APPENDIX FOUR

This appendix consists of four sections: 1) A vegetation frequency evaluation of the period since the first allotment evaluation of 2002 and the latest monitoring data gathered, 2008; 2) a table displaying the change in vegetation frequency classes between 2002 and 2008; and 3) an explanation of the change, by vegetation class, presented in the table. Representative comparison photographs between 2008 and photos from the last evaluation period, circa 2001, or earlier, for seven frequency transect locations, can be found in the photos in Appendix One.

Evaluation of 2008 Green Mountain Common Allotment

Riparian Frequency and Willow Density Transect Data-

A Comparison to the 2002 GMCA Riparian Area Evaluation

(Original analysis by Greg Bautz and revised by John Likins on February 4, 2011)

The December, 2002 Green Mountain Common Allotment (GMCA) Evaluation noted that frequency transects with photo points from 1997 to 2001 generally indicated that utilization rates of riparian vegetation were very high and very little herbaceous stubble height remained following grazing use in the fall; less than two inches at most sites, except for some riparian sites immediately adjacent to live water (greenline) where it was less than four inches. Six transects indicated that bare ground frequency was 10 percent, or higher. Three transects that had bare ground of 10 percent, or higher, in 1997, now have less than 10 percent bare ground. These three transects are located in riparian management pastures. All the transect sites have the potential of having bare ground of one percent or less. These 2002 observations still hold true for the 2008 riparian area conditions as well.

Nine transects indicated high amounts of litter that included vegetative matter that appeared to come from the current growing season and livestock manure. The high amounts of litter were in higher ratios than would be expected from the amount of live green vegetation present on the sites. Three transects indicated major reductions in litter and higher percentages of live vegetation. These transects occurred in riparian management pastures. Higher than expected amounts of upland grass species such as wheat grasses were found in five transects indicating that these riparian habitats are continuing to dry out. High amounts of forbs occurred in four transects. These same statements are essentially true for the 2008 riparian frequency data as well.

Field inspections at the end of the grazing season in 1999, 2000, 2001, and 2002 were made. These field inspections indicated that little regrowth of riparian vegetation had occurred which has prevented rest and recovery of grazed riparian plants. Stubble heights of riparian herbaceous vegetation were nearly always less than four to six inches except in riparian management pastures. These earlier observations still hold true for 2008 riparian area conditions as well.

Three willow monitoring transects (Crooks Creek 1&2, East Arapahoe Creek, and Soap Holes) with photo points were established in 1997 in the GMCA. These transects utilized permanent plot methods to measure willow density, percent dead crown, height, age class, and canopy cover. A fourth willow transect (Sheep Creek) utilized only photo points. Crooks Creek-1 and Crooks Creek-2 also monitored willow density and included a photographic record.

Density measurements are most sensitive to changes caused by mortality or recruitment into the population. Density measurements are less sensitive to vigor related changes, especially events (drought stress or physical damage caused by grazing animals) that break down crown portions of individual plants. These obvious crown shape and vigor changes can be observed in photos taken at each plot. These photos generally show poor vigor of willows on these key riparian management areas.

The 2002 evaluation noted data collection inconsistencies in the first four years (1997, 1999, 2000, and 2001) that the data were collected. In 2008 density data was collected again. One of the data collection inconsistencies included photos not being taken at all points for all four years, although those that were taken provide an excellent observation of vigor-related changes. Some individual willows, with multiple stems, that occurred away from the main plant may have been counted as two or more plants. This would result in higher densities than actually occurred on the site. Percent dead crown and average height were measured incorrectly from established techniques and therefore were not analyzed for this review. Following is a discussion of changes observed within the data, photos, and field observations of these willow communities that apply to changes in grazing management throughout the evaluation period. These data are summarized in Tables A-1. Selected comparison photos are located in Appendix 1.

East Arapahoe Creek

According to the 2002 evaluation, density measurements indicated little change from 1997 and 1999; a slight increase in the number of willow seedlings was observed in 2000. In 2001, a large increase was observed in the number of seedlings in the plots. In 2008, a slight increase in willows and other shrubs was noted in the frequency monitoring since 2000. Judging from the photos taken in 2008, there is no visual change in the appearance of the riparian area since 2001.

Percent canopy cover remained the same between 1997 and 2001. Examination of the 2008 monitoring photos shows little change from 2001 canopy conditions.

A density transect photo from 2001 was compared to a 2008 frequency transect photo at the same location. Although livestock herding has occurred on this site, drift back and livestock control problems, particularly in the hot season, have not allowed for any discernable improvement.

Vigor of young and mature willows has remained poor throughout this recent monitoring period.

Sheep Creek

Past density measurements between 1997 and 2000 detected little change in canopy cover, and the numbers of seedlings fluctuated up and down by about fifty percent between each of these years. These measurements show how quickly willows can respond to environmental and management changes in the short term. However, the gains made by the seedlings in these years appear to be quite ephemeral when compared to the 2008 photos where change is not visually detectable. Again, livestock control problems during this period did not allow for riparian area improvement.

Percent canopy cover remained relatively static throughout the period between 2001 and 2008.

Vigor of young and mature willows remained poor between 2001 and 2008.

Soap Holes

Density measurements showed little change between 1997 and 2001. To compare this earlier assessment to 2008 information, it was necessary to use the riparian frequency transect photos. Suitable 2008 willow density plot photos were again lacking for comparison. Little change was evident using the riparian frequency transect photos. Again, livestock control problems during this evaluation period did not allow for riparian area improvement.

Canopy cover remained relatively stable throughout the period between 2001 and 2008.

Vigor of young and mature willows remained poor between 2001 and 2008.

Crooks Creek-1

This study location is within a small fenced pasture on BLM administered public lands that is lightly grazed primarily in the fall; and was not part of the 2002 willow density evaluation. Nonetheless, the 2008 photos show increases in the number, size and vigor of young and mature willows compared to 2002.

Conclusions

Prior to initiating the 1999 prescribed management, Proper Functioning Condition assessments, frequency transects, willow density transects, photographs, and professional observation indicated that riparian habitats were generally in a low seral stage and were not producing near their potential.

Since the 2002 evaluation was completed and the early fall of 2008 (which was the last year the frequency and willow density data were collected); there has been no improvement outside of lightly used riparian management pastures or riparian exclosures.

The frequency transects and photos showed only ephemeral improvement that was not maintained, at all sites located outside of lightly used riparian management pastures and exclosures. More recent stubble height and utilization data from 2009 and 2010 do show stubble height objectives generally being met on the west side of GMCA. This recent attainment of stubble height objectives can be attributed to a known increase in herding frequency and intensity by the west side permittees.

All willow transects and photos, with the exception of Crooks Creek-1, indicated that willows were receiving heavy utilization which was adversely affecting available leader growth. These transects also indicated high amounts of physical damage caused by grazing animals using mature willows for shade throughout the monitoring period.

Between the 2002 evaluation and the early fall of 2008 when new monitoring data was collected (with the above noted exceptions), the overall indications are:

1) Adequate regrowth of riparian vegetation to promote reproduction and improve vigor of desirable species did not occur following grazing; again exceptions to this can be found in the 2009 and 2010 stubble height and utilization data and transect photos on the west side of the allotment.

2) Residual stubble height of riparian vegetation remains below adequate levels for soil stability and structure for species diversity (see Rangeland Health Standard No. 4).

3) Bare ground is higher than expected, and has increased slightly, over this period in the riparian areas indicating declining levels of cover for soil stability.

4) There are slightly increased amounts of litter at most of the monitoring locations, except where grazing is light or has been excluded. The litter included vegetative matter that appeared to come from the current growing season and abundant cattle manure which is indicative of heavy utilization of the riparian vegetation. This heavy utilization has prevented riparian area recovery.

5) There remain high amounts of upland species occurring in riparian habitats indicating drying of riparian areas.

6) Vigor of young and mature willows remained poor throughout this recent evaluation period.

7) Canopy cover remained largely unchanged throughout the evaluation period.

8) Density of willows remained nearly constant throughout the period. The drought years of the past decade and unsatisfactory control of cattle grazing in the willow habitats combined to inhibit new willow establishment.

Summary

Much of the concluding summary paragraph of the 2002 evaluation still applies when compared to this 2008 evaluation of GMCA riparian area conditions:

> "Based on the items identified above, Standard No. 2 is not being met, nor is there significant progress towards meeting the standard because present management is not providing sufficient rest and recovery time. Even with the deferred rotation system, there has essentially been season long grazing on most riparian areas resulting in heavy and severe utilization".

Documented exceptions (see Appendix 1) were observed on the west side of GMCA in 2009 and 2010. Riparian stubble height and utilization objectives were generally attained due to an intensified herding effort by the West Side permittees.

Table. A-1 Marlow/Clary Percentage of Frequency Change in the Vegetation Classes Between the Years 2000 and 2008[1].

Transect	Bunch-grass	Sod-formers	Sedges	CANE[2]	Forbs	Willows	Shrubs	Litter	Bare Ground
Weasel Spr's	+20	-3.5	-29.5	-10.25	+6.25	NP	NP	+2	+4.5
PB-BLM	+5.75	-6.75	-4.75	-6	+4	NP	NP	-6.5	+8.25
PB-PVT[3]	+1.25	+3	-10	N/A	+0.5	NP	NP	+3.75	+1.5
Sulphur Bar	-2.75	NP	-10	-9.75	+4.75	NP	NP	0 same	+17.5
Upper Haypress Creek	+3.75	-7.25	-0.75	-5.75	+13	NP	NP	-9.75	+5
Lost Cr	-8.5	+0.75	+27	-13.5	+10.25	NP	NP	-7.5	+4.5
East Arapahoe Creek	+9.75	+0.25	+23.75	+8.5	0 same	NP	NP	-1.25	-2
W. Fork Crooks Cr	+27.25	-34.75	+22	+2	+4.25	NP	NP	+1	-5.25
Arapahoe Cr	+3.75	+2	+34.75	+10.5	NP	NP	NP	+0.50	+3
Sheep Cr	+2	+1	-16.5	-16.25	+24.5	+0.5	+0.25	+9.25	+5
Soap Holes	+19.25	+4.25	-9.25	-12.75	-4.25	NP	-1.25	+1.25	+2.25
Harris Slough	-18	NP	-10.25	-7.75	+14.75	NP	NP	+13	+8.5
Mormon Spr's	+27.5	-8.5	-6	+1.5	+7	NP	NP	+0.75	-2.75
Crooks Cr#1[4]	+2.25	-1.5	+28.5	N/A	-4.5	+2	NP	-19.25	-6
Crooks Cr #2[4]	+17	-15.25	-27.8	N/A	-11.75	+15	NP	+19	+20.75
Bare Ring Slough	+4	+4.25	+7	+10.75	-3.5	NP	NP	-4.75	-7
Scotty Lake	+18	NP	+0.5	-8	-3.5	NP	NP	-8.5	+1.5
Sum Total Percent Change	+110.25 +14t -3t	-62 +7t -7t	+18.7 +8t -9t	-51 +5 -9t	+38 +10t -5t	+17.5 +4t	-1 +1t -1t	-7 +9t -7t	+59.25 +12t -5t

[1] The 2002 Rangeland Standards evaluation summarized change for the years 1997 to 2002. Note that this sampling intensity cannot detect actual changes unless they are greater than 10 – 15%.

[2] CANE (*Carex nebraskensis*) is a portion of the overall sedge percentage. Its occurrence is being tracked because it is a key monitoring species.

[3] In the absence of 2000 data, 1999 data was used for the initial year. This is considered a "control" location as it is rarely grazed.

[4] In the absence of 2000 or 1999 data, 1997 data was used for the initial year. Crooks Creek #1 is considered a "control" location as it does not receive hot-season use.

N/A= No data available.

NP = Not present since the initiation of the transect.

Summary of Change in the 2000 to 2008 Frequency Transects

A fundamental drawback to the 17 frequency transects established in the GMCA is that there appears to be no ungrazed control transect(s) to use for comparison. Without ungrazed control transect information, one must rely on inference to summarize the results that could (or not) be attributed to management. Also, the method used has 10 to 15 percent accuracy.

Bunchgrass

There was an increase in the abundance of bunchgrasses in fourteen of the seventeen frequency transects. This would be expected as these areas further desiccate and upland grass species invade.

Sod-formers

Sod-forming grasses increased at seven transects, decreased at seven, and exhibited no change at three. Not much change of significance.

Sedges

Sedges increased at 8 transects and decreased at nine. Significant (>15 percent) decreases occurred at three transects and one, a fenced pasture, increased. Most of the sedge population is made up of *Carex eleocharis* which is not preferred as a forage species by large ungulates. This trend would be expected as these areas further desiccate and upland grass species invade. The severe drought years of the past decade also influenced this trend.

CANE

The *Carex nebraskensis* population is a measured subset of the total sedge population. It declined in 9 and increased in ten; there is a question of sedge identification problems at several transects. It is preferred as a forage species by ungulates. This trend would be expected as grazers tend to congregate in these moist locations and favor feeding on *C. nebraskensis* as these areas further desiccate and upland grass species invade.

Forbs

Forbs increased at ten transects, decreased at five and had no change at two. This would be expected as these areas further desiccate and upland species invade. Past evaluations have indicated that weedy forb species were a concern and that increases in the forb component, which does not differentiate between species, were not always desirable.

Willows

The frequency transects were not the preferred method to measure willows. They were discussed earlier in the first part of this appendix; see the 2008 GMCA Update of the 2002 GMCA Riparian Frequency and Density Data.

Three transects had slight increases of willows, only none of which may really have been a significant increase, due to inherent lack of precision in the method of measurement, and the others showed no change. Willows were not present in the other fourteen transects since they were initiated in 1997.

Shrubs

Shrubs had a slight increase (+0.25 percent) at one transect and a small decrease (-2.5 percent) at another; again the precision of the method used is not fine enough to say anything other than there was minor riparian zone invasion by shrubs noted at two transects. Shrubs were not present in the other nine transects since they were initiated in 1997.

Litter

Litter has increased at nine transects, was unchanged at one, and decreased at seven. Ungulate pellets, horse manure, and cow manure are included in this measurement and can persist in the environment for the short-term (0 to 5 years). Such increases in litter would be expected as these animals would tend congregate in the moist areas and even more in the extended drought years.

Bare ground

Bare ground has increased at twelve transect locations and had small decreases at five. These increases in bare ground would be expected in the years of extended drought during the past decade and the past ineffective livestock control and handling performance. For example, Creeks Creek #1, a lightly used riparian pasture had a 6 percent decrease in the amount of bare ground between 1997 and 2008 while Crooks Creek #2 saw a significant increase in bare ground of about 21 percent.