APPENDIX 20 -- DISCUSSION ON UTILIZATION and RESIDUE

Following publication of the draft EIS, there were numerous comments made about whether utilization and residue (stubble height) guidelines should be used to help achieve rangeland health in sagebrush steppe areas. Due to the nature of the comments, BLM did an extensive literature review and analysis of this topic. This appendix discusses the basic issues that were raised during the comment period, and the validity of using utilization and residue as measures to help achieve rangeland health.

I. Background

Comments were received that criticized the inclusion of utilization and residue (stubble height) guidelines in the Standards and Guidelines. Dr. W.A. Laycock, for example, states that utilization and residue limits should be set only at the allotment management plan level and only as a tool to achieve a stated resource objective, not as the objective itself. He does not concur with the utilization table (Table 3.2.5, adapted from Holechek et al. 1995 and Holechek 1991) and states that this table uses research information in an inappropriate manner. He does not agree with Holechek's conclusion that "...in most cases it (50% utilization) causes range destruction in the rugged, arid ranges of the West." Dr. Laycock included 3 recent papers on the use of utilization standards with his comments. These papers (Burkhardt 1997; McKinney 1997; and Sharp et al. 1994) are discussed below. Other commentors agreed with Dr. Laycock, at least in part. For example, the California Cattlemen's Association also referenced the Burkhardt (1997) paper and stated that grazing use levels are not resource attributes and are inappropriate management objectives. They also believe that specific stubble height guidelines must be set on a site-specific basis, and they noted that some sites don't achieve a 4 inch stubble height in an ungrazed state. Mr. Carl Twisselman noted that he has received complaints about the 4-6 inch stubble height guideline for riparian areas, either because grass doesn't usually grow that high or because operators need to graze before that height is reached to prevent weeds from taking over.

On the other hand, several commentors strongly supported the use of utilization and/or residue (stubble height) guidelines in the document. Dr. Jerry Holechek pointed to the overwhelming number of range studies that show soil, watershed, and forage plant health to be closely tied to residues. He believes residues make more sense as standards than any other rangeland characteristic since they are the key element in soil stability, watershed health, and aesthetic appearance. He further stated that the best way to avoid downward trends is to maintain adequate residues and stubble heights. He referenced many research papers that support this view and contradict the assertions of Dr. Laycock. An annotated bibliography of these and other papers on the subject (including those cited by Dr. Laycock) is attached as Appendix C.

Other supporters of utilization and/or residue guidelines include Mr. Roger Peterson, Mr. Jack Booth, the California Department of Fish and Game, and the California Native Plant Society and Natural Resources Defense Council. In a joint letter the latter two organizations noted that utilization limits are essential to proper grazing management and that many studies have shown moderate or light use can result in greater economic returns to the livestock operator than heavy use.

Only one commentor, Dr. Elizabeth L. Painter, took issue with the use of residual dry matter guidelines (RDM) for annual rangelands. Dr. Painter stated that the RDM method was designed for use on private land with alien annual grasslands in order to maximize livestock production. Although this is an important comment that was considered in developing the final EIS, it will not be considered further in this discussion. Rather, this appendix will focus on utilization and residue guidelines in riparian areas and in the sagebrush steppe vegetation type.

II. Summary of Literature

There is a very rich literature on the subject of utilization and residue (stubble height) in managing grazing on rangelands. Some of this literature is summarized here. More information is contained in the annotated bibliography (Appendix C).

A. Recent criticism of utilization and residue levels

Three recent papers have criticized the use of utilization data in management. Sharp et al. (1994) do not believe that using utilization data is an appropriate management tool. They cite difficulties in measuring utilization, variability of utilization levels on bluebunch wheatgrass from 69% to 38% and on crested wheatgrass of 29% to 89% with no apparent harm to the range, and the difficulties in setting proper use levels. (It should be noted that crested wheatgrass is much more resistant to grazing than most native range grasses; because of this, data on its ability to cope with high utilization levels should not be extrapolated to native grasses.) Burkhardt (1997) claims that both utilization and stubble height methods are "likely the least effective management tool," and notes that these were developed to manage season-long grazing; he believes proper season of use and rest are far more effective in dealing with most riparian grazing problems. McKinney (1997) notes the problems associated with measuring utilization when averages are calculated based on plant-by-plant observations. He also maintains that overgrazing does not occur until after the grazing animal makes more than one visit to the plant.

Frost et al. (1994) discuss the difficulties in measuring utilization at times other than the end of the growing season. If utilization is measured before the end of the growing season, the total peak standing crop cannot yet be known; therefore a utilization estimate made at this time by comparing grazed versus ungrazed areas will be an overestimate of true annual utilization. They suggest a new term, relative utilization, for utilization measured in this manner.

B. Older papers that considered utilization as important to range management

Despite these criticisms there is no denying that estimating levels of utilization in order to achieve proper stocking rates has a long history in range management. Early authors investigated the effects of different stocking rates and utilization levels on above-ground biomass, forage production, cover, and other vegetation attributes, as well as livestock performance. Examples are Beetle et al. (1961), Cook (1977), Cooper (1953), Houston and Woodward (1966), Hyder (1951), Johnson (1953), Klipple and Costello (1961), Lang et al. (1956), Launchbaugh (1967), Lewis et al. (1956), Paulsen and Ares (1962), Pearson (1973), Pechanec and Stewart (1949), Pickford and Reid (1948), Skovlin et al. (1976), Smith (1967), Smoliak (1974), Valentine (1970), and Woolfolk (1949). These papers support the views of Holechek (1988 and 1998) on proper utilization levels to maintain and improve forage production and key species. For example, Cook (1977), working in sagebrush-grass range

concluded that 25% utilization on key forage plant species was reasonable for late spring and summer use and that 50% utilization was the maximum use that should occur in the winter. Skovlin et al (1976) found that light stocking (34% for bluebunch wheatgrass and lower for sandberg blue grass) provided a substantial increase in grazing capacity and better cattle gains per head than moderate or heavy stocking. It also provided the highest game density under dual use. Hyder (1951) concluded that on sagebrush-bunchgrass range in southeastern Oregon that "although 50 percent utilization is generally considered to be moderate, it probably represents excessive cropping on the range under consideration because of the large proportion of poor and fair range condition."

C. More recent papers applying utilization and residue to grazing management

There is no dearth of recent studies that consider stocking rate and associated grazing intensity (whether residue levels or utilization) to be important in managing rangeland grazing. Clary (1995) examined vegetation and soil responses to grazing simulation on riparian meadows and found that 10 cm or greater stubble heights appear to be required to ensure full biomass production in mountain meadow sedge communities. He concluded "If utilization guidelines are used, those rates that do not exceed 30% of the annual biomass production will likely maintain production the following year," and that grazing these communities "once annually to a 5-cm stubble height in the spring, or to a 10-cm stubble height in late summer, or at a utilization rate exceeding 30% of the total annual biomass production can reduce herbage production significantly." The recommendations in this paper apply only to maintaining or enhancing production and do not address the issues of streambank stability and channel maintenance.

Holechek (1992) found that the most effective management strategy on Chihuahuan Desert rangelands is to use a conservative stocking rate (30-35% use of forage) and that this is a critical factor in the superior vegetation, livestock, and economic performance on the College Ranch as compared to surrounding rangelands. Holechek (1993) summarizes the importance of stocking rate and residues. Holechek et al. (1994) concluded that conservative stocking (about 30% average use) can improve the herbaceous understory even on mesquite-infested range.

Heitschmidt and Walker (1996) argue that aesthetics must be considered in grazing and note that plant species composition does not impact society's acceptance of a given grazing practice nearly as much as things like amount of standing biomass, ground cover, and number of fecal patties. For this reason they argue that moderate rates of stocking must be employed (as opposed to heavier levels at any time) to ensure rangeland agriculture (i.e., grazing) is ecologically sound, economically viable, and socially acceptable.

III. Grazing systems versus season-long or year-long grazing

Burkhardt (1997) stated that utilization guidelines were developed for season-long grazing and are somehow not appropriate if the season of use is controlled, such as would occur through implementation of a grazing system. Grazing systems have become increasingly popular over the past 40+ years, particularly during the latter half of that time period (Vallentine 1990). Although these systems have been vigorously promoted by some individuals, many studies have shown that stocking rate and intensity of use (utilization) have more to do with successful range improvement than the grazing systems themselves. Vallentine (1990) cites Heady (1974), who concluded that grazing systems have worked only when the grazers have

quit overgrazing. Vallentine goes on to say that “It almost appears in some cases that grazing systems have been introduced as substitutes for good livestock and forage management.”

A. Stocking rates and utilization levels are more effective tools than grazing systems in improving rangelands

Van Poolen and Lacey (1979) reviewed data from studies previously conducted throughout the West and looked at the increase in herbage production as a result of implementation of grazing systems and of reductions in stocking rate. Utilization levels were defined as follows: heavy=60-80%; moderate=40-60%; light=20-40%. They found that mean annual herbage production increased by 13% when grazing systems were implemented at a moderate stocking rate. Increases were larger (35% and 27%) when continuous livestock use was reduced from heavy to moderate, and moderate to light, respectively. This suggests that land managers should place more emphasis on proper stocking intensity and less on grazing system implementation. Pieper and Heitschmidt (1988) agree, concluding that “stocking rate is and always will be the major factor affecting degradation of rangeland resources.”

Hart et al. (1989 and 1993) found that proper stocking rates and grazing intensities were more important than grazing systems in improving rangeland vegetation in Wyoming. Hughes (1990) reported on the experiences of BLM in managing a grazing system of 20 years duration on the Arizona Strip District. On the Beaver Dam Slope Allotment downward trends were recorded between 1970 and 1982 at average utilization levels of 36% (range 10-70%), while this same allotment showed an upward trend between 1981 and 1989 after utilization levels were adjusted to an average of 22% (range 11 to 34%). See the Annotated Bibliography for more examples of studies that concluded moderate rates of stocking and utilization are more important than grazing systems in improving rangelands.

B. Grazing systems do not foster range improvement unless attention is paid to stocking rates and utilization

Herbel (1974) reviewed research studies conducted on native rangeland in the 17 contiguous Western States. He found that most grazing studies have been established at fixed stocking rates and that downward adjustments were made only in severe drought. This is one of the reasons many of these grazing studies failed to show much improvement in range condition. This paper shows that stocking rate is likely the overriding factor in determining whether a grazing system works.

Many other authors have looked at the effectiveness in rotational grazing systems as compared to conservative season-long stocking in improving rangeland vegetation. For example, Laycock and Conrad (1981) found that on native sagebrush-grass range in fair to good condition and grazed at a moderate intensity (less than 40% in this study), rest rotation was not a better system than summer-long grazing. Eckert and Spencer (1987) report on a study from 1975 to 1984 on a BLM allotment 48 km south of Winnemucca, Nevada, in Wyoming big sagebrush-Thurber needlegrass, Wyoming big sagebrush-bluebunch wheatgrass, and Wyoming big sagebrush-Idaho fescue community types. A 3-pasture rest rotation grazing system for grazing May through October was initiated in 1973. This system included periodic heavy use during the growing season, as a result of no reduction in stocking rate. The amount of deferment and rest provided by the 3-pasture system was not sufficient to mitigate the effects of periodic overuse.

C. Rest periods are inadequate to compensate for heavy use at any time of the year

One of the principles behind rest-rotation grazing systems is that the period of rest provided following the impacts of livestock grazing allows for key forage species to recover their vigor. Several authors have investigated this and concluded that for the species examined recovery does not take place for several years if utilization is above conservative levels. For example, Mueggler (1975) clipped Idaho fescue and bluebunch wheatgrass to levels that approximated 50% removal of total herbage weight and studied their response for 5 years (they were protected from grazing during this period). He concluded that recovery of Idaho fescue in moderately low vigor required about 3 years, and bluebunch wheatgrass required a projected 6 years to recover. Thus it is unreasonable to expect these plants to recover with a rest of only 1 or 2 years.

Trlica et al. (1977) defoliated 7 important forage species once to a level of 90% at each of 4 phenological stages. They found that a 2 year recovery period was insufficient for complete recovery of antelope bitterbrush, fourwing saltbush, blue grama (except when defoliation occurred during the dormant season), and fringed sagewort. Western wheatgrass, little rabbitbrush, and scarlet globemallow made good recovery after a single defoliation followed by 14-26 months of rest.

It is often suggested that utilization at periods when plants are dormant has no effect on their vigor. Sauer (1978) showed that standing dead material is beneficial to bluebunch wheatgrass and that the species would be expected to decline in vigor with overuse in the dormant period. Sneva (1980) found that herbage yield of Whitmar wheatgrass was greater when standing dead material was present. Cook (1977) concluded that a maximum utilization of 50% in the winter should be allowed on seven species occurring in the sagebrush-grass vegetation type. Thus, utilization should be kept at conservative levels even in periods of plant dormancy. (Note that this discussion applies only to maintaining plant vigor and does not even address the benefits of maintaining residue for soil protection, infiltration, and wildlife.)

Taylor et al. (1997) looked at the response of vegetation to 4 increasing levels of stocking under a rotational grazing system and long-term rest. After 10 years of study (in Texas) they concluded “For rotational stocking to be successful, we recommend monitoring of grazing use on preferred plants. Range managers must then adjust both grazing methods and animal numbers to maintain proper use on key forage species.”

D. Conclusions

The lessons from these and other studies are that stocking rate and utilization are more important than grazing systems in improving rangelands and that attention must be given to maintaining conservative stocking rates and utilization levels at all times during the year. One or even two years' rest cannot be expected to make up for heavy use during one year.

IV. Should utilization levels or stubble heights (residue) be employed in managing rangelands in California?

Despite the importance of utilization in range management many authors have pointed out problems both in measuring it (Jasmer and Holechek 1984, Frost et al. 1994) and in applying it (Jasmer and Holechek 1984, Holechek 1998). With respect to measurement problems, Jasmer and Holechek (1984) give an excellent review of the literature on measuring utilization and the attendant limitations of all of these methods. Jasmer and Holechek summarizes the application difficulties by noting the problem that results from yearly variability of production of biomass: 30 percent use on key plant species in a drought year may result in severe defoliation, while a range receiving the same level of use in a wet year may appear ungrazed. Another problem with utilization levels is that they are not directly related to rangeland health per se.

All of these problems are eliminated or reduced if residue is monitored instead of utilization. Although the two are obviously related (the degree of utilization in any particular year determines the amount of residue left), residue is preferable for three reasons. The first is that it is easier to measure (Jasmer and Holechek 1994), whether residue is expressed in pounds per acre or as a residual stubble height. The second is that grazing intensity data between years and locations are much more comparable (Jasmer and Holechek 1994). The third is that residue is directly related to soil stability and infiltration rates (Thurow et al. 1988), maintenance of plant productivity (Sauer 1978, Sneva 1980, and Cook 1977), and wildlife habitat; all three of these attributes are directly related to rangeland health. An additional benefit is the increased aesthetic quality of the rangeland.

Residue in terms of pounds per acre has been applied to annual rangelands in California for many years. Residue in terms of stubble heights is becoming a well-established guideline in riparian areas as well (Clary 1989 and 1995). Both quantitative and qualitative methods are in place to monitor these types of residue levels. For sagebrush-steppe rangelands, however, guidelines have not been developed that relate proper residue levels to either stubble heights of key perennial grasses, leader lengths of important shrubs, or residue expressed in pounds per acre. As Jasmer and Holechek (1984) point out, however, some literature exists on this subject. They point to the paper by Hyder (1953) that recommends that 160 pounds per acre of residue be left at the end of the grazing season on big sagebrush rangeland in southeastern Oregon. They also suggest that such guidelines could probably be determined from the literature.

V. Decisions

Based on the review of existing information it is clear that it is not only possible but desirable to set Statewide guidelines on proper utilization and residue (stubble height) levels for the two major vegetation types, sagebrush-steppe and riparian vegetation. These guidelines would be used unless and until they are modified by site-specific (e.g., allotment or group of allotments) guidelines. The guidelines should be the same as those recommended under Alternative 4, for both the utilization levels for uplands and the stubble height requirements for riparian area. The literature supporting these levels seems clear.

As Dr. Holechek has pointed out in his comments, however, ranchers tend to resist residue and utilization level approaches because they can result in termination of grazing at times unfavorable to them and cause financial losses if implemented without adequate flexibility.

The issue becomes one of striking a balance between rangeland conservation and rancher welfare. For this reason, we have decided that in addition to adopting the utilization and residue levels of Alternative 4 we will adopt a modified version of the recommendations of Dr. Holechek in implementing these guidelines: Management changes will be implemented (e.g., reductions in livestock numbers or another management change) if utilization and/or stubble guidelines are exceeded more than 2 years out of every 5 years or 2 consecutive years on the average of the key areas across the allotment. In addition, at least 70% of the individual key areas should fall within the maximum utilization or minimum stubble height guidelines in most years. Because of the potential long-term damage associated with severe grazing, we are adding another caveat to Dr. Holechek's recommendation: that severe grazing use (defined here as >70% utilization) in any key area in any year will result in a management change.

Note that Dr. Holechek's recommendations referred to residue or stubble height guidelines on upland as well as riparian sites. Because we have not yet developed residue or stubble height guidelines for upland sagebrush-steppe grassland, we will retain the utilization guidelines in Alternative 4 of the draft EIS but to take steps to develop residue or stubble height guidelines to replace these. This will either be done at the Statewide level or at a more local level -- in either case, however, there will be an environmental analysis and public review prior to implementation.