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Western Watersheds Project (WWP) is a 501c3 non-profit membership conservation organization. WWP, on behalf of all its members, has been working for over a decade to beneficially influence the management of BLM administered lands in the western United States. WWP has a long history of close involvement as an interested public on numerous grazing allotments administered by the BLM in Idaho, Nevada, Utah, Wyoming, eastern Oregon and southwest Montana.

WWP is submitting these comments and analysis for incorporation into the BLM's analysis of Range (Livestock Grazing) issues in its current and future planning and for inclusion in grazing permit renewal, vegetation treatments and range improvement project analyses. Copies of these comments and analyses are being submitted simultaneously by email to the State Office and all Wyoming Field Offices for incorporation into these efforts. We support sustainable multiple use without loss of the potential productivity and diversity of these lands and also support the restoration of these lands to their full biological potential. In accordance with BLM's multiple use mandate, you must include consideration of the intrinsic values of the native biodiversity of these lands and protect those values for the long-term benefit of the American people as described in 43 CFR 1601.0-5(f).

WWP is knowledgeable of literally hundreds of grazing allotments which are failing the most minimal of environmental health criteria because of livestock grazing on BLM administered lands. The evidence we provide in these comments makes the case that these lands continue to be severely overstocked with livestock. BLM's own data and current management shows this to be the case. The best quantitative and peer-reviewed range science shows that continued emphasis on structural facilities erroneously called "range improvements" is a flawed strategy. BLM typically proposes these projects rather than making the difficult decision to adjust livestock numbers and seasons to be within the current capacity of the land. Without addressing this issue, the productivity and diversity of the land will continue to fall with the result that the land, the public interest and livestock producers will suffer over the long term. Many irreplaceable resources, for example, springs, their associated wetlands and wildlife have been lost and many more will be lost or irreversibly damaged if management continues to ignore the limitations of the land and the scientific knowledge regarding livestock grazing.

As part of these comments, we refer to voluminous scientific literature and reports that BLM must consider in its analyses. Your review and analysis of these documents and inclusion of them in planning and grazing-related projects is necessary to provide a “balanced” approach to the issues. Their inclusion is also essential for BLM to comply with NEPA’s mandate to take a “hard look” at science and do a thorough and integrated analysis of all disciplines. WWP can provide copies of most of these publications to you for our costs of reproduction and postage, should you request them.

Our comments are organized by sections including:

1. Introduction
2. What Does Range Science Tell Us?
3. Management Recommendations for Uplands
4. Management Recommendations for Riparian Areas
5. References

1.0 Introduction

WWP is concerned that, in the past, BLM has not included consideration of the best available science in its environmental analyses. BLM does not follow the well known and science-based principles of range management in managing livestock grazing. The three pertinent federal statutes (FLPMA, PRIA and the Taylor Grazing Act) require that BLM administer these lands in the long-term interests of the American people and not a handful of stockmen, who are permittees, on the public lands.

Livestock permittees are a small minority of livestock producers in the eleven western states and are insignificant in their numbers or their economic contribution to the States, their local and regional economies. Their numbers and contribution pale in comparison to the natural values of our public lands. Dr. Thomas Power, Chairman of the University of Montana’s Economics Department, in Wuerthner and Matteson (2002) points out the minimal economic contribution of federal public lands livestock grazing to local, state and regional economies in the West, including Utah. That reference can be found on-line at:

http://www.publiclandsranching.org/htmlres/PDF/wr_TAKING_STOCK.pdf

Dr. Power also points out that the majority of public lands livestock producers depend on non-agricultural sectors of these local, state and regional economies for employment, not livestock production. It is not in the public’s interest to blindly continue livestock grazing at unsustainable stocking levels in order to provide a short-term benefit to this small minority, while ignoring the values displaced by livestock grazing.

In its environmental analysis and subsequent land use plan, BLM must include detailed consideration of the information and data provided in several recent publications and the references cited herein before making its decision. The following three books provide volumes of meaningful assessments of the unfortunate current condition of public lands and the failing economic and social realities of public lands ranching. These are:

- *Welfare Ranching, The Subsidized Destruction of the American West* (Wuerthner and Matteson 2002)
- *The Western Range Revisited: Removing Livestock from Public Lands to Conserve Native Biodiversity* (Donahue 1999)
- *Waste of the West* (Jacobs 1991)

In addition, BLM must consider in detail the publications referenced in these comments and also National Research Council (2002), *Riparian Areas: Functions and Strategies for Management.* All of these publications are clear in describing the flaws in current methods of livestock management on public lands and should form a core of its analysis.

In addition, the BLM's *Rangeland Reform '94 DEIS* and *Executive Summary* (RRDEIS, BLM 1995) reported that riparian areas *"have continued to decline and are considered to be in their worst condition in history"*; livestock grazing is identified as the chief cause. Indeed, some riparian areas have literally been destroyed; that is, they no longer exist or have any potential for restoration.

In its recent DEIS to revise its grazing regulations, BLM bypassed consideration of best available science. It pretended that current grazing management is fine if interested publics and environmental organizations would just quit holding up BLM and Permittee proposals by creating an administrative paperwork burden (BLM 2003). BLM asserted that greater cooperation with stockmen would somehow result in improvement by merely "tweaking" stocking rates, but then went on to state that this seldom happens, that changes in grazing really only amount to changes in season or location of use and that *"Changes in active grazing use in excess of 10% are infrequent."*

In its RRDEIS, BLM provided definitions describing the status of upland plant communities. These were:

- Potential Natural Community (PNC) = existing vegetation is between 75 – 100% of the sites potential natural plant community.
- Late Seral Community = existing vegetation is between 50 – 74% of the sites' potential natural plant community
- Mid Seral Community = existing vegetation is between 25 – 49% of the sites' potential natural community
- Early Seral Community = existing vegetation is between 0 – 24% of the sites' potential natural community.

Table 1 indicates that management of uplands since the passage of the last Rangeland Reform regulation in 1995 has not resulted in improvement of upland condition. In fact, by BLM's own definitions, condition has declined. It also shows that productivity of those lands is greatly below potential with 63% of its lands below 49% of potential. The data also show that BLM's management has failed in the intervening 10 years to take meaningful actions to improve conditions.

In spite of the evidence of widespread loss of plant productivity and ground cover, accelerated erosion and BLM's own documentation of rapid declines in species such as sage grouse, BLM routinely chooses not to address livestock impacts in any scientific or sustainable fashion. Instead, BLM proposes more water developments and grazing systems. This ignores that in the 1960's, BLM began a massive program of developing water, putting streams and springs into pipelines, seeding with crested wheatgrass, building fences, engaging in rotation grazing, and spending millions of dollars to "even out livestock distribution".

Table 1. Comparison in BLM Upland Condition Between RRDEIS (1995) and Current Condition (BLM 2003)

Community Status	RRDEIS	Current DEIS	Change '94 to date
PNC	4%	6%	+2%
Late Seral	34%	31%	-3%
Mid Seral	40%	34%	-6%
Early Seral	15%	12%	-3%
Unclassified	7%	17%	+10%

An early example of this, among others, was in BLM's Vale District, where millions of dollars were spent on crested wheatgrass seedings and structural range improvements. Today, across BLM lands in the west, many of these systems have fallen into disrepair, the land has failed to recover and we are faced with more and more proposals to install grazing systems, water developments, treat and seed – not reduce livestock numbers. This is in spite of the fact that long-term studies, including those from the Vale District have shown that stocking rate is the critical variable, not grazing systems. These are cited in a later section.

This is all in the context of BLM's failure to scientifically and accurately determine those lands which are capable and suitable for livestock grazing. We must add to this the further failure of BLM to accurately and quantitatively determine how much forage (i.e. forage capacity) is currently available. On top of this, there is the failure of BLM to properly allocate that forage to watershed and stream protection, wildlife habitat and food, then to livestock if available. Then there is the failure to provide for long-term rest to facilitate recovery. Finally, we must add the unwillingness of permittees to use peer-reviewed range science principles for management, instead they rely on "snake-oil" solutions such as time-controlled grazing and maintain strong opposition to the most minimal standards of performance. These failures by BLM and livestock permittees have prevented the recovery of damaged ecosystems in order that they might sustain use as envisioned in the Taylor Grazing Act and FLPMA.

Instead, BLM continues to use the take "half/leave half" principle for livestock use. In its planning, permits and analyses, BLM typically includes livestock use levels of 50% of forage as proper. They do this without providing any scientific foundation for this claim, nor do they adequately monitor this use and use it to manage livestock. The following paragraphs provide a summary of the relevant range science regarding utilization levels, plant growth and productivity, effects of precipitation regime, capability and suitability, capacity determinations, range improvements, stocking rates and range economics. These principles are well founded in the range science literature.

2.0 What Does Range Science Tell Us?

2.1 <u>Plant Growth and Precipitation.</u> In order to understand the implications of grazing livestock at these heavy forage utilization levels in arid regions, it is important to understand the precipitation regime and its relationship to forage production. Holechek et al (2001) point out what we all understand at the most basic level. That is, precipitation is the single most important factor determining the type and amount of vegetation in a particular area. In the 11 Western States, 80% of the area receives less than 500 mm (19.6 inches) of annual average precipitation. Further, this precipitation is subject to great year-to-year variation.

Four locations representative of precipitation patterns for Wyoming BLM lands are used for illustration. Long-term precipitation records were analyzed for stations at Kemmerer, Rock Springs, LaBarge and Worland. The effects of annual variations in precipitation on plant community production are important to understand in establishing livestock stocking rates and management. Table 2 provides a summary of annual precipitation statistics for these locations. Data was obtained from the Western Regional Climate Center database which can be found on line at http://www.wrcc.dri.edu/index.html . Figure 1 provides plots of annual precipitation and occurrence of below average and drought years for these locations.

The analysis uses the Standard Precipitation Index (SPI) developed by McKee et al (1993) which considers drought, or extremely dry conditions, as years with 2" less than average precipitation.

Table 2. Summary of Precipitation Statistics for Four Wyoming Locations

Description	Kemmerer	LaBarge	Rock Springs	Worland
Period of Record	1949 – 2003	1958 – 2003	1949 – 2003	1960 - 2003
Years of Record	43	28	50	43
Average, inches	10.26	7.94	8.7	7.63
Range, inches	5.06 – 23.72	3.44 – 17.82	4.53 – 14.54	3.75 – 11.27
Year below average	25	16	27	21
Percent years below average	58.1	57.1	54	48.8
No drought years based on SPI	14	5	13	6
Percent drought years based on SPI	30.2	17.8	26	13.9

Figure 2 shows the monthly distribution of precipitation at these locations. The differences in overall precipitation amounts are reflected in the relative magnitudes of monthly precipitation at each of the locations, with Worland being the driest. All locations have increased precipitation during spring and late summer. Winters are generally characterized by consistent, but lower precipitation from month to month.

These periods of precipitation vary in their effects on the plant communities. Increased precipitation during the spring-summer-fall months may not be effective due to the higher temperatures occurring then. Typically, the fall-winter period is the period of greatest increase in soil moisture due to lower temperatures and lower evapo-transpiration. Precipitation effectiveness during the warmer spring – fall periods varies with the storm intensity and soil condition. Storms must be of high enough intensity to promote recharge of the soil profile into the root zone to be effective for plant growth. Generally, this is greater than 0.6 inches in desert shrub types, although very high intensity storms may not be effective due to rainfall rates in excess of infiltration that result in overland runoff and flash events.

Spring plant growth in these arid areas depends on the amount of moisture received and retained during the fall-winter period. Relatively dry summers may allow little regrowth and by the time fall comes, temperatures may be low and growth limited. Trampled and compacted soils exacerbate this effect (Blaisdale and Holmgren 1984). Some desert shrubs such as Artemisia sp. with both shallow and deep root systems can take advantage of both shallow and deep soil moisture (West 1983).

Annual production of available forage at the Desert Experimental Range in western Utah was highly correlated with total annual precipitation, showing an 800% variation in forage production between the driest and wettest years (Hutchings and Stewart, 1953). Scientists developing quantitative ecosystem relationships for the Prototype Oil Shale Program managed by BLM in Utah's Uinta Basin found that annual sagebrush stem leader growth used as an index of production had a high correlation with winter precipitation (October – March) and that spring annual plant biomass was correlated with spring precipitation (ERI 1984; WRSOC 1984). These studies were carried out under the supervision of BLM's Vernal Field Office.

Analysis of twenty years of data for perennial grass production and annual precipitation for a study area at the Chihuahuan Desert Rangeland Research Center in New Mexico showed a high correlation (Holechek et al, 2001). A graph of this data is shown in Figure 3. Annual perennial grass production varied between 6 and 750 lbs per acre, corresponding to the second-lowest and highest precipitation years. The linear regression plot of the same data is provided in Figure 4. Results of long term studies of crested wheatgrass production from experimental plots on BLM land at Malta, Idaho showed that crested wheatgrass production was most closely related to May-June precipitation (Sharp et al, 1992). They found that annual production of crested wheatgrass during 35 years averaged about 500 pounds/acre and ranged between 130 and 1090 pounds/acre depending on precipitation (Figure 5). These relationships demonstrate that this is a predictable phenomenon that should be taken into account in setting livestock grazing seasons, stocking rates and management on an annual basis as well as over the longer term. A typical NRCS soil survey (USDA 1980) for these arid areas shows that total production of potential plant communities varies by about 300% between favorable and unfavorable years. This wide range in production between dry and wet years is typical in the arid regions of the West and should be reflected in related levels of livestock use.

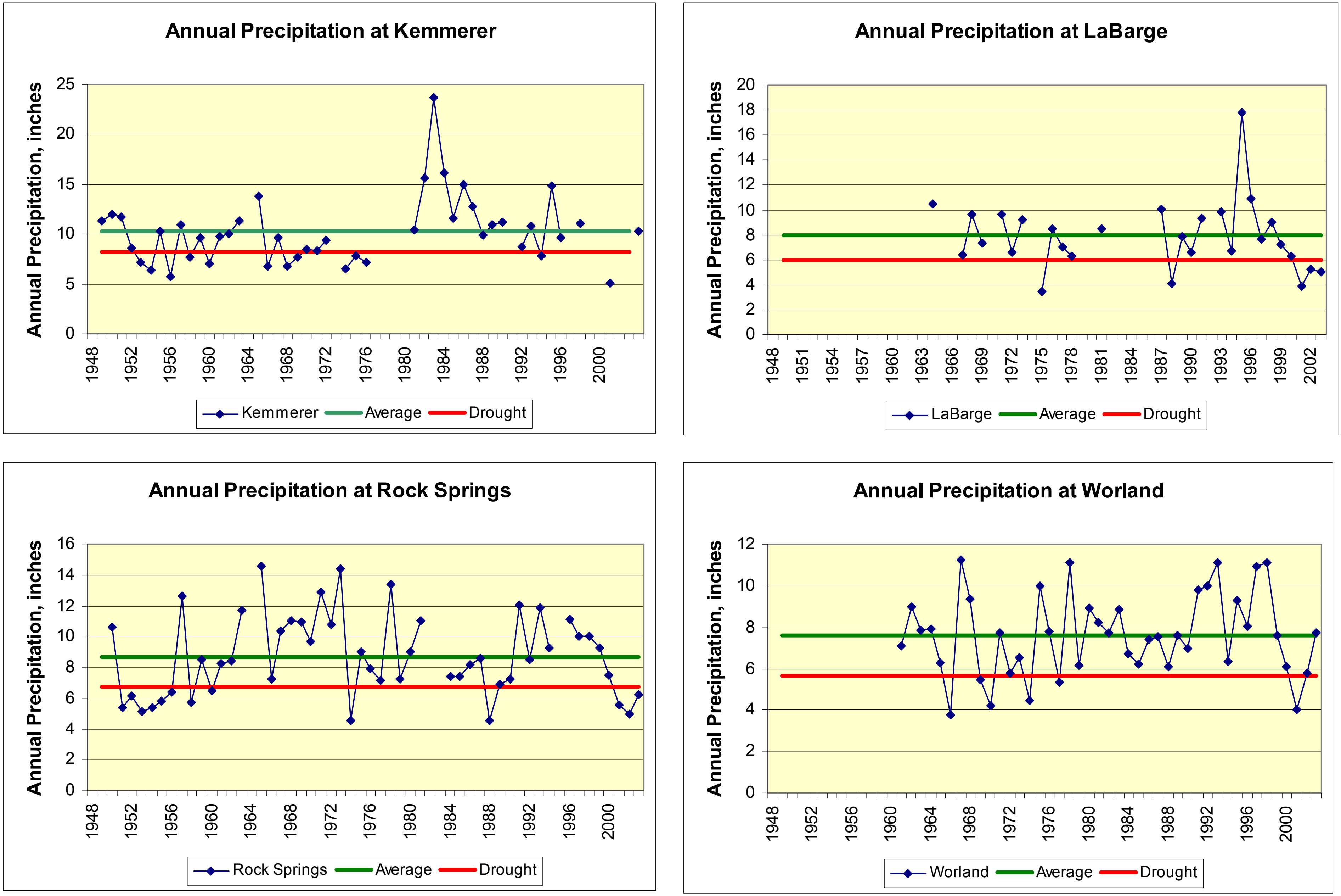

Figure 1. Annual precipitation patterns in Kemmerer, LaBarge, Rock Springs and Worland, Wyoming

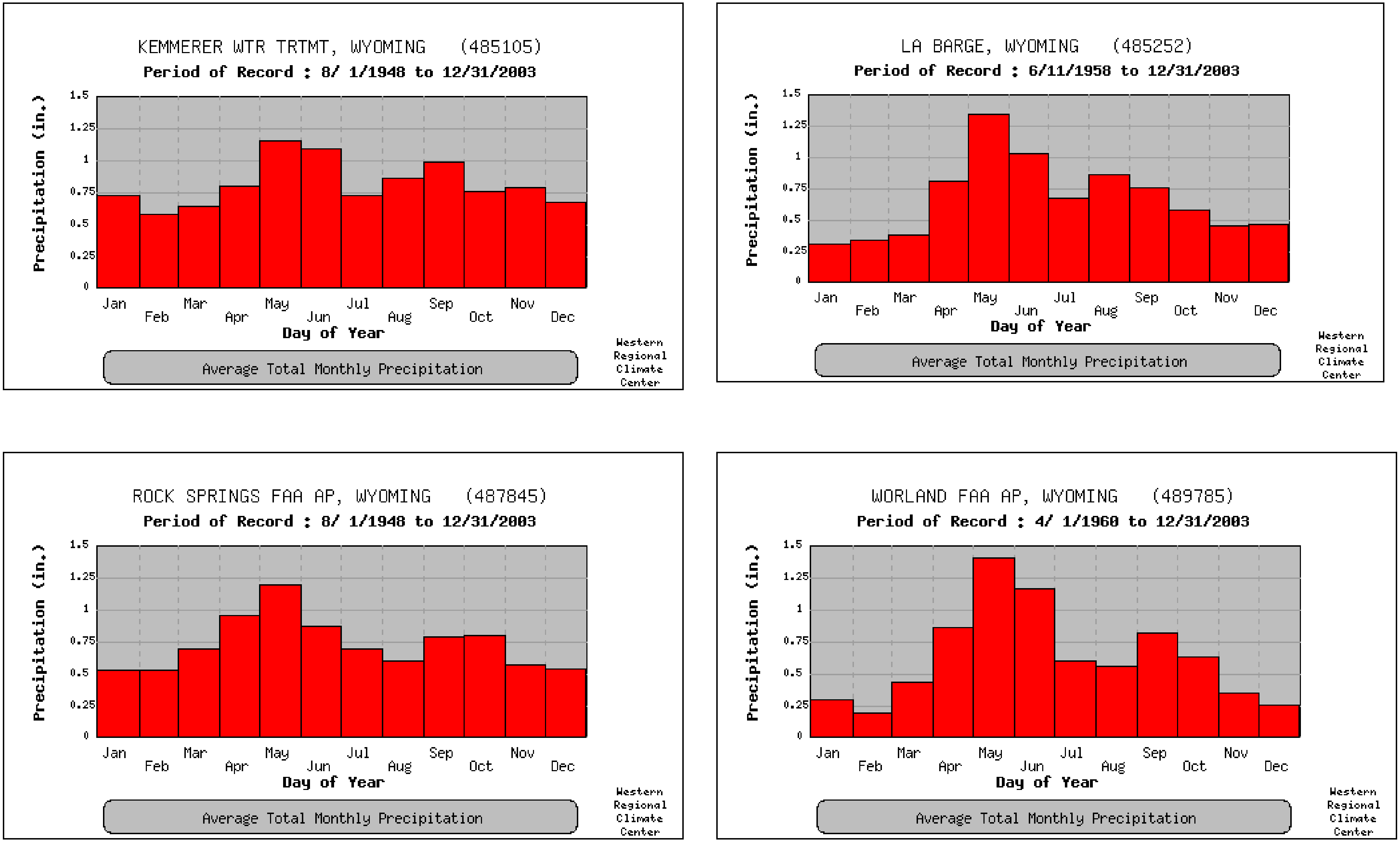

Figure 2. Monthly precipitation patterns in Kemmerer, LaBarge, Rock Springs and Worland, Wyoming.

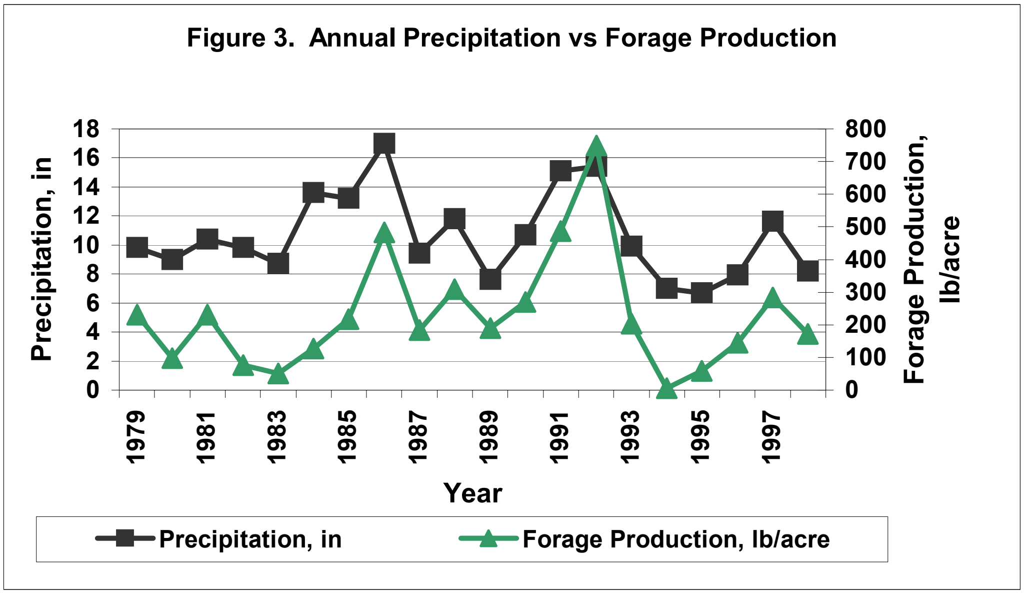
Figure 3. Annual Precipitation vs Forage Production
Precipitation, in
18
16
14
12
10
8
6
4
2
0
800
700
600
500
400
300
200
100
0
Forage Production, lb/acre
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
Year
Precipitation, in
Forage Production, lb/acre

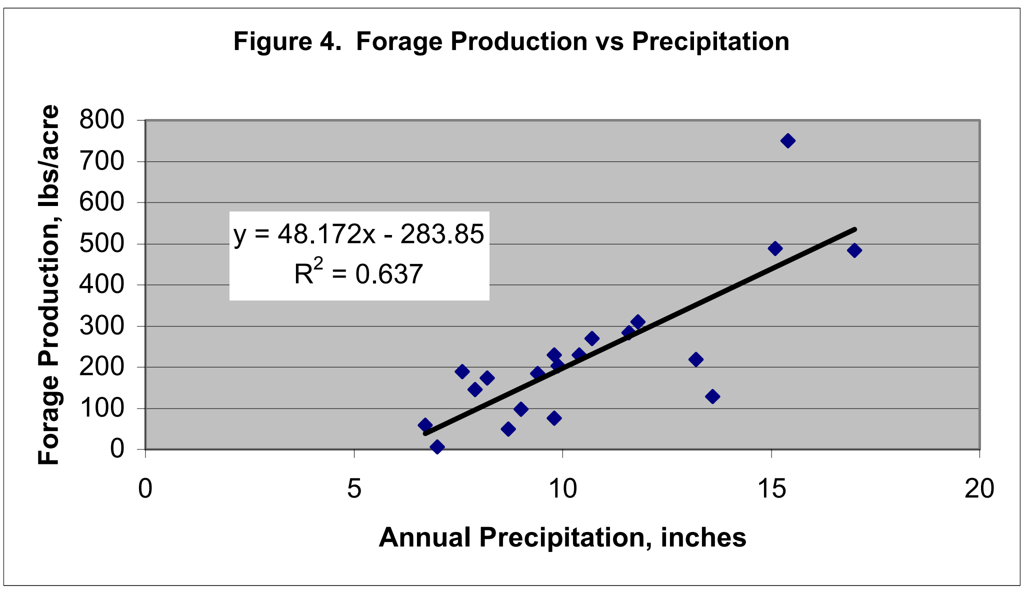
Figure 4. Forage Production vs Precipitation
Forage Production, lbs/acre
800
700
600
500
400
300
200
100
0
y = 48.172x - 283.85
R2 = 0.637
0
5
10
15
20
Annual Precipitation, inches

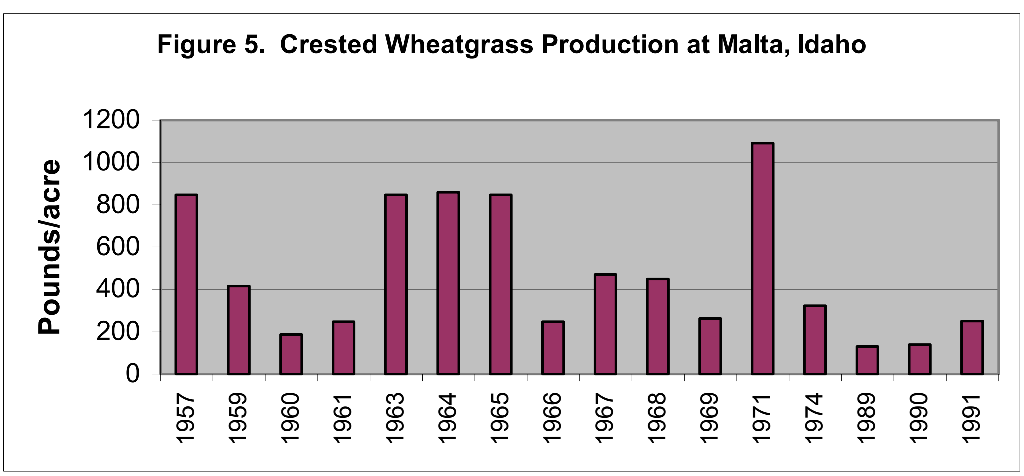
Figure 5. Crested Wheatgrass Production at Malta, Idaho
Pounds/acre
1200
1000
800
600
400
200
0
1957
1959
1960
1961
1963
1964
1965
1966
1967
1968
1969
1971
1974
1989
1990
1991

2.2 Grazing Intensity and Effects on Productivity. Much of the current research and analysis of livestock grazing management, plant productivity and economics has come out of the Department of Animal and Range Sciences at New Mexico State University. This work has been presented in a series of textbooks and papers in the range science literature. These references provide analyses of the interactions of livestock stocking rates, plant productivity and economics based on a set of long term grazing management studies from native rangeland types. They provide recommendations for determining livestock grazing intensity to maintain vegetative productivity and economic stability, while taking into account the effects of inherent variation in precipitation in desert ecosystems.

The effects of different livestock grazing intensities on forage plant production was studied in a ponderosa pine type in Colorado as early as the 1940's (Schwan et al, 1949). This study showed that forage consumption at a rate of 57% produced an average of twice as much forage as a rate of 71%. An area left ungrazed by livestock for 7 years produced three times as much forage as the 71% use area. The authors concluded that, as grazing use increased, forage production decreased. During that same period, Dyksterhuis (1949), in a classic paper on the use of quantitative ecology in range management, presented examples of how stocking rates must be adjusted based on precipitation and range condition, which included a rating based on departure from the potential plant community. NRCS (USDA, 1982) considers proper grazing management as that management that sustains the potential plant community.

The effects of conservative (30 – 35%) use vs. heavy (60 – 65%) grazing use on grasses and forbs by cattle was determined in a New Mexico study (Galt et al, 1999). Both of these pastures had experienced conservative use for over 10 years. In 1997, one pasture was changed to heavy use. Quantitative measurements at key locations in both pastures in the following year, while being rested, provided the results shown in Table 3.

Table 3. Standing Crop of Grasses and Forbs from Galt et al (1999)

Location/Forage Component	Spur Pasture Heavy Stocking Rate Pounds/acre	Deep Lake Pasture Conservative Stocking Rate Pounds/acre
Perennial Grasses	352	824
Forbs	256	436
Total Forage	608	1260

This study showed that heavy stocking rates, even for a single year, resulted in serious declines in productivity in the succeeding year. Perennial grass production was reduced by 57% and forbs by 41% in the heavily grazed pasture compared to the conservatively grazed pasture. The authors cited a number of other studies in arid environments that showed heavy stocking rates were accompanied by decreases in forage production when compared to conservative use. After drought, the ability of forage plants to recover was directly related to the standing crop levels maintained during the dry period. The studies cited showed that grazing during different seasons was less important than grazing intensity.

Five long-term stocking rate studies from three different locations in Arizona, New Mexico and Utah documented similar patterns (Holechek et al 1999a). In the Desert Experimental Range in Utah, a 13-year study with moderate (35%) and heavy (60%) use by sheep resulted in annual forage production of 198 lbs/acre and 72 lbs/acre. The authors recommended 25 – 30% use of all forage species. A 10-year study at the Santa Rita Range in Arizona demonstrated that perennial grass cover and yield showed an inverse relationship to grazing intensity, while burroweed, an undesirable species, increased with increasing forage use. The authors recommended a 40% use level. A 37-year study at the Jornada Experimental range in New Mexico involving conservative (33%) and moderate (45%) use showed that the lower grazing intensity resulted in greater black grama (perennial grass) cover. Lowland areas with high clay content and periodic flooding grazed at moderate intensity had higher cover of Tobosa, a perennial grass, than heavily grazed areas. They recommended 30% be used as a stocking intensity with no more than 40% removed in any year. A 10-year study at the Chihuihuan Desert Rangeland Research Center looked at four grazing intensities of 25%, 35%, 50% and 60%. Light (25%) and moderate (35%) use produced 70% more forage than 50% use and more than double that achieved at 60% use. Here, the author recommended conservative stocking at 30 – 35%.

Hutchings and Stewart (1953), suggested that 25 – 30 % use of all forage species by livestock was proper. They recommended this level because routinely stocking at capacity will result in overgrazing in half the years and necessitate heavy use of supplemental feed. Even with this system, they recognized that complete destocking would be needed in 2 or 3 out of ten years. Holechek et al (1999a) concluded that the research is remarkably consistent in showing that conservative grazing at 30 – 35% use of forage will give higher livestock productivity and financial returns than stocking at grazing capacity. They also recognized that consumption by rodents and other wildlife must be taken into account as part of this utilization. Otherwise, rangeland productivity would suffer even at these levels of use. Galt et al (2000) recommended levels of 25% utilization for livestock and 25% for wildlife with 50% remaining for watershed protection. In none of these cases have the scientists recommended 50% utilization by livestock and they are clear that even at the lower use levels recommended, wildlife use is included.

BLM has never even looked into the issue of the relationship between its typical riparian greenline stubble height standard of 3 – 4", usually applied to Nebraska sedge and other sedge species, and the effects of applying this standard on adjacent riparian plant community productivity. Carter (1998) showed that before greenline N. sedge had been reduced in height to the standard of 6", riparian grasses had been reduced to 2" stubble height and 89% of stream banks had been trampled, compacted or were actively eroding into the stream. Monitoring data from the Wasatch-Cache National Forest (USDA 1993) included the observation that a Nebraska sedge stubble height of 7.6" corresponded to an estimated 70% use of riparian grasses. Lile et al (2003), compared clipping of N. sedge to stubble heights of 2" and 4" during early season, late season and multiple clippings to both heights. Late season use or 2" stubble height did not allow recovery. Only the 4" early season use achieved the 4" criteria, but did not regrow to meet the 6" criteria by the end of the growing season. This shows that season-long or late season use does not allow sufficient time for re-growth and that 3-4" stubble heights are not effective in protecting riparian vegetation.

Schulz and Leininger (1990) studied long-term riparian exclosures compared to areas that continued to be grazed. They found that, after 30 years, willow canopy cover was 8.5 times greater in livestock exclosures than in adjacent grazed riparian areas. Grasses were 4 to 6 times greater in cover within the exclosure than outside. Mean peak standing crop of grasses within the exclosure was 2,410 Kg/Ha, while outside in caged plots, mean peak standing crop was 1,217 Kg/Ha.

Often cited, Franklin Crider's study on root growth stoppage from plant top removal provided quantitative measurements of plant re-growth under different amounts of removal (Crider 1955). Three mid-west perennial grasses were grown from seed in pots under ideal conditions of watering and fertilization. After sixty days of growth, these potted grasses were clipped once at intervals from 10% to 90% of the above ground biomass. Repeat clippings of the potted grasses were made every two days to return the plants to the same height as the original clipped percent. The experiment lasted thirty three days at which time root growth of controls became inhibited by the size of the pot. Crider concluded that under these ideal growing conditions, if these species of grasses had 40% or less of their aboveground biomass clipped either once or many times, then the net root mass was the same or more at the end of the experiment. This was used to make the assumption that grazing during the entire growing season at 40% or less would sustain plants from one season to the next. This same study has been used to justify the 50% or "take half/leave half" proposition that range managers have used for decades. Clearly, the long-term range studies cited here show that under actual field conditions, these use levels are excessive and light grazing (25%) is most equitable to BLM's mandate for sustainable use.

2.3 Forage Needs Other Than Livestock. Let's assume for the moment that Crider's finding (40% removal in a growing season) applies to the very arid lands found on Wyoming BLM lands. If Crider's results apply, then the 40% removed needs to be shared with all the animals that require forage. Some is needed for wild grazers (insects, nematodes, mammals), some for the generation of litter and nutrient cycling. A certain amount of the plant needs to remain to ensure regeneration of the plant and to ensure plant community structure is sufficient for wildlife habitat needs and soil erosion protection. A certain proportion of plants must remain ungrazed to allow for seed and flower production to ensure propagation of the species and provide food for pollinators and granivores, an often overlooked requirement.

Existing research helps answer the question of how much of the annual plant growth is required for wild grazers. For a detailed review of this research we recommend that you download Catlin et al (2003) from:

http://rangenet.org/directory/jonesa/sulrprec/index.html

Based on a number of studies of mammal consumption of forage, some annual forage consumption needs for mammals where mammal populations are at or near their potential are provided in Table 4.

Table 4. Forage Needs of Mammals

Mammal	Forage Needs kg/hectare
Deer	12.7
Rabbits	72.7
Rodents	142.3
Total	227.6

Less is understood regarding the typical vegetation needs for insects. What is known is that insects play a significant role. For example, harvester ants are granivores with individual colony populations of tens of thousands of individuals. Even in the driest and hottest parts of North America, the total biomass of one species of harvester ant, *Messor (Veromessor) pergandei* has approximately the same total biomass as the total rodent population in the same area. One of many ecological roles harvester ants fulfill is dispersing plants as a result of accidental abandoning of seeds near the nest. The analysis here focuses on the typical forage needs of insects.

A number of studies have reported the percent of plant growth consumed by insects. In grassland and savannah, insect consumption of a single species varied from less than 1% to 19% with a mean of 3.5% (Wiegert and Peterson, 1983). Rangeland grasshoppers consume between 1- 3% in typical years (Mispagel 1978) and up to 99% in periods of super abundance (Nerny and Hamilton 1969). Hewitt and Onsager (1983) suggest that between 21-23% of available range forage is consumed by all grasshopper species in the western U.S. each year. This production is transferred to birds and mammals such as sage grouse and rodents as a food source, to the soil for nutrient cycling and to higher trophic levels such as raptors and other carnivores. It is important for ecosystem function and cannot be dismissed.

Nematodes provide critical soil nutrient cycling and structure functions. This complex array of species normally has a higher diversity and biomass than other rangeland flora and fauna combined. Some nematodes consume plants and should be considered as a component in the consumption of rangeland plants. Ingham and Detling (1984) estimated that nematodes consumed between 6 and 13 % of below ground net productivity in the mixed grass prairie. Other studies by Scott et al (1979) and Anderson (1987) found that root feeding arthropods and nematodes consume between 7-26% of the net productivity in normal years. For the full citations to these studies please visit the paper at the web site shown above.

Holechek et al (2001) provide equivalents in forage consumption between livestock and wildlife. They are summarized in Table 5. Studies in the Vernal resource area during the 1970's and 1980's generated many years of quantitative data describing the abundance of many species of animal, bird and insect in the different vegetation types occurring there. This information is available in the Vernal Field Office for review and analysis. Some of it is provided in the (ERI 1984; WRSOC 1984) reports referenced. Final determinations of livestock stocking rates and utilization criteria for livestock must take this information into account, using the current vegetation production for the area under consideration.

Table 4. Animal Equivalents from Holechek et al (2001)

Animal	Animal Unit Equivalents
Mature cow	1.0
Yearling cow	0.75
Domestic sheep	0.15
Horse	1.8
Bison	1.8
Elk	0.7
Moose	1.2
Bighorn sheep	0.18
Mule deer	0.15
Pronghorn	0.12

2.4 What is an AUM? Various estimates have been used in the past to define the amount of forage consumed by livestock (AUM). BLM often uses the value of 800 lbs/AUM. This section discusses some of that variability and proposes a standard forage amount for livestock consumption. A check of USDA market statistics at:

http://www.ams.usda.gov/mnreports/lm_ct166.txt

shows that during 2003, auction weights of mature steers averaged 1268 lbs and mature heifers averaged 1157 pounds. Recent auction weights for mature cows have seen ranges up to 1400 pounds. Ray et al (2004) give a weaning weight of 480 pounds for calves. Holechek et al (2001) state that daily dry matter consumption averages 2% of body weight per day. They then calculate that a 1000 pound cow will consume 20.0 lbs dry forage/day and a 750 pound yearling will consume 15 lbs dry forage/day, for a total of 35 lbs/day. The 1969 AMP for the North Rich Allotment in Rich County and Cache Counties (Wasatch-Cache NF) used 30 lbs/day for a cow calf pair. In its FEIS for the Land and Resource Management Plan for the Curlew National Grassland (USDA 2002), the Caribou-Targhee National Forest used 34 pounds per day for a cow/calf pair. There is little doubt that cattle weights have increased over time and a value that is accurate under current conditions must be applied. In fact, Anderson et al (ca 2000) calculated a 35% increase in dressed weights per animal between 1975 and 1995. Their analysis can be found at:

http://agecon.uwyo.edu/RiskMgt/marketrisk/TheCattleCycle.pdf

Using the average auction weight for heifers (1157 lbs), the weaning weight for calves (480 lbs) and the 2% consumption rate from Holechek et al (2001) results in forage dry weight consumption of:

(1157 + 480) x 0.02 x 30 days = 982 lbs/month, or 32.7 lb/day

Even this will likely be an underestimate since calves graze all summer and are probably closer to the yearling weight given in Holechek et al (2001) and mature cows can be a good deal larger than the heifer weight used here. BLM must also count calves in its AUM for permitting purposes. FLPMA requires that an AUM be the forage consumed by a mature cow or its equivalent each month. Therefore, calves must be counted in the AUM allocation for permitting purposes. We propose that BLM establish a forage consumption allocation for a cow/calf pair of 1,000 lbs/month = 1 AUM.

2.5 Grazing Systems. In a review paper that considered grazing systems, grazing intensity and season of use, Holechek et al (1998) determined that, *"financial returns from livestock production, trend in ecological condition, forage production, watershed status and soil stability are all closely associated with grazing intensity."* They found that grazing systems such as rest-rotation had limited or no benefit in arid systems. Citing long-term studies in Arizona, they documented that after 12 years of rest-rotation management compared to continuous grazing, neither forage plant densities nor forage plant production differed between the treatments. Grazing intensity employed was 30 – 35% use with occasional high use of 50% or more. *"Rest and deferment were not sufficient to overcome the effects of periodic heavy use on primary forage plants when rest-rotation grazing was applied on big sagebrush range in northern Nevada."* In an Arizona study comparing winter-spring grazing with summer-fall rest to continuous grazing, the rotation scheme was inferior to the year-long system from the standpoint of perennial grass density and production. Perennial grass production was closely associated with the degree of use and was highest where grazing use was lowest. In a Vale, Oregon study, lasting over 20 years at moderate grazing intensity, rotational grazing showed no advantage over season-long grazing in improving range condition or forage production. *"The key factor in range improvement appeared to be the reductions in grazing intensities that were applied when the project was initiated..".*

A review of the "classic" range studies, which are the long-term stocking rate and grazing system studies that provide the scientific foundation for modern range management again showed that light use is closer to sustainable use, while heavy use is not (Holechek et al 1999a). Definitions of "heavy", "moderate" and "light" grazing developed in 1961 were cited. Heavy grazing was defined as the degree of forage utilization that does not allow desirable forage species to maintain themselves. Moderate grazing was defined as the level at which palatable species can maintain themselves. Light grazing was defined as the degree of utilization at which palatable species are able to maximize their herbage producing ability. However, it is clear that using even "moderate" grazing in depleted areas will not allow them to recover.

When averaged across all the long-term studies for all regions, heavy grazing was 57% use of primary forage species, moderate use was 43% and light use was 32%. In arid regions, the research showed that moderate grazing use was 35 – 45%. When the average forage production change over time was compared with use, heavy stocking resulted in a 20% decline in production, moderate use experienced no change and light use resulted in an 8% increase. During drought, moderately stocked pastures produced 20% more forage than heavily stocked pastures, light grazing produced 49% more forage than heavy and 24% more than moderate stocking levels. Heavy stocking resulted in a downward trend and light stocking an upward trend in ecological condition. Moderate stocking showed a slight, but not significant increase in condition, resulting in depleted ranges being maintained in depleted condition.

Table 6 provides summary statistics from that paper. It must be remembered that these comparisons are to prior heavy use, not to ungrazed lands. It is apparent from these studies that "moderate" use levels will not allow significant recovery of severely depleted range. In fact, in studies of long-term rest at Idaho National Engineering Laboratory, the recovery rate of grasses in sagebrush communities was slow, progressing from 0.28% to 5.8% over 25 years (Anderson and Holte, 1981 and Anderson and Inouye, 2001). <u>It is clear from these examples that native plant communities in heavily depleted sites will require decades to recover in the absence of livestock, while their ability to recover in the presence of livestock at any level of use has not been demonstrated</u>.

Relying on additional water developments, fences and grazing systems will not alleviate the problem. The use of range improvements and rotation systems is not sufficient to correct over-stocking. Results from 18 western grazing system studies by Van Poollen et al (1979) found that adjustment of livestock numbers, or stocking intensity was more important than implementing grazing systems to improve herbage production. Holechek et al (1999a) recognized that *"various rotation grazing systems cannot overcome the rangeland deterioration associated with chronic overstocking."* Holechek et al (2000) also showed that the various claims made by advocates of short-duration or time-controlled grazing were false.

A comprehensive discussion of rest-rotation is found in Clary and Webster's General Technical Report titled *"Managing Grazing of Riparian Areas in the Intermountain Region."* (Clary and Webster 1989). They summarized a dozen studies showing significant increases in forage production occurred with decreased intensities of grazing. The article described the improvements found in reducing grazing from heavy, to moderate and then to light grazing. Grazing with utilization above 50% was described as heavy, moderate was 30 - 50% and <25-30% was called light grazing in most of these studies.

Table 5. Summary of Data from 25 Classic Grazing Studies (Holechek et al 1999a)

Description	Heavy	Moderate	Light
Average Forage Use %	57	43	32
Average Forage Production lb/acre	1,175	1,473	1,597
Drought Years Production lb/acre	820	986	1,219
Average Calf Crop %	72	79	82
Average Lamb Crop %	78	82	87
Calf Weaning Weight lbs	381	415	431
Lamb Weaning Weight lbs	57	63	--
Gain per Steer lbs	158	203	227
Steer/calf Gain per Day lbs	1.83	2.15	2.3
Steer/calf Gain per Acre lbs	40.0	33.8	22.4
Lamb Gain per Acre lbs	26.0	20.4	13.8
Net Returns per Animal $	38.06	51.57	58.89
Net Returns per Acre $	1.29	2.61	2.37

Clary and Webster's study concluded that *"managers should place more emphasis on proper stocking intensity and less on grazing system implementation. The concentrated use of grazing pastures is not compensated for during rest years if grazing use is heavy. In summary, although grazing systems have great intuitive appeal, they are apparently of less consequence than once thought. In fact as long as good management is practiced so that there is control of livestock distribution and grazing intensity, the specific grazing system employed may not be significant."*

Holechek et al (2001) have indicated that, depending on topography, areas of severe degradation, or *"sacrifice areas"* occur around water sources including water developments. These can extend from 1 mile to several miles from these sources and out further if stocking rates are too high. Based on this, a single water development can result in an area of soil compaction, erosion and severe loss of ground cover and vegetation for thousands of acres. They also indicate that installing water developments in locations that have had limited access to livestock in the past may increase ecological damage to areas that are important refuges for relict plant communities and wildlife that have not been displaced by livestock.

Catlin et al (2003) provides a review of grazing systems. It summarizes more than 40 studies concerning rest rotation and related issues. Short term rest (one year) as typically applied does not lead to significant improvements of deteriorated ranges. Clearly, the long-term range studies we have cited show that it is stocking rate, not water developments, or grazing systems that are most important in maintaining or improving rangeland productivity. It is critical that BLM take this information into account in determining livestock stocking intensities and evaluating the efficacy of added water developments or grazing systems.

2.6 Economic Considerations. The studies we have cited show that light stocking results in greater forage production and improvement in range condition when compared to both heavy and moderate use. Moderate and light use also provided greater financial returns than those obtained with heavy use. Because these financial figures included data from humid areas, a separate analysis taking into account the necessity for destocking during drought in arid regions showed that conservative stocking (35% use) would provide the highest long-term financial returns on semi-desert rangelands in Arizona.

Economic analyses in (Holechek et al, 1999b) show that conservative stocking rates yield better returns. For example, in the sheep experiment at the Desert Experimental Range in Utah, the lower stocking rate (35% use) yielded a financial return of $0.39/acre compared to $0.14/acre for the higher stocking rate (60% use). A modeling study that evaluated 29 years of financial returns for a cow-calf operation revealed that a relatively constant stocking rate of 35% use was considered the best approach.

Winder et al (2000) reported on comparisons of stocking rates and financial returns using 30 or 40% of current years perennial grass growth. The 30% use level provided greater vegetation productivity and financial returns. After drought in 1994 through 1996, forage production on the pastures with the lower stocking rate (30% use) increased 71% compared to 35% increase on those with the moderate stocking rate (40%). Economic returns were $0.52/acre for the conservative use level and

$0.31/acre for the moderate use level. A combination of stubble heights, clippings and ocular measures were used to set annual stocking rates, termination of the grazing season, sale of cattle to balance numbers with capacity and destocking during drought. Under these criteria, all pastures were destocked in the summer of 1994 and the moderately stocked pasture was destocked in May, 1999. After livestock were removed due to drought, pastures were rested for two years, then afterwards stocked in late fall according to current year's forage production.

Results of seven years' research in New Mexico's Chihuahuan Desert to evaluate the relationship between range condition and financial returns showed similar relationships (Holechek et al 1996a). Condition was evaluated using the Dyksterhuis (1949) definitions based on departure from climax. This study showed a relationship between forage production and range condition. Higher condition range, or that nearer climax community plant composition, had higher production of forage and more preferred forage species than lower condition range. Excellent range condition provided over four times the financial return of fair condition range and 65% greater return than good condition range.

The reasons for this were the high costs of management and the energy lost by livestock in seeking forage in lower condition range. In a companion paper, livestock returns were compared to conventional investments such as bonds or stocks (Holechek et al, 1996b). This analysis showed that over-capitalization in infrastructure, coupled with over-stocking lead ranchers into a boom and bust cycle as climatic conditions change. In wet years, they added livestock, generally when prices were high then sold off their herds during dry, or bust periods when prices and productivity are low. The final analysis concluded that conservative stocking, minimal investment in range improvements and greater spacing of watering points reduced fixed costs and insulated the operation from the vagaries of precipitation and market forces.

In addition to the economics of livestock production, BLM is required to analyze other economic values and determine the values foregone by its proposed action. NEPA (40CFR1508.8) recognizes that the analysis of effects must include ecological, aesthetic, historic, cultural, economic, social, or health issues. BLM typically has clouded the distinction between "cultural" as applied to historical features such as buildings, artifacts, or paleo-resources with societal lifestyle issues. In particular, in its recent DEIS to revise the grazing regulations, BLM used the abstraction called "lifeways" . This distinction needs to be clearly drawn. It appears BLM is trying to draw in "lifestyle" or "lifeways" as some sort of cultural feature that is given protection by the cultural preservation laws and SHPOs. This is not the intent of these laws or NEPA. If it were, would not "lifestyles" or "lifeways" other than livestock production also deserve protection, consideration and analysis?

NEPA, at 40 CFR 1501.2 (b) states that federal agencies must *"Identify environmental effects and values in adequate detail so they can be compared to economic and technical analysis."* 43 CFR 1601.0-5(f) defines Multiple Use as: "*Multiple use means the management of the public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people; making the most judicious use of the lands 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; the use of some lands for less than all of the resources; a combination of balanced and diverse resource uses that takes into account the long term needs of future generations for renewable and non-renewable resources, including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical values; and harmonious and coordinated management of the various resources without permanent impairment of the productivity of the lands and the quality of the environment with consideration being given to the relative values of the resources and not necessarily to the combination of uses that will give the greatest economic return or the greatest unit output."*

FLPMA requires BLM to manage the public lands for multiple use. This means that the agency must make *"the most judicious use of the land for some or all of [the various] resource values . . . [and to] use . . . some land for less than all of the resources . . . ."* 43 U.S.C. § 1702(c). This requires BLM to undertake a decision process *"to balance competing resource values to ensure that the public lands are managed in a manner 'that will best meet the present and future needs of the American people.'"* 43 U.S.C. § 1702(c); Comb Wash at 101. BLM's balancing of values must be reasoned and well-informed. Therefore, the agency must accumulate sufficient data and consider relevant rigorous science to determine what uses are appropriate in any given area.

Applied to the management of livestock grazing, the analysis must, on a site-specific level, weigh the benefits and harms of grazing to determine if BLM should allow this use in any given area. Moreover, should the agency conclude that livestock grazing is an appropriate use, BLM must consider multiple-use values in determining how that area should be grazed. National Wildlife Fed'n v. BLM, No. UT-06-91-1 (DOI, Office of Hearings and Appeals, Hearings Div.) (Dec. 20, 1993) at 25, *aff'd* Comb Wash (*citing* 43 U.S.C. §§ 1701(a)(8), 1702(c)). Therefore, in establishing grazing thresholds such as stocking rates and utilization levels, BLM is required to abide by *"FLPMA's mandate [that it] protect the full spectrum of environmental, ecological, cultural, and recreational values."* Id.

Other than asserting in various ways that continued livestock grazing at current levels provides for preservation of rural values and lifestyles, BLM generally does not provide any economic analysis of the costs and benefits of public lands livestock grazing and its contribution to local and regional economies. It does not analyze the values of uses foregone in favor of livestock grazing and its infrastructure. See the detailed and quantitative analysis by Dr. Power in (Wuerthner and Matteson 2002) that is referenced above.

Dr. Power shows that *"Livestock grazing on federal lands is generally unimportant to local economies and even less so to state and regional economies. In terms of income and numbers of jobs provided, the contribution of federal lands grazing is less than 0.1% across the West. Farm and ranch operations are increasingly reliant on nonfarm income sources to be financially feasible, while livestock grazing competes with other uses of public lands – such as clean water, recreation, wildlife habitat – that contribute to the ongoing vitality of western economies."*

In his analysis of the economies of individual rural counties, Dr. Power showed that federal lands grazing does not contribute significantly to those economies across the west. In fact, given the high percentage of ranching families that have jobs, either full or part time outside the ranch (60 – 70%), it is ranchers that depend on the other economic sectors for their ability to persist, not federal grazing. Dr. Power states, *"It is not that towns depend on agriculture, but that agriculture increasingly depends on the vitality of urban and nonagricultural rural economies to provide the nonfarm income that keeps farm operations alive."*

Dr. Power states that claims about the relative importance of federal grazing to the economies of western states can be analyzed by answering these questions:

1. "What portion of the value produced by cattle and sheep operations is associated with feed used?
2. What portion of the feed for those cattle and sheep operations comes from grazing on federal lands?
3. What portion of the total agricultural activity involves raising cattle and sheep?
4. What part of the total economy is represented by agriculture."

Souder (1997) analyzed the economics of livestock grazing in the Central Winter Ecosystem Management Area on the Kaibab Plateau using readily available economic data. His analysis showed the values of various activities in the study area generated values that are tabulated in Table 7.

Table 7. Summary of Values Received Annually in the Central Winter EMA

Resource	Local Benefits
Dispersed Recreation	$6,400,000 (Locally and Regionally)
Hunting Mule Deer and Turkey	$719,392 (Mule Deer = $470,528)
Livestock Grazing	$43,283
Fuelwood Gathering	$45,492

BLM should include consideration and analysis of these sources in its planning and grazing-related project proposals and also provide more analysis of the economic benefits of wildlife through hunting, fishing and wildlife-watching associated recreation. These benefits are summarized in the Fish and Wildlife Service *2001 National Survey of Fishing, Hunting and Wildlife-Watching Associated Recreation* (DOI 2002). That survey showed that in Wyoming alone, expenditures for hunting, fishing and wildlife-associated recreation were $634,049,000.00 in 2001

2.6 Grazing Capability and Suitability Determinations. Current range science recommendations include adjusting the stocking rate for livestock in order to account for distance from water and steepness of slope (Holechek et al, 2001). The Natural Resources Conservation Service has adopted these guidelines for slope adjustments (Galt et al, 2000). Their suggested reductions in grazing capacity for cattle with distance to water and increasing slope are provided in Table 8.

They note that on cold desert ranges of the U.S., snow reduces water availability problems in winter. Also, sheep do not require water every day and can use areas further than 2 miles from water. Sheep on New Mexico winter ranges used slopes of less than 45% with no adjustment necessary for slope, whereas slopes greater than 45% were hardly used. Regional criteria for the Intermountain Region of the Forest

Service designate lands with greater than 30% slope as not capable for cattle and greater than 45% slope as not capable for sheep. Other factors used by the Intermountain Region of the Forest Service for determining lands that are not capable include: current vegetation production less than 200 lb/acre, forested areas and areas with highly erodible soils (Blackwell 2001; USDA 2001).

Table 7. Adjustments for Distance to Water and Slope for Cattle (Galt et al, 2000)

Distance from Water miles	Percent Reduction in Grazing Capacity
0 – 1	0
1 – 2	50
>2	100
Slope %	
0 – 10	0
11 – 30	30
31 – 60	60
>60	100

Suitability determinations should be performed on those lands that are found capable for livestock to determine whether or not livestock grazing should be allowed. For example, important or critical fish and wildlife habitat, recreation areas, locations of sensitive populations, natural research areas, watershed protection areas among others should not be considered suitable and should be closed to livestock. These capability and suitability determinations are critical components in meeting the definitions and mandates of FLPMA, PRIA and NEPA regarding sustainability and multiple use. See also the discussion in the previous section regarding balancing of resource uses and values.

3.0 Management Recommendations for Uplands

It is critical for BLM to incorporate the science we have cited in its analysis for planning and grazing-related project documents to ensure that best available science is applied on the ground. In this way, it may be possible to sustain livestock grazing on those lands that are capable and suitable. The following steps should be implemented in each of these efforts.

3.1 <u>Literature Review</u>. Review the literature on the effects of grazing livestock in arid environments. This review should address the effects of different levels of grazing intensity (stocking rate), grazing systems, range improvements and livestock exclusion on upland habitats. It should include an evaluation of their effects on maintenance, productivity and recovery rates of native plants and soil communities. It should also review the use of various standards, indicators and monitoring methods used to manage grazing and their ability to accurately and timely assess and be representative of plant and soil community characteristics.

3.2 Determine Soil and Plant Community Status. Using GIS, map all vegetation, range site types and soil types on BLM lands in the affected areas. Design and carry out a science-based review of existing information and a field survey to accurately assess current conditions in the plant and soil community. This survey should determine the distribution of plant species, their ground cover and production. It should do this by allotment, pasture and range site (soil) type. Survey locations should be selected to incorporate distance to the nearest source of water so effects due to proximity to water can be determined. The survey should also include considerations of slope in order to assess the interaction of susceptibility to erosion based on slope and proximity to water sources. Results should be analyzed in the context of past grazing management including type of livestock, seasons of use and grazing intensity. Summarize historical actual use records and grazing systems for each allotment to provide a basis for evaluating proposed actions.

3.3 Determine Capable and Suitable Acres for Livestock Grazing. Based on the science we have provided and criteria we have discussed (slope, distance to water, forage production, hazard of erosion, etc), establish a protocol for determining capable and suitable lands for livestock grazing. This protocol should include a recovery prescription for lands that are severely depleted of their native herbaceous plant communities or have bare ground exceeding thresholds that lead to accelerated erosion.

3.3 Determine a Sustainable Livestock Stocking Rate. Establish the percent of diets of domestic sheep, cattle, deer, elk, pronghorn and sage grouse that are grasses, forbs and shrubs and their seasonal variation in selection of these foods. We suggest information from Holechek et al (2001) as a starting point. Using this information and the population management goals for wildlife, calculate wildlife needs. This should include the stubble height and other criteria established in Braun et al (1977) and Connelly et al (2000). Based on the information we provided in section **2.0** above, and the limitations on use of perennial grasses established by the scientific review, calculate the available AUMs of palatable native forage grasses, forbs and shrubs that can be utilized by livestock without impairment of plant productivity. Use this analysis to determine livestock stocking rates for each allotment and pasture for normal and dry precipitation years. Livestock numbers should not be increased during above normal precipitation years to allow for improvement of plant and soil conditions.

3.4 Develop a Systematic Monitoring Protocol. Based on the science we have referenced here, develop a systematic monitoring protocol for assessing livestock use (forage amount) in a timely manner to avoid over use of any pasture. The timing of measurement must be established relative to the permitted grazing season of use. It is critical that during the early years of application, these must be assessed frequently in order to ascertain the length of time livestock may remain in each pasture before excessive use occurs. This information will lead to establishment of realistic grazing schedules that lower the risk of excessive livestock grazing and damage. If indicators such as stubble height are proposed, they must also have a demonstrated relationship to actual percent use on grasses, forbs and shrubs by field testing.

3.5 <u>Determine Recovery Prescriptions for Lands Below Potential</u>. Analyze peer-reviewed science and government publications we have referenced as well as others that have specifically evaluated different grazing scenarios and their ability to recover native components of damaged arid lands to their potential. Use this information to develop recovery prescriptions for allotments and pastures that are not at potential (based on their departure from potential species distribution, ground cover and productivity). Prescriptions that should be evaluated should include options such as (a) long-term rest, (b) reduced stocking rates, (c) grazing systems, (d) reseeding with native species, (e) vegetation treatments and others. The time required for recovery of potential should be evaluated for each method.

3.6 <u>Determine Impacts of Water Developments</u>. Water developments have been used for decades on the promise that they would result in better livestock distribution and improvement in conditions on the ground. BLM has never quantitatively assessed these claims. It is critical that BLM provide this analysis based on evidence from the literature and its own survey of conditions in Wyoming. The analysis described in sections **3.1** and **3.2** above should include an element that locates and maps all water developments in the area of interest. Based on field surveys combined with historical range data and satellite imagery, determine the impacts and/or benefits of these past water developments on upland plant communities and soils. The effects of these water developments on their source waters (spring, stream or seep) and associated wetland habitats should be assessed, documented and reported in each project analysis.

4.0 Management Recommendations for Riparian Areas

BLM must provide assured protection of springs, streams, riparian areas and wetlands as these areas are highest in wildlife values, yet occupy only a small land area. While continuing to propose additional water developments and grazing systems as means of protecting riparian areas, BLM does not provide scientific evidence that the values of these areas are actually protected by these methods. The evidence in the government and scientific literature is that excluding livestock from riparian areas is the only effective method of protection and recovery. According to FLPMA, BLM is to "accelerate" recovery through its management options.

Don Duff (1977) published results of studies that showed greater fish and vegetation production and stream bank recovery occurred within exclosures on Big Creek, Utah than outside in grazed areas. In fact, he stated that conditions outside the exclosures continued to decline. He concluded that 6 to >8 years of rest were necessary to restore aquatic and riparian habitat. Even after 30 years of excluding livestock, sediment from uplands and riparian areas outside the exclosures continues to impair salmonid spawning, rearing and feeding substrates. The literature is consistent in showing that exclusion of livestock from riparian areas is the most effective method of restoring their ecological integrity. There is little evidence that continued livestock grazing of degraded streams under various management schemes or at any level leads to recovery of habitat attributes required for native fish and wildlife. BLM must objectively evaluate its alternatives to livestock exclosures in the literature review proposed in paragraphs (4.1) and (4.7) below and include those evaluations and the science upon which they are based in its project analysis.

We are concerned over the lack of quantitative monitoring of streams, springs and riparian areas. Some of the limitations of the current BLM PFC assessment technique are discussed in Stevens et al (2002). BLM has not provided any systematic protocol for this monitoring and in general does not assess spring or wetland conditions. We are concerned that reliance will be placed on stubble heights without providing any evidence that, in arid ecosystems, use of this standard promotes recovery of critical habitat elements in damaged stream or wetland systems, or for that matter, prevents degradation of those attributes.

If stubble height is used, it must be correlated with percent riparian vegetation use and a stubble height standard set so that livestock use is kept within constraints that do not lead to lowered production of riparian vegetation in future years. In addition, it must be shown to be protective of stream bank integrity through comparison to percent bank trampling, bank erosion and bank stability. The literature review we propose in section **4.1** should address these issues, establish and justify riparian utilization standards and bank trampling standards that are protective of stream banks and riparian vegetation. This analysis of this and other issues presented below must be incorporated into each project analysis.

4.1 **Literature Review.** Review the literature on the effects of livestock grazing, grazing systems, range improvements and livestock exclusion on stream, spring and riparian habitats, their maintenance and recovery as well as water quality. Carter (2001) reviews the effects of livestock grazing on riparian areas and water quality. This report is available on line at:

http://www.westernwatersheds.org/reports/grazeWQ_JCarter/WQWWP.doc

Review the use of various indicators such as riparian stubble height and bank trampling measures, their application and relation to stream bank stability, riparian vegetation productivity, in-stream aquatic habitat and restoration rates. This review will incorporate analysis of the literature we have referenced in addition to any sources BLM and its consultant may provide.

4.2 **Assessment of Current Condition of Springs, Seeps and Wetlands.** Locate and map all springs and wetlands not associated with perennial streams on BLM lands in the project area. Photograph and describe each, document whether and how they have been modified for water developments and if so, whether the development is still functioning. Assess their current condition, wetland extent (area) and flow using photographs and DOI (1994). These habitats should be surveyed to establish a current baseline. The surveys should also be repeated during each permit mid-term and one year prior to permit renewal. Conduct the baseline mapping, analysis and photographs for each project.

4.3 **Develop a Monitoring Protocol for Springs, Seeps and Wetlands.** Based on the science reviewed in section **4.1**, develop a systematic monitoring protocol for livestock use of riparian/wetland herbaceous vegetation at springs, streams and wetlands. This assessment protocol will:

a Establish stubble height and livestock trampling standards and assess these effects at each spring and wetland area and at multiple locations on each flowing stream within each pasture. A defined protocol should specify the number of measurements to be taken at each location, the length of stream reach to assess and a method to evaluate trampling damage to springs and wetlands.

b Measure percent use of riparian grasses, not sedges. These measurements will be taken in the riparian zone outside the stream channel, not along the greenline.

c Monitor water quality for conformance to standards

d Establish a schedule for each allotment/pasture that measures these parameters no later than 3 weeks after livestock enter a particular pasture or allotment subdivision. It is important to measure these use levels early in the grazing period so stocking rates and management can be adjusted in a timely manner to prevent exceeding the standards. Accelerated measurements during the first year, in particular, are necessary to refine the grazing schedule and stocking rate for future years.

e Record the data, also including allotment, pasture, location designation, turn-in date, monitoring date, riparian species measured, percent bank trampling, eroding banks, percent area trampled (springs and wetlands) and stubble heights. Record raw data on prepared forms so that means and standard deviations can be calculated. Enter this information into an electronic database that can be regularly updated following each monitoring event and is accessible to interested parties either on-line or by request.

4.4 Assessment of Current Condition of Streams. Based on best available science, describe a methodology and schedule for performing stream habitat and water quality surveys. This should include analysis of existing data and collection of baseline habitat and water quality data, maps and photographs that will be included in each project analysis.

4.5 Develop Stream and Water Quality Monitoring Protocol. In addition to the baseline survey, the project analysis should develop a monitoring protocol that provides for assessment of stream habitat and water quality during succeeding permit terms near the permit or lease mid-term and the year prior to renewal. This monitoring protocol should continue to include PFC assessments using DOI (1993) as modified by Stevens et al (2002). Winward (2000) also provides insight into stream and riparian monitoring technology. Any of these protocols must be supplemented by collecting additional data that quantitatively documents certain critical stream habitat conditions. We suggest the Rosgen method, USDA (1992, 1997) or other acceptable fish habitat survey protocols. Regardless of method, certain critical pieces of information must be collected to supplement PFC assessments. The literature should be reviewed and analyzed and details of methodologies, data management, reporting and public access explained. This critical supplemental data includes:

a. Establishing permanent, marked stream cross-section survey points for determining channel profile, width and depth similar to those used by Duff (1977). Priority locations are in Rosgen Type "C" channels, if available and should encompass a complete meander with multiple cross-sections (minimum 3 at each reach). These channel surveys and the following data must be collected for a minimum of two reaches of each perennial stream in each pasture.

b. Bank condition surveys including measurement of the following parameters over a minimum 100' stream reach or full meander on both sides of the stream (Winward, 2000, recommends 363 feet). Bank condition parameters (i – iv_ will be assessed from the water line to the top of the bank, not at the greenline:
   i. the linear feet of stream banks that are vegetated/stable
   ii. the linear feet of stream banks that are vegetated/unstable
   iii. the linear feet of stream banks that are unvegetated/stable
   iv. the linear feet of stream banks that are unvegetated/unstable
   v. the linear feet of stream banks that are undercut
   vi. the linear feet of stream bank with overhanging vegetation.
c. During the baseline survey, and during succeeding permit terms, at permit mid-term and last permit year, collect triplicate MacNeil Core Sediment samples of salmonid spawning gravels (<2") near the downstream extent of each stream in each pasture. Based on the literature, establish criteria for sediment fines (<6.35 mm) as a percent of substrate that allows successful salmonid reproduction. Generally, levels of sediment fines above 30% result in significant mortality of eggs and larvae.
d. Data collected will be systematic and quantitative in order that statistical analysis can be employed. All data will be entered into an electronic database for access by interested parties.

Describe the monitoring protocols. This description will include: the actual methodologies, data entry forms, schedules and locations; provide maps of all locations for monitoring; and incorporate an electronic database with links to maps that is accessible to the interested public. Include the baseline data in each project analysis. BLM must show it has the capability, either with its own staff or outside contractors, to do the necessary monitoring to ensure recovery and prevention of future degradation.

4.6 <u>Develop Stream, Spring and Wetland Recovery Prescriptions</u>. For streams, springs and wetlands that are not functioning properly and/or have impaired water quality, analyze available methods for their recovery. Include an anticipated time frame for recovery to take place based on the scientific literature. Discuss and evaluate these options for recovery, including their costs and benefits and review the scientific literature provided. Methods for recovery should include consideration of: (a) closing pastures; (b) exclosure fencing; (c) removal of water developments; (d) restoration/replanting of riparian areas; (e) active herding to minimize livestock use; (f) removal of livestock when utilization standards are reached, and any other methods discovered in the literature. Propose and adopt methods that will best recover these degraded streams during the first permit term. In the on-going permitting, management and monitoring of livestock grazing, the land use plan and permit documents should require documentation of condition and recovery rates by implementation of the described monitoring program. These will be analyzed to demonstrate the changes resulting from application of the particular prescription or combinations of methods adopted.

Yours truly,

John Carter
Utah Director

5.0 References

All references listed are incorporated into our comments and should be used by BLM in its planning and livestock-related project analyses.

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