APPENDIX II

SOILS REPORT
FOR
ENVIRONMENTAL ASSESSMENT

EAST ROSEBUD, WEST ROSEBUD, BUTCHER CREEK, RED LODGE CREEK ALLOTMENTS & BLACK BUTTE WILDLIFE HABITAT AREA

RANGELAND PROJECT

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INTRODUCTION

This report focuses on the characteristics and condition of soil and soil quality. Associated issues include soil productivity and soil stability. The analysis area includes lands within the Forest boundary of the Butcher Creek Allotment, the Red Lodge Creek Allotment, the East Rosebud Allotment, the West Rosebud Allotment, and the Black Butte Wildlife Habitat Area.

The Report is organized as follows:

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-Multiple Use Sustained Yield Act of 1960
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APPLICABLE LAWS, REGULATIONS AND POLICY

a. Federal

Forest and Rangeland Renewable Resource Planning Act of 1974 and National Forest Management Act of 1976

In response to requirements set forth in these two Acts, final rules on National Forest System Land and Resource Management Planning established specific minimum management requirements to be met in accomplishing the goals and objectives for National Forest System lands. These requirements were intended to guide the development, analysis, approval, implementation, monitoring, and evaluation of forest plans. Requirements specific to soils are found in 36 CFR 219.27, volume 47, #190, 09/30/82 (Federal Register 1982) as follows:

(a) Resource protection. “All management prescriptions shall:
(1) Conserve soil and water resources and not allow significant or permanent impairment of the productivity of the land;
(2) Consistent with the relative resource values involved, minimize serious or long-lasting hazards from flood, wind, wildfire, erosion.
(4) Protect streams, stream banks, shorelines, lakes, wetlands, and other bodies of water...;

(f) Soil and Water Conservation.
“Conservation of soil and water resources involves the analysis, protection, enhancement, treatment, and evaluation of soil and water resources and their responses under management and shall be guided by instructions in official technical handbooks. These handbooks must show specific ways to avoid or mitigate damage, and maintain or enhance productivity on specific sites. These handbooks may be regional in scope or, where feasible, specific to physiographic or climatic provinces. Refer to the section below, Best Management Practices for a discussion of the Forest Service Soil and Water Conservation Practices Handbook.”

Multiple Use Sustained Yield Act of 1960

It is the policy of the Congress that the national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes (16 USC 2 (I); Sec 528). The terms multiple use and sustained yield are defined as:

“The management of all the various renewable surface resources of the national forests so that they are utilized in the combination that will best meet the needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some land will be used for less than all of the resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output.” (multiple use)

“The achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the national forests without impairment of the productivity of the land.” (sustained yield)

b. Forest Service

Regional Direction

The most recent soil quality standards were adopted by the Northern Region Regional Office effective November 12, 1999. (Forest Service Manual (FSM) 2500 - WATERSHED AND AIR MANAGEMENT, R-1 SUPPLEMENT 2500-99-1). The objectives are: To meet direction in the National Forest Management Act of 1976 and other legal mandates. To manage National Forest System lands under ecosystem management principles without permanent impairment of land productivity and to maintain or improve soil quality.

Custer National Forest Land and Resources Management Plan

Management goals for soil, water and riparian resources are identified in the Forest Plan under Chapter II - Forest Wide Management Direction and Chapter III – Management Area Direction.

The Forest Plan goal for watershed management is to:

"[E]nsure that soil productivity is maintained and that water quality is maintained at a level which meets or exceeds state water quality standards." (page 4)

Forest Plan objectives for soil and water resources are:

"National Forest System lands will be managed so that the soil and watershed conditions are in a desirable condition and will remain in that condition for the foreseeable future. Soil and water quality objectives are designed to assure that these resources meet State water quality objectives and BMP's (Best Management Practices) are incorporated to assure this." (page 5)

c. Best Management Practices

Soil and water conservation practices (or BMPs) are the primary mechanism to minimize water quality impacts from non-point source pollution and still allow dispersed land management activities to occur on National Forest land. To reach these objectives the Forest Service developed a soil and water conservation practice handbook.

R1/R4 Forest Service Soil and Water Conservation Practices Handbook (USDA Forest Service 1995)

Practices specific to range management include:

17.01 - Range Analysis, Allotment Management Plan, Grazing Permit System and Permittee Operating Plan
17.02 - Controlling Livestock Numbers and Season of Use
17.03 - Controlling Livestock Distribution
17.04 - Rangeland Improvements
17.05 - Riparian Planning Considerations for Grazing

These practices were refined, based on site-specific conditions, to arrive at the desired grazing management system (including range improvements and allowable use standards) for the preferred alternative.

AFFECTED ENVIRONMENT

Introduction

Both natural events and human activities have the potential to impact soil resources on both forest and range lands. Significant natural events include wildfire and climate/weather extremes (floods, drought, hail, etc) while the most significant human activities include mining, livestock grazing, roads, floodplain development, timber harvest and recreation. The degree of impact depends upon the soil characteristics and how sensitive and resilient these soils are to these disturbances. Soils vary extensively across landscapes and thus are dictated by local landform, geologic material and climate.

a. Natural Characteristics and Processes

Elevations within the project area range from 5,400 feet near the forest boundary to 7400 feet near the upper most areas of most allotments. Based on a 30 year period of record, the average annual precipitation associated with these elevations range from 24 to 32 inches (Montana State Library - Natural Resource Information System (http://nris.state.mt.us/gis/gisdatalib/downloads/precip_Stillwater.pdf).

The underlying geology within the project area is glacial outwash over granite bedrock. These structures have produced steep mountain side slopes, wide and relatively flat valley bottoms, and moderately sloping prairie

foothills. Soils are generally deep unconsolidated alluvium. Rotational slumps have occurred along slopes adjacent to the prairie, while recent debris flows have occurred in tributary channels of East and West Rosebud.

Vegetation is largely defined by climate and soils, but other natural agents including fire, insects or disease can drastically alter the vegetative composition. Within the project area, the most recent fire occurred in the East Rosebud drainage; the 1996 Shepard Mountain Fire. Insect or disease mortality has occurred across the Beartooth Front, but has not been quantified for this analysis area. The wind events of this past winter have mostly affected areas outside of the analysis area.

b. Human Influences

Activities that have caused soil disturbance in the analysis area include road and trail building, timber harvest, livestock grazing and recreation. Small areas on the allotment have become “disturbed” sites from recreational use. These areas are generally roadsides, trailheads and areas just beyond trailheads that are frequented by recreationists. Soils in these areas are compacted or exposed from use, but the areas are generally small. The most recent timber harvest activities occurred in the Red Lodge Creek watershed about 20 years ago. Although not fully documented, these activities have likely recovered and are not a large contributor to detrimental soil conditions. National Forest system roads are considered a permanent conversion of land from productive acreage and are not included in soil quality assessments.

Fire suppression efforts since the early 1900s have reduced the frequency and size of wildfires from historic levels. These suppression efforts have likely resulted in excessive fuel accumulations that may allow for more wide spread stand replacement fires in the future, thereby increasing the risk of higher than normal erosion and associated sedimentation impacts. Except for the East Rosebud Allotment, fuel loads are considered high throughout the analysis area.

Livestock grazing has occurred within the project area since the early 1900s. Livestock numbers have decreased over the years; in some allotments quite substantially. For example, actual use in the West Rosebud Allotment averaged 467 AUMs in the ‘40’s to 60’s and dropped to 412 permitted AUM’s in 1976, and 364 permitted AUM’s in 1983. Current permitted AUM’s is 226. Livestock grazing effects are discussed in site-specific terms below.

General Grazing Influences

The effects of livestock grazing on soil resources in the western United States are well documented. The most obvious effect of livestock grazing is a change to vegetation structure and composition; certain species increase in abundance, while other species decrease. These changes can lead to changes in soil chemical and physical properties. Soil chemical properties include soil organic carbon, nitrogen, phosphorus, pH, and others. Soil physical properties include soil bulk density, surface crusts, infiltration, and others.

Some studies show that light grazing actually increases soil organic carbon (SOC) and nitrogen (N) (Ganjegunte et al., 2005). Bauer et al (1987), Lodge (1954), Rhoades et al (1964), and Wood and Blackburn (1984) all found that soil organic matter, soil nitrogen, soil phosphorus levels differed slightly among grazing treatments and exclosures. Lack of a clear relationship between grazing practices and SOC has been attributed to soil variations, depth of soil sampling, and insufficient evaluation of carbon (C) distributions within the grazing system (Schuman et al., 1999).

There are many studies of the effects of grazing on soil bulk density, infiltration, runoff, and sediment yield. Some studies report higher bulk density and lower infiltration with prolonged grazing and others report the opposite (Reed and Peterson (1961), Knoll and Hopkins (1959), Laycock and Conrad (1967). Laycock and Conrad (1967) attributed the differences to varying soil moisture conditions. Lusby (1965) determined that hillslope erosion has a seasonal cycle in which winter freeze-thaw loosens the soil and summer rains compact it. Spring and early summer livestock grazing causes an earlier and more pronounced compaction of the loosened soil than grazing during late summer.

Numerous studies have shown that soil surface ground cover is a major factor in erosion. Wood and Blackburn (1981), McCalla et al (1984a, 1984b), Lusby (1965), Thompson (1968), and Meeuwig (1971, 1970) all reported

that standing vegetation, litter, bare ground, total ground cover, bulk density, initial soil moisture content, organic matter content, and rock cover all had some influence on infiltration, runoff and sediment yield. Dadkhah and Gifford (1980) reported that the most important factor influencing sediment production was grass cover and that 50 percent protective ground cover was sufficient to provide adequate soil stabilization. Packer (1963) found that about 70 percent ground cover appears to be a requirement for preventing accelerated erosion and effective soil stabilization.

c. Existing Condition

Soil function and stability is a critical parameter for properly functioning riparian areas. If a riparian area is functioning properly it is evidenced that the soils are also functioning properly. If a riparian area is non-functioning then it is also true that soils and soil function is not functioning properly. Rather than duplicate discussions of effects of grazing on soils in riparian areas those effects are as discussed in the For additional information on environmental effects as they pertain to riparian areas see For additional information on environmental effects as they pertain to riparian areas see Appendix III - Riparian Ecosystem Report.

Soils in the project area range from fine to coarse textures and are shallow to deep. Many of the soils have abundant coarse fragments. The major soil series are Mollisols and Inceptisols.

There are 34 integrated sample points within the project area (Beartooth Area Terrestrial Ecological Unit Inventory (TEUI) In Progress). Data collected at these points included soil classification, disturbance, erosion class, rooting depth and abundance, vegetation existing cover class, potential natural vegetation, and ecological classification data. The project area was also traversed by range professionals and soils professionals to identify and document potential areas at risk. The traverses consisted of visual observation of plant health and vigor, bare ground, litter, soil surface condition, soil structure, and rooting depth.

Based on data from TEUI, utilization studies, riparian PFC assessments, and pasture traverses the majority of allotments appear to have adequate amounts of ground cover, adequate soil structure and function, and minimal levels of accelerated erosion and thus meet soil quality standards. Because of the high variability of soils and impact of grazing on soils it is very difficult to determine aerial extent of allotments or pastures not meeting soil quality standards. As described above, literature suggests that parameters typically assessed can vary seasonally and are affected by climate. Only at a few localized areas were potential problems identified in upland areas.

Butcher Creek Allotment

Butcher Creek is currently comprised of 1 pasture with an upper bench on the east side of the Allotment connected by an old trail system leading through small narrow openings over two hills to a larger meadow located on the north end on East Fork of Butcher Creek. This is a small Allotment with only 74 acres suitable for livestock grazing.

There is a small area about 30 feet by 80 feet that is mostly bare ground. It is located below a spring area in a drainage leading to the pond on private land. It appears to be a result of both livestock and wildlife disturbance and is perhaps a mineral lick and/or dusting area. This area is so small and is used by both livestock and wildlife that it is probably not feasible to attempt to address, especially given wildlife use.

Red Lodge Creek Allotment

Red Lodge Creek is currently comprised of 1 pasture with upper and lower bench areas. There are approximately 234 acres suitable for livestock grazing. This Allotment has several irrigation ditches that water livestock through-out the Allotment

According to range inspection reports over-grazing occurred on 38 acres of this Allotment, in 2007, which was compounded by a “twice-over” grazing rotation in late June and early July. This resulted in root systems of Idaho fescue being greatly impacted (shriveled). This was determined by measurements made on this key forage plant after 100 days of rest from livestock grazing. The Idaho fescue bunch grass plants had only ½ inch of re-growth,

where the adjacent pasture fescue plants had 4 to 5 inches of re-growth. There was less litter and potentially less organic matter and hence, less nutrient cycling opportunities. This overgrazing occurred on approximately 16%percent of the allotment suitable acres. Soil quality standards are currently being met but if this overgrazing continues it could lead to a loss of nutrient cycling and soil productivity.

East Rosebud Allotment

The East Rosebud Allotment is currently comprised of 1 pasture split in half by the East Rosebud River dividing a narrow valley bottom into two sides. The east side of the river has approximately 189 acres or 39% of the area suitable for livestock grazing and the west side has 294 acres - 61%. The east side has a paved road, a campground, and picnic areas. The west side has a two track road on the north and south ends, but not connected in the middle due to a land slide. The total primary range for the Allotment is 484 acres.

This area is recovering from the Shepard Mountain Fire that burned in September 1996. Most all of the Allotment was burned. Trees and shrubs are well on their way to becoming re-established. Some of the wetter sites were not burned.

Very small areas were considered severely grazed. Those spots were located in one relatively large block of native grassland across the East Rosebud River from Jimmy Joe Campground. Severe grazing averaged only 5% of the total suitable acres on this Allotment. Even though allotment monitoring identified this severe grazing it is not considered overgrazing and generally speaking, forage health and soil cover were well maintained during the duration of this monitoring.

West Rosebud Allotment

The West Rosebud Allotment is currently comprised of 2 pastures plus several small areas not formally grazed. The West Rosebud Pasture has approximately 250 acres suitable for livestock grazing. The Morris Creek Pasture has 186 acres. The total primary range for the Allotment is 436 acres.

Recent monitoring showed this Allotment averaged 21 acres over-grazed (exceeded the 55% use level by dry forage weight) which is 5% of the suitable acres. These acres were not considered over-grazed due to the short time period of the grazing disturbance. These small areas fit better into the category of severe grazing, not over-grazing. Severe grazing is defined as a one-time bite on a healthy plant. Due to this very short grazing period, the grazed plant had the ability to maintain a healthy root system. Over-grazing occurs when multiple bites occur on individual plants resulting in the shrinkage of forage plant's root systems. These stressed plants then lose their ability for fast re-growth. Generally speaking, forage health and soil cover were maintained during the duration of this study.

Black Butte Wildlife Management Area

Currently no livestock grazing is authorized on the Black Butte Wildlife Management Area. As no livestock management has occurred in this area, the existing condition currently meets soil quality standards. Specifically, soil compaction, erosion, displacement, and puddling are not concerns.

Desired Condition

The desired condition for soils within the analysis area is to maintain soil and site stability while sustaining vegetation biomass. Soil and site stability refers to soil long term productivity and nutrient cycling. Soil quality is a widely discussed and applied issue. Soil quality and long-term productivity is a component of overall rangeland health. Surrogates such as aggregate stability, organic matter and soil crusts can be measured to assess soil quality, and the threshold values for soil disturbance types can vary across forest regions. The Forest Service Manual direction (FSM 2554, 1999) describes that total detrimental soil conditions should be 15% or less of an activity area (pasture or allotment in this analysis). Where more than 15% occurs, cumulative impacts should not increase the amount, and net movement should be to improve soil quality. Soil productivity is a measure of soil quality, as are soil hydrologic function and ecosystem health. National Forest Management Act of 1976 (NFMA) requires that land be managed to ensure these soil qualities are kept. Soil quality is monitored and indicated by

such things as fire effects, compaction, displacement (erosion), puddling, or loss of ground cover and aboveground organic matter. These attributes are site-specific (Page-Dumroese et. al., 2000) in that the effects of an amount of disturbance will vary with site factors such as slope and soil texture.

ENVIRONMENTAL EFFECTS

a. Background

Seasonality affects the processes operating on grazed lands. Soil chemical properties, nutrient levels, and physical properties may vary by season. Effects of grazing on soils and vegetation may also vary by season, climate, and weather patterns.

Soil and landform conditions and characteristics are highly complex and variable. Given that soil quality attributes are site specific and the effects will vary with soil and site properties it is difficult, if not impossible, to predict with a high degree of certainty, how changes in management will affect the future condition of soils and soil quality.

b. Effects By Alternative

Spatial bounds for cumulative effects are the areas within the allotment boundaries. This is because soil is relatively stationary and most subject to direct disturbance.

Soil function and stability is a critical parameter for properly functioning riparian areas. If a riparian area is functioning properly it is evidenced that the soils are also functioning properly. If a riparian area is non-functioning then it is also true that soils and soil function is not functioning properly. Rather than duplicate discussions of effects of grazing on soils in riparian areas those effects are as discussed in Appendix III - Riparian Ecosystem Report.

Alternative 1 – No Grazing

Direct and Indirect Effects: Livestock grazing impacts would not occur under this alternative. Livestock use has direct physical impacts on soils by trampling and trailing. New livestock grazing impacts will no longer occur. Soil condition would continue to be affected by recreational livestock grazing and wildlife use. Removal of fence and water developments may impact soil quality depending on time and duration of impact, but the impact would be temporary and localized. Soil conditions would slowly improve over time. Recovery would be dependent on soil and site characteristics and climate. The few areas that currently do not meet soil quality standards will move towards desired condition of improved soil quality. Soil compaction at water developments and springs will moderate leading to improved water infiltration and vegetative cover.

This alternative may provide the fastest rate of recovery for all grazing impacted sites.

As is currently the case, no livestock grazing will be authorized on the Black Butte Wildlife Management Area.

Alternative 2 - Current Management

Direct and Indirect Effects: Under this alternative, livestock use would be maintained at the currently permitted level. Grazing impacts on upland soils and vegetation would be higher than the other two alternatives. Soil disturbance by trampling and trailing would continue at current rates and locales. Climate variability will more directly affect changes in less resilient sites. In some areas of these pastures, heavy grazing or lack of deferment may cause a downward trend in vegetation which may, in turn, result in a downward trend in soils if protective vegetation is removed or reduced.

As is currently the case, no livestock grazing will be authorized on the Black Butte Wildlife Management Area.

Alternative 3 - Proposed Action

The changes in grazing management proposed under this alternative are designed to reduce grazing duration and improve livestock distribution. Better livestock distribution will increase use of under-utilized secondary range and reduce over-utilization on primary range and grazing pressure on soil problem areas and riparian areas. Even though little of the area may not meet soil quality standards this alternative should allow those areas to move towards the desired condition of meeting soil quality standards.

Direct and Indirect Effects: The proposed action (Alternative 3) would allow vegetation and soil conditions to improve and move toward desired condition at a higher rate than Alternative 2. In some heavily impacted areas, the current condition will be maintained for a longer period of time. In these areas slow improvement may be possible, however, Alternative 1 would provide more rapid improvement in soil conditions and vegetation health.

Structural range improvements such as fences are proposed in this alternative to more adequately control livestock distribution and minimize detrimental effects on soils and other resources. Construction and implementation of these range improvements may have a negative impact to soil quality. Controlling time and duration of the impacts of construction will minimize the effects. In many cases livestock tend to congregate around water developments and along fence lines. Water developments heavily impact the soil and vegetation conditions in a small area proximal to the development. This may lead to an unwanted impact on soil quality in these areas.

Changing distribution patterns and reducing grazing pressure are anticipated to improve other areas of the pasture.

A 55 percent utilization standard in key areas is proposed for this alternative. Selection of key areas to monitor and help drive decisions on pasture management should include sensitive soil areas. This should help reduce pressure on sensitive soil areas in the allotments.

Cumulative Effects for Alternative 1, 2, and 3: Cumulative effects occur when past, present, or foreseeable activities overlap in both time and space with the proposed activities. Thus, cumulative effects are limited to the activity area where the proposed activities would occur. In other words, cumulative effects would occur only where proposed activities would occur where previous management has affected soil conditions. Activities outside of the locations of proposed management are not subject to cumulative effects because they do not overlap spatially with the lands being proposed for management in the Butcher Creek, Red Lodge Creek, East Rosebud Creek, West Rosebud Creek Allotments, and the Horse Butte Wildlife Habitat Area. Soil effects do not extend off of the piece of ground where they occur.

The risks of cumulative effects were assessed within each proposed activity area. Cumulative effects consist of the impacts from all past, present, future and proposed activities that overlap in time and space with the proposed project.

Past Actions and Their Effects on Current Conditions: Few of the allotment areas had evidence of past harvest activities. Past harvest activities did occur in the Red Lodge Creek Alloment area. At this time most of the area has adequate ground cover and erosion is not considered a problem. Firewood cutting along roads has had minimal effects on soil productivity because it is carried out by hand and the fine branches and needles are left in the woods.

Combined Effects from Past, Proposed, Ongoing and Foreseeable Activities: Cumulative effects on soils are the combination of the existing detrimental disturbance from past activities combined with the estimated disturbance that would result from the proposed project. The units with the highest risk of exceeding the regional soil standards are those that had past activities and still have some detrimental soils disturbance.

The current road and trail system contribute to soil disturbance and movement, but this is confined to the roads/trails. Therefore, overall effects to soil stability and productivity are limited and more appropriately evaluated on a watershed basis using other techniques.

Effects by Allotment/Pasture

Butcher Creek Allotment

With the proposed reduction of 30 percent in permitted AUMs and the implementation of 55 percent utilization standard the impact of cattle on soil quality should be reduced. These changes should allow for organic material to build up and protect the soil surface and reduce the impact of cattle on soil compaction. Placement of supplements, herding, and monitoring should also allow these areas to improve soil condition.

If the extension of the existing allotment boundary fence between the Butcher Creek and Red Lodge Creek Allotments is constructed this should reduce the impact of cattle to both allotments.

Red Lodge Creek Allotment

With the proposed reduction of 30 percent in permitted AUMs and the implementation of 55 percent utilization standard the impact of cattle on soil quality should be reduced. These changes should allow for organic material to build up and protect the soil surface and reduce the impact of cattle on soil compaction. Placement of supplements, herding, and monitoring should also allow these areas to improve soil condition.

East Rosebud Allotment

There is no proposed change in grazing AUMs for the East Rosebud Allotment. With the one potential range improvement proposed for the East Rosebud Allotment, a temporary portable holding and loading corral provided by the permittee to assist loading cattle into semi trucks at the end of the grazing season, a potential does exist to impact soils. Care should be taken to minimize the amount of disturbance and to limit the vehicle traffic to the defined road system and if there is a need to drive off the road template to limit that disturbance to conditions when the soil is dry.

Management intensity to improve livestock distribution would be increased through herding and improved mineral distribution (salting away from water sources, fence-lines, and other key livestock use areas). With the implementation of a 55 percent utilization standard the impact of cattle on soil quality should be reduced. These changes should allow for organic material to build up and protect the soil surface and reduce the impact of cattle on soil compaction. Placement of supplements, herding, and monitoring should also allow these areas to improve soil condition.

West Rosebud Allotment

There is no proposed change in grazing AUMs for the West Rosebud Allotment, though a number or range improvements are proposed. After construction of all range improvements described for the West Rosebud Allotment, management direction would include a livestock rotation schedule utilizing a modified five pasture deferred rotation system. The rotation system would require that the grazing sequence of all pastures combined provide for early season use one year, late season use the next, and mid season use the third year. This deferment would allow for recovery of leaf and root volume during the critical growth periods, which should also lead to improved soil condition.

With the implementation of a 55 percent utilization standard the impact of cattle on soil quality should be reduced. These changes should allow for organic material to build up and protect the soil surface and reduce the impact of cattle on soil compaction. Placement of supplements, herding, and monitoring should also allow these areas to improve soil condition.

Black Butte Wildlife Habitat Area

This area was used as an allotment for cattle grazing until 1970 at which time it was closed to grazing in favor of wildlife habitat management and for possible use as a Forest Service Administrative Site.

Grazing would occur every other year with allowable use set at no more than 35% to 40% use by dry weight in all key use areas. While the general grazing treatment would be light use under a more normal grazing regime, every 6 to 8 years, an opportunity to provide a high disturbance vegetation treatment through the use of high stock density/short duration grazing would be an option. This flash grazing treatment would provide quicker

response for enhancing the palatability of forage species for the benefit of wildlife. Under this scenario, a large number of livestock would be authorized to graze the Black Butte Wildlife Habitat Area for a period of 1 to 3 days. Water availability/amount for livestock would have to be determined previous to entering the area and all livestock would have to be watered just previous to moving them into the pasture to prevent overuse and crowding in riparian areas. Daily herding of livestock would also be required to avoid livestock piling up on fences and overuse of riparian areas. On-the-ground monitoring would be required by the permittee and/or Forest Service to insure that vegetation and soils objectives were being met.

REGULATORY FRAMEWORK AND CONSISTENCY

The existing condition indicates approximately that at most, there is very little detrimental disturbance throughout the project area. The soil analysis indicates that all alternatives and all activities proposed by the alternatives would meet the Region 1 Soil Quality Standards. All Forest Plan management direction would be met by the proposed action.

MITIGATION

No additional mitigation is recommended.

MONITORING

A soil quality monitoring plan is recommended to determine if the proposed management is moving soil quality and soil condition towards the desired condition. Vegetation, soil and hydrologic attributes should be collected initially as a baseline and then once during the end of each grazing cycle to determine trends and rates of recovery. For two pasture rotation systems, two cycles may be necessary to provide sufficient time to establish trends.

Monitoring parameters should include Identification of key areas and establishment of long term monitoring sites. These should include those areas listed above as potentially not meeting soil quality standards. Soil compaction should be assessed by collecting soil bulk density samples, soil penetration readings, and/or soil structure determinations on key areas. Ideally a combination of all should be collected the first year as a baseline. Soil surface cover readings should include transect or plot data to determine the amount of bare ground, litter, rock fragments, and live vegetation on key areas.

REFERENCES

Bauer A., C.V. Cole and A.L. Black. 1987. Soil property comparisons in virgin grasslands between grazed and nongrazed management systems. Soil Sci. Soc. Am. J. 51:176-182.

Dadkhah, M. and G.F. Gifford. 1980. Influence of vegetation, rock cover, and trampling on infiltration rates and sediment production. Water Resources Bull. 16:979-986.

Federal Register. 1982. National Forest System Land and Resource Management Planning, Department of Agriculture, Forest Service. 36 CFR Part 219. Vol. 47, No. 190, September 30, 1982. 4 pages.

Ganjegunte, Girisha K., George F. Vance, Caroline M. Preston, Gerald E. Schuman, Lachlan J. Ingram, Peter D. Stahl, and Jeffrey M. Welker. 2005. Soil Organic Carbon Composition in a Northern Mixed-Grass Prairie: Effects of Grazing. Soil Sci. Soc. Am. J. 69:1746–1756 (2005).

Knoll, G. and H.H. Hopkins. 1959. The effects of grazing and trampling upon certain soil properties. Kansas Academy of Sci. 62:221-231.

Laycock, W.A. and P.W. Conrad. 1967. Effects of grazing on soil compaction as measured by bulk density on a high elevation cattle range. J. Range Manage. 20:136-140.

Lodge, R.W. 1954. Effects of grazing on the soils and forage of mixed prairie in southwestern Saskatchewan. J. Range Manage, 7:166-170.

Lusby, G.C. 1965. Causes of variation in runoff and sediment yield from small drainage basins in western Colorado. USDA Misc. Publ. 970. Paper no. 14.

Lusby, G.C. 1970. Hydrologic and biotic effects of grazing and nongrazing near Grand Junction, Colorado. J. Range Manage. 23:256-260.

McCalla, G.R., W.H. Blackburn, and L.B. Merrill. 1984a. Effects of livestock grazing in infiltration rates, Edwards Plateau of Texas. J. Range Manage. 37:265-269.

McCalla, G.R., W.H. Blackburn, and L.B. Merrill. 1984b. Effects of livestock grazing in sediment production, Edwards Plateau of Texas. J. Range Manage. 37:291-294.

Meeuwig, R.O. 1971a. Soil stability on high elevation rangeland in the intermountain area. USDA For. Ser. Res. Pap. INT-94.

Meeuwig, R.O. 1971b. Infiltration and water repellency in granitic soils. USDA For. Ser. Res. Pap. INT-111.

Meeuwig, R.O. 1970. Sheet erosion on intermountain summer ranges. USDA For. Ser. Res. Pap. INT-85.

Page-Dumroese, D., M. Jurgensen, W. Elliot, T. Rice, J. Nesser, T. Collins, and R. Meurisse. 2000. Soil quality standards and guidelines for forest sustainability in northwestern North America. Forest Ecology and Management. 5182:1-18.

Packer, P.E. 1963. Soil stability requirement for the Gallatin elk winter range. J. Wildlife Manage. 27:401-410.

Reed, M.J. and R.A. Peterson. 1961. Vegetation, soil, and cattle responses to razing on Northern Great Plains range. USDA Tech. Bull. 1252

Rhoades, E.D., E.F. Locke, H.M. Taylor, and E.H. McIlvan. 1964. Water intake on sandy range as affected by 20 years of differential cattle stocking rates. J. Range Manage. 17:185-190.

Schuman, G.E., J.D. Reeder, J.T. Manley, R.H. Hart, and W.A. Manley. 1999. Impact of grazing management on the carbon and nitrogen balance of a mixed-grass rangeland. Ecol. Appl. 9:65–71.

Thompson, J.R. 1968. Effect of grazing on infiltration in a western watershed. J. Soil Water Conserv. 63-65.

U.S. Code. Title 16-Conservation, Chapter 2-National Forests, Subchapter I-Establishment and Administration, Sec. 528- Development and administration of renewable surface resources for multiple use and sustained yield of products and services; Congressional declaration of policy and purpose. [Online]. Available: http://www.gpoaccess.gov/uscode/. Search 16USC528.

U.S. Code. Title 16-Conservation, Chapter 2-National Forests, Subchapter I-Establishment and Administration, Sec. 531- Definitions. [Online]. Available: http://www.gpoaccess.gov/uscode/. Search 16USC531.

USDA-FS, 1995. Forest Service Handbook 2509.22 - Soil and Water Conservation Practices. U.S. Department of Agriculture - Forest Service, Missoula, Montana. Chapters 17 and 18.

USDA-NRCS, 1999, MT-DNRC, 1999. Best Management Practices for Grazing - Montana. Montana, Dept. of Natural Resources and Conservation. Helena, MT. 29 p.

Wood, M.K. and W.H. Blackburn. 1981. Sediment production as influenced by livestock grazing in the Texas rolling plains. J. Range Manage. 34:228-231.

Wood, M.K., and W.H. Blackburn. 1984. Vegetation and soil responses to cattle grazing systems in the Texas rolling plains. J. Range Manage. 37:303-308.