	$ 27,540	$ -	18		WIBC	$ 1.80	$ 27,540	$ -
2 yo Bulls ShareCrop	850			ShareCrp	$ 1.80	$ -	$ -		12	ShareCrp	$ 1.80	$ -	$ 18,360		12	ShareCrp	$ 1.80	$ -	$ 18,360		12	ShareCrp	$ 1.80	$ -	$ 18,360
Yrlg Bulls (Sell/Donate)	600			Surplus	$ 2.10	$ -	$ -			Surplus	$ 2.10	$ -	$ -	20	20	Surplus	$ 2.10	$ 25,200	$ 25,200	21	20	Surplus	$ 2.10	$ 26,460	$ 25,200
Calf Bulls	365																								
Total Sold/Given:		8	32		**Totals:**	$ 12,240	$ 70,260	23	82		**Totals:**	$ 33,053	$139,710	70	119		**Totals:**	$ 84,665	$159,010	71	119		**Totals:**	$ 85,925	$ 159,010
		Total:	40			**Cash**	**Non-Cash**	**Total:**	105			**Cash**	**Non-Cash**	**Total:**	189			**Cash**	**Non-Cash**	**Total:**	190			**Cash**	**Non-Cash**
TOTAL VALUE Created:					**Value Created:**		**$ 82,500**				**Value Created:**		**$172,763**				**Value Created:**		**$243,675**				**Value Created:**		**$ 244,935**

Appendix J: Multi-Year Sales Summary for South Unit Alternative C - (*Years 4 - 6*): First Revenue in *Year 4*

SOUTH UNIT	Alternative C:																		
Buffalo Sales Projections	*The*	Buffalo first stockedin year "1"																	
2013-2018	*Big Idea*	**4**						**5**						**6**					
	Fall Weight	Sold	Transfer/ Given	Note	Price	Cash Total	Non-Cash	Sold	Transfer/ Given	Note	Price	Cash Total	Non-Cash	Sold	Transfer/ Given	Note	Price	Cash Total	Non-Cash
South Unit Females																			
Cull cows Harvest	1050			WIBC	$ 1.05	$ -	$ -	15		WIBC	$ 1.05	$ 16,538	$ -	20		WIBC	$ 1.05	$ 22,050	$ -
Cull cows Share Crop	1050			ShareCrp	$ 1.05	$ -	$ -		20	ShareCrp	$ 1.05	$ -	$ 22,050		20	ShareCrp	$ 1.05	$ -	$ 22,050
Cull cows Ceremonies	1050			Wakes	$ 1.05	$ -	$ -			Wakes	$ 1.05	$ -	$ -			Wakes	$ 1.05	$ -	$ -
2 yo Females Sold	750			WIBC	$ 1.50	$ -	$ -			WIBC	$ 1.50	$ -	$ -			WIBC	$ 1.50	$ -	$ -
2 yo Females ShareCrop	750			ShareCrp	$ 1.50	$ -	$ -		35	ShareCrp	$ 1.50	$ -	$ 39,375		40	ShareCrp	$ 1.50	$ -	$ 45,000
Yrlg Females (Sell/Donate)	500			Surplus	$ 1.90	$ -	$ -	10		Surplus	$ 1.90	$ 9,500	$ -	25	20	Surplus	$ 1.90	$ 23,750	$ 19,000
Calf Females	325																		
South Unit Males																			
Trophy Bulls Non-Tribal	1700		6	Hunt	$ 1.80	$ -	$ 18,360		7	Hunt	$ 1.80	$ -	$ 21,420		7	Hunt	$ 1.80	$ -	$ 21,420
Trophy Bulls Tribal	1700		6	Hunt	$ 1.50	$ -	$ 15,300		7	Hunt	$ 1.50	$ -	$ 17,850		7	Hunt	$ 1.50	$ -	$ 17,850
Mgmt Bulls Non-Tribal (3+)	1350		6	Hunt	$ 1.35	$ -	$ 10,935		7	Hunt	$ 1.35	$ -	$ 12,758		7	Hunt	$ 1.35	$ -	$ 12,758
Mgmt Bulls Tribal (3+)	1350		6	Hunt	$ 1.00	$ -	$ 8,100		7	Hunt	$ 1.00	$ -	$ 9,450		7	Hunt	$ 1.00	$ -	$ 9,450
Slaughter Bulls (3+)	1350			WIBC	$ 1.14	$ -	$ -			WIBC	$ 1.14	$ -	$ -			WIBC	$ 1.14	$ -	$ -
Sun Dance Bulls (2-3+ yrs)	1350			SunDance	$ 1.80	$ -	$ -			SunDance	$ 1.80	$ -	$ -			SunDance	$ 1.80	$ -	$ -
2 yo Bulls Harvest	850	26		WIBC	$ 1.80	$ 39,780	$ -	20		WIBC	$ 1.80	$ 30,600	$ -	14		WIBC	$ 1.80	$ 21,420	$ -
2 yo Bulls ShareCrop	850			ShareCrp	$ 1.80	$ -	$ -		12	ShareCrp	$ 1.80	$ -	$ 18,360		18	ShareCrp	$ 1.80	$ -	$ 27,540
Yrlg Bulls (Sell/Donate)	600			Surplus	$ 2.10	$ -	$ -	20	20	Surplus	$ 2.10	$ 25,200	$ 25,200	40	35	Surplus	$ 2.10	$ 50,400	$ 44,100
Calf Bulls	365																		
Total Sold/Given:		26	24		**Totals:**	$ 39,780	$ 52,695	65	115		**Totals:**	$ 81,838	$ 166,463	99	161		**Totals:**	$ 117,620	$ 219,168
		Total:	50			**Cash**	**Non-Cash**	**Total:**	180			**Cash**	**Non-Cash**	**Total:**	260			**Cash**	**Non-Cash**
TOTAL VALUE Created:					**Value Created:**		**$ 92,475**				**Value Created:**		**$ 248,300**				**Value Created:**		**$ 336,788**

Appendix K: Multi-Year Sales Summary for South Unit Alternative D - (*Years 3 - 6*): First Revenue in *Year 3*

SOUTH UNIT	Alternative D:																							
Buffalo Sales Projections	*The Western*	Buffalo first stockedin year "1"																						
2013-2018	*Option*	**3**						**4**						**5**						**6**					
	Fall Weight	Sold	Transfer/ Given	Note	Price	Cash Total	Non-Cash	Sold	Transfer/ Given	Note	Price	Cash Total	Non-Cash	Sold	Transfer/ Given	Note	Price	Cash Total	Non-Cash	Sold	Transfer/ Given	Note	Price	Cash Total	Non-Cash
South Unit Females																									
Cull cows Harvest	1050			WIBC	$ 1.05	$ -	$ -			WIBC	$ 1.05	$ -	$ -			WIBC	$ 1.05	$ -	$ -			WIBC	$ 1.05	$ -	$ -
Cull cows Share Crop	1050		15	ShareCrp	$ 1.05	$ -	$ 16,538		15	ShareCrp	$ 1.05	$ -	$ 16,538		15	ShareCrp	$ 1.05	$ -	$ 16,538		15	ShareCrp	$ 1.05	$ -	$ 16,538
Cull cows Ceremonies	1050			Wakes	$ 1.05	$ -	$ -			Wakes	$ 1.05	$ -	$ -			Wakes	$ 1.05	$ -	$ -			Wakes	$ 1.05	$ -	$ -
2 yo Females Sold	750			WIBC	$ 1.50	$ -	$ -			WIBC	$ 1.50	$ -	$ -			WIBC	$ 1.50	$ -	$ -			WIBC	$ 1.50	$ -	$ -
2 yo Females ShareCrop	750		15	ShareCrp	$ 1.50	$ -	$ 16,875		6	ShareCrp	$ 1.50	$ -	$ 6,750		35	ShareCrp	$ 1.50	$ -	$ 39,375		35	ShareCrp	$ 1.50	$ -	$ 39,375
Yrlg Females (Sell/Donate)	500			Surplus	$ 1.90	$ -	$ -			Surplus	$ 1.90	$ -	$ -			Surplus	$ 1.90	$ -	$ -			Surplus	$ 1.90	$ -	$ -
Calf Females	325																								
South Unit Males																									
Trophy Bulls Non-Tribal	1700		4	Hunt	$ 1.80	$ -	$ 12,240		5	Hunt	$ 1.80	$ -	$ 15,300		4	Hunt	$ 1.80	$ -	$ 12,240		4	Hunt	$ 1.80	$ -	$ 12,240
Trophy Bulls Tribal	1700		4	Hunt	$ 1.50	$ -	$ 10,200		5	Hunt	$ 1.50	$ -	$ 12,750		4	Hunt	$ 1.50	$ -	$ 10,200		4	Hunt	$ 1.50	$ -	$ 10,200
Mgmt Bulls Non-Tribal (3+)	1350		4	Hunt	$ 1.35	$ -	$ 7,290		6	Hunt	$ 1.35	$ -	$ 10,935		4	Hunt	$ 1.35	$ -	$ 7,290		5	Hunt	$ 1.35	$ -	$ 9,113
Mgmt Bulls Tribal (3+)	1350		4	Hunt	$ 1.00	$ -	$ 5,400		6	Hunt	$ 1.00	$ -	$ 8,100		4	Hunt	$ 1.00	$ -	$ 5,400		5	Hunt	$ 1.00	$ -	$ 6,750
Slaughter Bulls (3+)	1350			WIBC	$ 1.14	$ -	$ -			WIBC	$ 1.14	$ -	$ -			WIBC	$ 1.14	$ -	$ -			WIBC	$ 1.14	$ -	$ -
Sun Dance Bulls (2-3+ yrs)	1350			SunDance	$ 1.80	$ -	$ -			SunDance	$ 1.80	$ -	$ -			SunDance	$ 1.80	$ -	$ -			SunDance	$ 1.80	$ -	$ -
2 yo Bulls Harvest	850			WIBC	$ 1.80	$ -	$ -			WIBC	$ 1.80	$ -	$ -			WIBC	$ 1.80	$ -	$ -			WIBC	$ 1.80	$ -	$ -
2 yo Bulls ShareCrop	850		12	ShareCrp	$ 1.80	$ -	$ 18,360		6	ShareCrp	$ 1.80	$ -	$ 9,180		12	ShareCrp	$ 1.80	$ -	$ 18,360		12	ShareCrp	$ 1.80	$ -	$ 18,360
Yrlg Bulls (Sell/Donate)	600	10	10	Surplus	$ 2.10	$ 12,600	$ 12,600	13	12	Surplus	$ 2.10	$ 16,380	$ 15,120	13	12	Surplus	$ 2.10	$ 16,380	$ 15,120	13	12	Surplus	$ 2.10	$ 16,380	$ 15,120
Calf Bulls	365																								
Total Sold/Given:		10	68		**Totals:**	$ 12,600	$ 99,503	13	61		**Totals:**	$ 16,380	$ 94,673	13	90		**Totals:**	$ 16,380	$ 124,523	13	92		**Totals:**	$ 16,380	$ 127,695
		Total:	78			**Cash**	**Non-Cash**	**Total:**	74			**Cash**	**Non-Cash**	**Total:**	103			**Cash**	**Non-Cash**	**Total:**	105			**Cash**	**Non-Cash**
TOTAL VALUE Created:					**Value Created:**		**$112,103**				**Value Created:**		**$ 111,053**				**Value Created:**		**$ 140,903**				**Value Created:**		**$ 144,075**

Appendix L: Total Economic Benefit from Buffalo on the South Unit, Alternative A - (*Years 1 - 6*)

Proforma	Alternative A	*The Stronghold Unit*		Years 1-6	Buffalo first stocked in year "1"		
South Unit Buffalo Economic Benefits to OST							
Bison Revenue	**Value Type**	**1**	**2**	**3**	**4**	**5**	**6**
Bison Sales	Cash	**$ -**	**$ -**	**$ -**	**$ 24,660**	**$ 58,253**	**$ 111,233**
Bison Donations or Inventory Increase	Non-cash	$ -	$ -	$ 64,650	$ 67,778	$ 184,305	$ 219,688
Total Value Generation	Cash+Non-Cash	**$ -**	**$ -**	**$ 64,650**	**$ 92,438**	**$ 242,558**	**$ 330,920**
Non-Bison	**Escalator**						
Economic Benefits	2%						
Staff Salaries & Payroll		77,546	79,097	80,679	82,292	83,938	85,617
Total Non-Bison Benefits		**$ 77,546**	**$ 79,097**	**$ 80,679**	**$ 82,292**	**$ 83,938**	**$ 85,617**
Total Economic Benefits	Cash	**$ 77,546**	**$ 79,097**	**$ 80,679**	**$ 106,952**	**$ 142,191**	**$ 196,849**
Total Economic Benefits	Cash+Non-Cash	**$ 77,546**	**$ 79,097**	**$ 145,329**	**$ 174,730**	**$ 326,496**	**$ 416,537**

Appendix M: Total Economic Benefit from Buffalo on the South Unit, Alternative B - (*Years 1 - 6*)

Proforma	Alternative B	*The Herding Alternative*		Years 1-6	Buffalo first stocked in year "1"		
South Unit Buffalo Economic Benefits to OST							
Bison Revenue	**Value Type**	**1**	**2**	**3**	**4**	**5**	**6**
Bison Sales	Cash	**$ -**	**$ -**	**$ 12,240**	**$ 33,053**	**$ 84,665**	**$ 85,925**
Bison Donations or Inventory Increase	Non-cash	$ -	$ -	$ 70,260	$ 139,710	$ 159,010	$ 159,010
Total Value Generation	Cash+Non-Cash	**$ -**	**$ -**	**$ 82,500**	**$ 172,763**	**$ 243,675**	**$ 244,935**
Non-Bison	**Escalator**						
Economic Benefits	2%						
Staff Salaries & Payroll		77,546	79,097	80,679	82,292	83,938	85,617
Total Non-Bison Benefits		**$ 77,546**	**$ 79,097**	**$ 80,679**	**$ 82,292**	**$ 83,938**	**$ 85,617**
Total Economic Benefits	Cash	**$ 77,546**	**$ 79,097**	**$ 92,919**	**$ 115,345**	**$ 168,603**	**$ 171,542**
Total Economic Benefits	Cash+Non-Cash	**$ 77,546**	**$ 79,097**	**$ 163,179**	**$ 255,055**	**$ 327,613**	**$ 330,552**

Appendix N: Total Economic Benefit from Buffalo on the South Unit, Alternative C - (*Years 1 - 6*)

Proforma	Alternative C	*The Big Idea*		Years 1-7	Buffalo first stocked in year "1"		
South Unit Buffalo Economic Benefits to OST							
Bison Revenue	**Value Type**	**1**	**2**	**3**	**4**	**5**	**6**
Bison Sales	Cash	**$ -**	**$ -**	**$ -**	**$ 39,780**	**$ 81,838**	**$ 117,620**
Bison Donations or Inventory Increase	Non-cash	$ -	$ -	$ -	$ 52,695	$ 166,463	$ 219,168
Total Value Generation	Cash+Non-Cash	**$ -**	**$ -**	**$ -**	**$ 92,475**	**$ 248,300**	**$ 336,788**
Non-Bison	**Escalator**						
Economic Benefits	2%						
Staff Salaries & Payroll		77,546	79,097	80,679	82,292	83,938	85,617
Total Non-Bison Benefits		**$ 77,546**	**$ 79,097**	**$ 80,679**	**$ 82,292**	**$ 83,938**	**$ 85,617**
Total Economic Benefits	Cash	**$ 77,546**	**$ 79,097**	**$ 80,679**	**$ 122,072**	**$ 165,776**	**$ 203,237**
Total Economic Benefits	Cash+Non-Cash	**$ 77,546**	**$ 79,097**	**$ 80,679**	**$ 174,767**	**$ 332,238**	**$ 422,404**

Appendix O: Total Economic Benefit from Buffalo on the South Unit, Alternative D - (*Years 1 - 6*)

Proforma	Alternative D	*The Western Option*		Years 1-6	Buffalo first stocked in year "1"		
South Unit Buffalo Economic Benefits to OST, Pine Ridge Reservation							
Bison Revenue	**Value Type**	**1**	**2**	**3**	**4**	**5**	**6**
Bison Sales	Cash	**$ -**	**$ -**	**$ 12,600**	**$ 16,380**	**$ 16,380**	**$ 16,380**
Bison Donations or Inventory Increase	Non-cash	$ -	$ -	$ 99,503	$ 94,673	$ 124,523	$ 127,695
Total Value Generation	Cash + Non-Cash	**$ -**	**$ -**	**$ 112,103**	**$ 111,053**	**$ 140,903**	**$ 144,075**
Non-Bison	**Escalator**						
Economic Benefits	2%						
Staff Salaries & Payroll		61,523	62,753	64,008	65,289	66,594	67,926
Total Non-Bison Benefits		**$ 61,523**	**$ 62,753**	**$ 64,008**	**$ 65,289**	**$ 66,594**	**$ 67,926**
Total Economic Benefits	Cash	**$ 61,523**	**$ 62,753**	**$ 76,608**	**$ 81,669**	**$ 82,974**	**$ 84,306**
Total Economic Benefits	Cash+Non-Cash	**$ 61,523**	**$ 62,753**	**$ 176,111**	**$ 176,341**	**$ 207,497**	**$ 212,001**

Appendix P: Sanderson et al. Matrix of Ecological Characteristics to Assess How Bison Herds Can Contribute to Overall Ecological Restoration at Varying Scales

Major factor	Subfactor	South Unit
Herd size and composition	herd size	modest-large
	population structure	modest
Landscape size and use	landscape size for bison	modest-large
	human footprint	large
	management of movements	small
Ecological interactions	natural selection	small
	interaction with vertebrates	large
	interaction with ecosystem	unclear
Human and cultural interactions	public access	large
	indigenous cultural use	large
Geography	representation	large
Health and genetics	presence and management of disease	large
	genetic integrity	large
Sociopolitical environment and capacity	supportive legal environment	large
	long-term security of recovery	large
	capacity to manage	large
	market incentives	large

This evaluation (Sanderson et al., 2008) provides a qualitative scoring mechanism to evaluate how OSPRA's herd(s) may contribute to ecological restoration of buffalo in North America (see the full matrix document below). Those "large" scores suggest the herd will contribute much to ecological restoration, while the "modest" and "small" scores suggest a smaller contribution based on each factor. This evaluation suggests OST's buffalo do indeed fit in that middle area between a conservation herd and a production herd. The animals cannot be entirely classified as one or the other.

The scoring matrix may be seen below.

Table 3. Scorecard for characterizing contributions of North American bison herds to the Vermejo vision of ecological recovery.

Major Factor	*Subfactor*	*No Contribution*	*Small Contribution*	*Modest Contribution*	*Large Contribution*	*Exceptional Contribution*	*Notes*
Herd size and composition	*herd size*	<2	2 - 400	400 - 1000	1000 - 5000	> 5000	Cutoffs based on models of population sustainability and maintenance of long term genetic diversity, assuming a natural population structure (Gross and Wang 2005). Population sizes assume sufficient habitat area is available to support herd at natural densities.
	population structure	age structure, sex ratio, social units and population size managed for goals inconsistent with ecological recovery	at least one aspect of population structure (i.e. age structure, sex ratio, social units and population density) managed to match natural reference conditions (see notes)	two or more aspects of population structure managed to match natural reference conditions	all aspects of population structure managed to match natural reference conditions	no manipulation of population structure	Factors related to population structure include age structure, sex ratio, social units and population density. For details of natural age structure, sex ratio, social units, and other demographic parameters at reference sites, refer to Gates et al. (2005) and upcoming IUCN action plan
Landscape size and use	*landscape size available to bison*	< 10 acres	10 - 5,000 acres	5,000 - 50,000 acres	50,000 - 500,000 acres	>500,000 acres	Landscape size should be scaled with population size so that densities suitable for social interactions and ecological functions are maintained (e.g. Sanderson 2006)
	human footprint	>20% landscape converted to human uses incompatible with bison	15 - 20% landscape converted to human uses incompatible with bison	5 - 15% of landscape converted to human uses incompatible with bison	1 - 5% of landscape converted to human uses incompatible with bison	< 1% of landscape converted to human uses incompatible with bison	Human uses incompatible with bison are habitat conversions that destroy bison habitat (e.g. agriculture, housing, roads, etc.) or render it unusable (e.g. overgrazing by domestic animals, soil toxins, etc.)
	management of movements	movements are tightly controlled within small, fenced lots	movements are confined by perimeter barrier and limited by some internal barriers	animals are free to move anywhere within the managed landscape, but are limited at landscape perimeter (e.g. perimeter fencing, but no internal fencing)	animals are free to move on their own, with rare exceptions	animals are free to move on their own, with no exceptions	Bison may make nomadic or migratory movements if free to move unhindered.
Ecological Interactions	*natural selection*	all selection by humans for production or purpose other than ecological recovery	some but limited natural selection or management to mimic natural selection (at least 1 of the 5 selection pressues active)	some but limited natural selection or management to mimic natural selection (at least 3 of the 5 selection pressues active)	most natural selection processes operational (4 of 5 selection pressures); others managed to mimic nature	all natural selection processes are present without active human intervention	Natural selection pressures on bison include (1) mortality from native predators, (2) native diseases, (3) drought, (4) climatically induced food limitation (including interannual variation in forage quality), and (5) unmanipulated mate competition

	interaction with suite of native vertebrate species	no native vertebrate species and no plans for restoration of species	no or few (<10%) other native veterbrate species present, but restoration is planned	some (10 - 50%) native vertebrate species present (e.g. some native herbivores, few or no predators, some dependent species) and/or restoration efforts are underway	most (50 - 90%) native vertebrate species present (e.g. all native herbivores, some predators, most dependent species)	all native vertebrate species are represented in the system and there is no known impairment to intra-specific interactions	Lists of native species dependent on or associated with bison need to be developed for each major habitat type. Representative lists for shortgrass prairie can be found in Johnsgard (2005). Direct bison interactions with other animal species include predation, provision of carcasses and habitat creation. Further research is required (see text).
	interaction with ecosystem processes	herd does not in any significant way with ecosystem processes.	herd interacts significantly with ecosystem processes, over <10% of landscape	herd interacts significantly with ecosystem processes, over 10-50% of landscape	herd interacts significantly with ecosystem processes, over 50-90% of landscape	herd interacts significantly with ecosystem processes, over the entire landscape	Bison interactions with ecosystem processes include differential grazing, disturbance through wallowing, modification of fire regimes, and nutrient redistribution from excretion. Further research is required (see text.)
Human Cultural Interactions	*public access*	no access	public access limited to perimeter, but bison are sometimes viewable	public access limited to selected locales/times on the landscape	public access across most landscape (>50%) at most times (>50%)	full public access across landscape at all times	Access at all times must be appropriate and compatible with other ecological recovery goals

	Indigenous cultural use	No traditional use allowed	Privately owned and/or agricultural bison near traditional use territory but no access allowed.	Bison within tribal traditional territory some access allowed, but no hunting.	Bison within traditional territory some access allowed for interaction and hunting.	Bison within traditional territory unlimited access for hunting and interaction.	Indigenous uses include hunting and use of bison parts for shelter, clothing, food, and tools.
Geography	*representation*	herds lives in a habitat that was not in the historical range of the species	in a major habitat type	one of top 10 representatives of a major habitat type in terms of ecological recovery within the historical range of the species	one of top 3 representatives of a major habitat type in terms of ecological recovery and within the historical range of the appropriate subspecies	best representative of a major habitat type within the historical range of the appropriate subspecies	Herds are assigned to potential major types based on geographic location and/or ecological baseline information. Comparisons of scores (based on other factors) are made within major habitat type in order to score this factor.
Health and Genetics	*Presence and management of disease*	Presence of reportable disease prevents recovery	Presence of reportable disease constrains recovery, but management is planned	Presence of reportable disease constrains recovery, but disease is managed	No "reportable" diseases	No "reportable" disease and herd is not mixing with or adjacent to any sources of "reportable" disease	Reportable diseases include foot and mouth disease, anthrax, tuberculosis and brucellosis; "Constraining recovery" means a disease issue limits some other aspect of ecological recovery to only a "modest" contribution
	genetic diversity	low genetic diversity and no unique genetic traits	some genetic diversity or some unique traits	moderate genetic diversity or unique genetic traits or lineage history	high genetic diversity and some unique genetic traits and known	high genetic diversity and many unique genetic traits and fully	See examples of genetic diversity ranges for different herds in Halbert 2003

	genetic integrity	strong physigonomic resemblence to domestic cattle, indicating significant hybridization	>5% detected cattle markers or hybridization status is unknown, but physignomically similar to bison	Less than 5% detected nuclear cattle genes and/or cattle mitochondrial DNA but physignomically similar to bison	Less than 1% detected nuclear cattle genes with no or limited cattle mitochondrial DNA	No detected cattle genes and no known genetic history with hybrid populations	Cattle markers in bison genetics have been defined by Halbert 2003.
Sociopolitical environment and capacity	*Supportive legal and policy environment for ecological recovery*	legal or policy constraints bar ecological recovery and no attempt is being made to change law or policy, including international disputes that preclude cooperation	significant or multiple legal or policy constraints exist to ecological recovery; active attempts are being made to change law or policy	minor legal or policy constraints exist to ecological recovery; active attempts are being made to change law or policy	minor legal or policy constraints exist to ecological recovery; these laws or policies are under review with a commitment for change; international cooperation exists, if necessary	ecological recovery is legal within jurisdiction and supported by public policy, including international agreements as necessary	Legal and policy constraints vary across the bison's historical range with state, provincial, tribal and national jurisdictions. Further research is required to define all the constraints for ecological recovery and suggest possible remedies. See text for examples.
	Long-term security of recovery objectives	current land manager is not supportive of ecological recovery	current land manager is supportive of ecological recovery, but there is no explicit statement about management objectives for ecological recovery	current land manager is supportive of ecological recovery, with explicit management objectives related to ecological recovery	current land manager is supportive and future of ecological recovery is guaranteed through legal mechanisms over >50% of landscape	current land manager is supportive and future of ecological recovery is guaranteed through legal mechanisms over >90% of landscape	Support of the land managers, whether public or private, is crucial for ecological recovery. Legal mechanisms to guarantee future ecological recovery include conservation easements, legal mandates for public agencies, etc. Further mechanisms may be defined through further research.

	capacity to manage	no capacity to manage bison ecologically	management models for ecological recovery of bison exist that are appropriate for site, but have not been applied because of lack of capacity	modest capacity to manage bison exists, but further capacity-building is required to achieve scientific management	substantive capacity to manage bison for ecological recovery, with some capacity-building programs in place	substantive scientific capacity to manage bison for ecological recovery, with on-going capacity-building programs in place	Modest capacity consists of professional managers informed about the ecological requirements of bison as relates to particular landscape; substantive capacity consists of knowledgeable and experienced managers, with scientific support, for management. Capacity-building programs include training from experts on all aspects of bison ecological recovery.
	market incentives	there are no market incentives or models for ecological recovery of bison	market incentives for managing bison for ecological recovery exist and are appropriate for site, but have not been applied	market incentives for managing bison for ecological recovery are contributing to the economic sustainably of the site in some way (>10% of income)	market incentives for managing bison for ecological recovery are contributing to the economic sustainably of the site in a signficant way (> 50% of income)	a fully sustainable economic model based on market incentives is in place and has operated successfully for > 5 years	Market incentives for bison ecological recovery may include a green certification program, public awareness of the health benefits of bison meat, and marketing programs that connect bison products to verifiable ecological recovery.

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X. ABOUT THE AUTHORS

Ranch Advisory Partners, LLC provides agricultural advisory services in the ecological and financial aspects of ranching and agricultural properties. Services include total ranch management; structured finance strategies; operations financial optimization; agricultural operations design, implementation, and oversight; grazing planning; rangeland health evaluations and monitoring; wildlife habitat vegetative manipulation and monitoring; and hydrology.

The firm is based in Bozeman, Montana and has operations in nine western states. The firm's partners have owned and managed ranches in Montana and Wyoming and have also provided ranch management and structured finance services to landowners on roughly four million acres of western ranchlands. This experience has covered private and publicly owned lands, as well as the fields of ecosystem services finance, agriculture, recreation, hydrology, and energy development.

Todd Graham has twenty years' experience managing ranches for absentee owners and providing ranch management consulting services on four million acres of ranchlands across the West. His work focuses on improving the health of the land and wildlife habitat while implementing land-based enterprises that are financially sustainable. He has helped landowners and public land management agencies improve ranchland performance, improve rangeland health, has enrolled landowners' carbon credits to be sold on the open market, and is a widely invited speaker on land management and conservation issues. He served as Ranch Manager to the Sun Ranch in Montana's Madison Valley that sought to run its livestock in concert with large wildlife populations and carnivores and has helped design and implement some of the largest wildlife habitat improvement projects in the West. He has provided consulting services for family ranches, amenity ranch owners, tribes, federal government, state government, conservation organizations, and energy companies.

Jeremy Gingerich has over 14 years of experience working on and managing progressive cattle and bison ranches in Colorado and Montana, within some of the most diverse and critical wildlife habitat in the Northern Rockies including the Madison Valley's Sun Ranch and Ted Turner's Red Rock Ranch. A *B.S.* in *Natural Resources Recreation and Tourism* and the study and practice of *Holistic Management* provides the ecological foundation for his practice of ranch management and management consulting. Throughout his career, he has used a landscape-scale approach that recognizes the dynamics among livestock, wildlife, fisheries, riparian systems, and healthy rangelands. Jeremy recently completed an M.S. Fellowship at the prestigious *King Ranch Institute for Ranch Management*, where his Master's project was facilitating the development of a Strategic Plan for Turner Enterprises' 590,000-acre Vermejo Park Ranch in New Mexico. Jeremy currently manages the Banded Peak Ranch in Southwestern Colorado and cooperates on ranch management consulting projects through Ranch Advisory Partners based in Bozeman, MT.