APPENDIX H

GUSG STRUCTURAL HABITAT GUIDELINES

GUSG Structural Habitat Guidelines

Background and Data Sources

Guidelines for the maintenance of sage-grouse habitats were first provided by Braun et al. (1977). Subsequent research improved knowledge about the seasonal habitat use, movements, and migratory patterns of sage-grouse across their range. Connelly et al. (2000) built upon those findings and developed more specific habitat guidelines for the structural characteristics of the overstory and understory of sagebrush communities used by sage-grouse. Although Connelly et al. (2000) improved the 1977 recommendations, they lacked in habitat structural information specific to GUSG.

The GUSG habitat guidelines formulated for the RCP differ slightly from the Connelly et al. (2000) guidelines. As Connelly et al. (2000:275) mention, "…the judgment of local biologists and quantitative data from population and habitat monitoring are necessary to implement the guidelines correctly." This is the case in current GUSG range.

GUSG inhabit the Colorado Plateau (Fig. 3, pg. 33) where some sagebrush communities are different from those which served as a basis for the guidelines in Connelly et al. (2000). Connelly et al. (2000) reported grass and big sagebrush cover values from floristic provinces other than the Colorado Plateau, including the Wyoming Basin, Columbia Basin, Northern Great Basin, Snake River Plain, and Silver Sagebrush provinces. The Colorado Plateau is older (geologically) and has less productive soils than some of the aforementioned provinces. The moisture regime is also more characteristic of warm season grasses (summer monsoon moisture patterns) (S. B. Monsen, personal communication) rather than cool season grasses (spring and fall moisture regimes). Therefore, the herbaceous communities on the Colorado Plateau are not directly comparable to the other floristic provinces, especially when comparing herbaceous understories. Thus, the basis for some differences in the 2 sets of guidelines (Connelly et al. 2000 and RCP) are a result of local soil parent material and precipitation patterns.

In addition, much of the data used in development of the habitat structural characteristics in Connelly et al. (2000) were dominated by GRSG habitat use and movement information. Connelly et al. (2000) did use some GUSG habitat use information (Hupp 1987, Young 1994, Commons et al. 1999), but other sources of information were not used because they were located in unpublished CDOW correspondence summary reports (Woods and Braun 1995), or were new (Apa 2004). Using this more extensive data for GUSG, we have developed vegetation structure guidelines specific to the sagebrush communities within GUSG range.

In developing these habitat guidelines, we summarized *only GUSG habitat use data*. Although GRSG investigations were reviewed, no GRSG data were used in the development of these habitat guidelines. All of the known structural vegetation data collected in breeding (Young 1994, Apa 2004), summer - fall (Young 1994, Woods and Braun 1995, Commons 1997, Apa 2004), and winter (Hupp 1987) habitat were summarized. Note that Apa (2004), collected habitat data from 5 different GUSG population areas, while many of the other studies focused on Gunnison Basin.

Studies were not separated based on annual precipitation. Data reported in Apa (2004) were collected during a significant drought and variables such as grass and forb cover

and height were likely lower than normal because of the lack of precipitation. Overstory shrub structural variables were less likely to be influenced by short-term drought.

Following the development of the guidelines, 1 additional GUSG vegetation dataset was used to validate the guidelines (NPS, unpublished data). In all vegetation structure categories, the mean or median reported in the NPS reports fell within the guideline ranges established in this plan.

Seasonal Habitat Definitions

Until seasonal GUSG habitats are mapped in a given population area (see "Habitat Monitoring" rangewide strategy, pg. 220, Objective 1, Strategies 7 and 8) the following definitions of seasonal habitats should be used. For additional limiting criteria, such as slope and aspect, consult with local biologists.

Breeding Habitat: sagebrush communities delineated within 4 miles (see "GUSG Disturbance Guidelines", Appendix I, for discussion) of an active strutting ground. Breeding habitat includes active strutting grounds, and nesting and early brood-rearing habitat (Connelly et al. 2000), usually in use from mid-March through late-June.

None of the studies we reviewed for GUSG breeding habitat structural guidelines divided brood-rearing habitat into early- or late-brood-rearing (Young 1994, Apa 2004), so all of the brood habitat information was included in breeding habitat. The data summary to develop the guidelines for breeding habitat was done without respect to nest success, so data from both successful and unsuccessful nests were used. Although data have been presented that suggest herbaceous vegetation might differ between successful and unsuccessful GRSG nests (Connelly et al. 2004), no consistent differences have been reported. There is, in fact, more conclusive and consistent evidence that shrub structure characteristics (i.e., horizontal and vertical cover values) differ between successful and unsuccessful nests (Connelly et al. 2004).

Summer – Fall Habitat: vegetation communities including sagebrush, agricultural fields, and wet meadows (Connelly et al. 2000) that are within 4 miles (see "GUSG Disturbance Guidelines", Appendix I, for discussion) of an active strutting ground.

For the summer - fall guidelines we used habitat use data from non-brooding females and males (Young 1994, Woods and Braun 1995, Commons 1997, Apa 2004).

Winter Habitat: sagebrush areas (Connelly et al. 2000) within currently occupied habitat that are available (i.e., not covered by snow) to sage-grouse in average winters. These areas either have sufficient shrub height to be above average snow depths, or are exposed due to topographic features (e.g., windswept ridges, south-facing slopes). Sites are typically characterized by sagebrush canopy cover > 25% and sagebrush > 12–15 inches in height (Schoenberg 1982) associated with drainages, ridges, or southwest-facing aspects having slopes < 15% (Gill 1965, Wallestad 1975, Beck 1977, Robertson 1999).

Only 1 study (Hupp 1987) reported winter habitat information and these data were collected in the Gunnison Basin.

Habitat Guideline Development

Where possible, study areas in the literature were categorized as arid or mesic. As per Connelly et al. (2000), arid and mesic sites can be determined locally using the precipitation and soil characteristics (Tisdale and Hironaka 1981, Hironaka 1983, Winward 2004, Monsen 2005). We classified data from Gunnison Basin, Dry Creek Basin, and Dove Creek (south) as arid. It is well understood that the Gunnison Basin has both mesic and arid sites, but we were not able to discern between the sites. The data from Piñon Mesa, Miramonte (in San Miguel Basin), Cerro Summit - Cimarron, Crawford, north Dove Creek, and Hamilton Mesa (in San Miguel Basin), were considered more mesic sites. Most of the data reported were in the form of means and standard errors. The mean and standard error for each structural variable were summarized by arid or mesic sites across the entire range of the GUSG. The means were bounded by the standard errors to create a variable "distribution range" and a guideline was developed using the distribution range. Numerical maximum and minimum data points were not included. The guideline range is compared with Connelly et al. (2000).

Seven overstory and understory vegetation structural characteristics guidelines for GUSG breeding and summer - fall habitats are reported: (1) sagebrush canopy cover; (2) non-sagebrush canopy cover; (3) sagebrush height; (4) grass cover; (5) forb cover; (6) grass height; and (7) forb height. Only 2 overstory vegetation structural characteristic guidelines were developed for winter habitat: (1) sagebrush canopy cover and (2) sagebrush height.

Many species of shrubs were included in the non-sagebrush canopy cover portion of the guidelines. In more arid locations, the non-sagebrush shrubs included, but are not limited to, horsebrush, rabbitbrush, bitterbrush, snakeweed, greasewood, and winterfat. In mesic locations the aforementioned shrub species can occur, but the shrub community may also include Gambel's oak, snowberry, serviceberry, and chokecherry.

None of the 6 studies we evaluated sampled vegetation structural variables in the same manner. Commons (1997) used a modification of Daubenmire (1959) and Canfield (1941) to estimate understory and overstory coverages, respectively. Understory measurements were estimated to the nearest 5%. In contrast to most of the other studies, Commons (1997) did not use the foliar intercept to estimate shrub canopy cover (%), but instead used the canopy cover estimate. The canopy cover value overestimates foliar intercept (foliar cover), which is the standard used in essentially all other sage-grouse research. No grass or forb heights were reported (Commons 1997). Hupp (1987) estimated sagebrush canopy cover using the foliar intercept. Young (1994) used a modification of Canfield (1941) to estimate shrub, forb, and grass cover, but grass and forb heights were not reported. Woods and Braun (1995) used methods similar to Commons (1997), but it is unknown whether shrub foliar or intercept cover was used to estimate canopy cover. No grass or forb heights were reported. Apa (2004) used Canfield (1941) to estimate foliar cover for non-sagebrush and sagebrush canopy cover, and Daubenmire (1959) to estimate understory coverage. Although sagebrush height was sampled in many different ways, the actual measurement (not including inflorescences) was standard across all studies. The importance of using standard monitoring protocols and techniques within GUSG range is clear, and is addressed for the future in the "Habitat Monitoring" rangewide strategy (see pg. 220).

Using the Guidelines

The vegetation structure guidelines we present (Tables 1 – 3) should be interpreted as minimum standards, and managers should strive to meet the full potential of any given site. These habitat guidelines should be considered adaptive, and interim in nature. The guidelines were developed from actual grouse use sites, but should be considered as guidance until further and more specific and quantified data are available from grouse research, or until the development of a rigorous mapping protocol. These guidelines are intended to represent a variety of landscape situations. Landscapes are diverse; some areas on the landscape will not meet these guidelines, some areas will meet the guidelines, and some areas will exceed the guidelines. As new information is collected, these guidelines, as well as the plan are meant to be adaptable.

Table 1. GUSG breeding habitat guidelines[a].

BREEDING HABITAT [b]				
Vegetation Variable	**Gunnison sage-grouse**		**Connelly et al. (2000)**	
	Arid[c]	**Mesic[c]**	**Arid**	**Mesic**
Sagebrush Canopy [d] %	15 - 25	10 – 20	15 - 25	15 – 25
Non-sagebrush Canopy [d] %	5 - 15	5 – 15	-	-
Total Shrub Canopy [d] %	20 - 40	15 – 35	-	-
Sagebrush Height cm (inches)	25 – 50 (9.8 – 19.7)	30 – 50 (11.8 – 19.7)	30 – 80 (11.8 – 31.5)	40 – 80 (15.7 – 31.5)
Grass Cover [d] %	10 - 30	20 – 40	-	-
Forb Cover [e] %	5 - 15	20 – 40	≥ 15	≥ 25
Grass Height [f] cm (inches)	10 – 15 (3.9 – 5.9)	10 – 15 (3.9 – 5.9)	> 18 (> 7.1)	> 18 (> 7.1)
Forb Height [f] cm (inches)	5 – 10 (2.0 – 3.9)	5 – 15 (2.0 – 5.9)	-	-

[a] Breeding habitat guidelines were developed using data in GUSG studies by Young (1994) and Apa (2004).
[b] Breeding habitat is defined as sagebrush communities delineated within 4 miles of a lek (see "GUSG Disturbance Guidelines", Appendix I, for discussion. Breeding habitat includes lek, nesting and early brood-rearing habitat usually from mid-March through late-June.
[c] Arid or mesic communities are as defined by Winward (2004).
[d] Canopy cover measured according to Canfield (1941) and further described by Connelly et al. (2003).
[e] Understory cover measured according to Daubenmire (1959).
[f] The tallest vertical point (droop height) where the bulk of a plant's mass occurs.

Table 2. GUSG summer - fall habitat guidelines[a]. No specific habitat guidelines have been included for riparian or wet meadow habitat used by GUSG during this period. BLM and USFS currently have riparian and/or wet meadow management guidance which is consistent with the needs of GUSG.

SUMMER - FALL HABITAT[b]				
	Gunnison sage-grouse		**Connelly et al. (2000)**	
Vegetation Variable	**Arid[c]**	**Mesic[c]**	**Arid**	**Mesic**
Sagebrush Canopy[d] (%)	5 – 15	5 – 20	10 – 25	10 – 25
Non-sagebrush Canopy[d] (%)	5 - 15	5 – 15	-	-
Total Shrub Canopy[d] (%)	10 - 30	10 – 35	-	-
Sagebrush Height cm (inches)	20 – 40 (7.9 - 15.7)	25 – 50 (9.8 – 19.7)	40 – 80 (15.7 – 31.5)	40 – 80 (15.7 – 31.5)
Grass Cover[e] (%)	10 - 25	10 – 35	-	-
Forb Cover[e] (%)	5 - 15	15 – 35	> 15	> 15
Grass Height[f] cm (inches)	10 – 15 (3.9 – 5.9)	10 – 15 (3.9 – 5.9)	variable	variable
Forb Height[f] cm (inches)	3 – 10 (1.2 - 3.9)	5 – 10 (2.0 - 5.9)	variable	variable

[a] Summer - fall habitat guidelines were developed using data in GUSG studies by Young (1994), Woods and Braun (1995), Commons (1997), and Apa (2004)

[b] Summer – fall habitat is defined as vegetation communities, including sagebrush, agricultural fields, and wet meadows (Connelly et al. 2000) that are within 4 miles (see "GUSG Disturbance Guidelines", Appendix I, for discussion) of an active strutting ground.

[c] Arid or mesic communities are as defined by Winward (2004).

[d] Canopy cover measured according to Canfield (1941) and further described by Connelly et al. (2003).

[e] Understory cover measured according to Daubenmire (1959).

[f] The tallest vertical point (droop height) where the bulk of a plant's mass occurs.

Table 3. GUSG winter habitat guidelines[a].

WINTER HABITAT[b]				
	Gunnison sage-grouse		Connelly et al. (2000)	
Vegetation Variable	**Arid[c]**	**Mesic[c]**	**Arid**	**Mesic**
Sagebrush Canopy[d]: %	30 – 40	-	10 – 30	10 – 30
Sagebrush Height[e]: cm (inches)	40 – 55 (15.8 – 21.7)	-	25 – 35 (9.8 – 13.8)	25 – 35 (9.8 – 13.8)

[a] Winter habitat guidelines were developed using GUSG data from Hupp (1987).
[b] Winter habitat is defined as sagebrush areas (Connelly et al. 2000) within currently occupied habitat that are available (i.e., not covered by snow) to sage-grouse in average winters.
[c] Arid or mesic communities are as defined by Winward (2004).
[d] Canopy cover measured according to Canfield (1941) and further described by Connelly et al. (2003).
[e] Measured from ground level to the tallest stem (excluding inflorescence) according to Hupp (1987).