

APPENDIX A

GrSG STRUCTURAL HABITAT GUIDELINES

Greater Sage-Grouse Structural Habitat Guidelines

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. (2000c) 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. As Connelly et al. (2000c:275) mentioned, "...judgment of local biologists and quantitative data from population and habitat monitoring are necessary to implement the guidelines correctly." Connelly et al. (2000c) only referenced 1 Colorado study (a total of 16 studies across the west) for breeding habitat, and 3 (a total of 9) for winter habitat guidelines. Although Connelly et al. (2000c) improved the 1977 recommendations (Braun et al. 1977), information was lacking regarding habitat requirements for Colorado GrSG.

GrSG in Colorado inhabit the Wyoming Basin and Colorado Plateau floristic provinces. These provinces are distinctly different from a majority of the floristic provinces where data reported in Connelly et al. (2000c) were collected. Connelly et al. (2000c) reported grass and big sagebrush cover values from floristic provinces other than the Colorado Plateau and Wyoming Basin including the Columbia Basin, Northern Great Basin, Snake River Plain, and Silver Sagebrush provinces. Each floristic province has sometimes slightly, and sometimes significantly, different soils with differing geologic origins and precipitation patterns, which can impact a province's productivity and resulting plant community. Connelly et al. (2000c) used some habitat data from Colorado for breeding (Peterson 1980) and winter (Beck 1977, Schoenberg 1982, Hupp 1987), although Hupp's data (1987) were specific to the Gunnison Basin and GuSG winter habitat. Since Connelly et al. (2000c) developed the guidelines, additional information (Gill 1965, Peterson 1980, Schoenberg 1982, Remington 1983) has been identified and new reports (Hagen 1999, Hausleitner 2003, Graham and McConnell 2004, Graham and Jones 2005, Rossi and Jones 2007) have been developed. In addition, some of the information is so new (spring and summer 2006) the data have only been recently summarized for this plan and have not been included in a formal report (A.D. Apa, CDOW, personal communication).

In developing these habitat guidelines, we summarized only Colorado GrSG habitat use data that spanned 41 years (1965 – 2006). Breeding habitat information includes nest and brood-rearing habitat data. None of the studies divided brood-rearing habitat into early or late-brood-rearing, therefore all of the brood habitat information was included into breeding habitat. Summer/late-brood-rearing data included non-brooding female and male habitat use data. None of the studies was separated by annual precipitation. Some studies were conducted during very wet periods (mid-1980s) and some were conducted during very dry periods (2001-2003).

Seasonal Habitat Definitions

Until seasonal GrSG habitats are mapped in a given population area (see "Habitat Monitoring" strategy, pg. 354) the following definitions of seasonal habitats should be used (see Appendix B, "GrSG Disturbance Guidelines"). For additional limiting criteria, such as slope or aspect, consult with local biologists.

Breeding Habitat – sagebrush communities delineated within 4 miles of an active strutting ground (Appendix B, Fig. B-1). Breeding habitat includes active strutting grounds, and nesting and early brood-rearing habitat (Connelly et al. 2000c), usually in use from March through July.

None of the studies we reviewed for GrSG breeding habitat structural guidelines divided brood-rearing habitat into early- or late-brood-rearing, 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). For the breeding structural habitat guidelines we used habitat use data from Gill (1965), Peterson (1980), Schoenberg (1982), Hausleitner (2003), Graham and McConnell (2004), Graham and Jones (2005), Beck et al. (2006), Rossi and Jones (2007), and A.D. Apa (CDOW, personal communication).

Summer-Fall Habitat: vegetation communities including sagebrush, agricultural fields, and wet meadows (Connelly et al. 2000c) that are within 4 miles of an active strutting ground.

For summer-fall guidelines we used habitat use data from Schoenberg (1982), Hagen (1999), Graham and McConnell (2004), Graham and Jones (2005), Rossi and Jones (2007), and A.D. Apa (CDOW, personal communication).

Winter Habitat: sagebrush areas (Connelly et al. 2000c) 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). Winter habitat data were summarized from Schoenberg (1982), Remington (1983), and Hagen (1999).

Habitat Guideline Development

Where possible, study areas in the studies evaluated were categorized as arid or mesic. As per Connelly et al. (2000c), arid and mesic sites can be determined locally, using precipitation and soil characteristics (Tisdale and Hironaka 1981, Hironaka 1983, Winward 2004, Monsen 2005). We classified data from North Park and parts of Moffat County (excluding Cold Springs Mountain) as arid. We classified data from Cold Springs Mountain of Moffat County, NESR, and PPR as mesic. 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 for arid or mesic sites across the entire range of GrSG in northwestern Colorado. The means were bounded by the standard errors to create a variable “distribution range” and the guideline was developed using

the distribution range. Numerical maximum and minimum data points were considered but not included. The guideline range is compared with Connelly et al. (2000c).

Eight overstory and understory vegetation structural characteristic guidelines for GrSG breeding and summer-fall habitats are reported: (1) sagebrush canopy cover; (2) non-sagebrush canopy cover; (3) total shrub cover; (4) sagebrush height; (5) grass cover; (6) forb cover; (7) grass height; (8) forb height. Only 2 overstory vegetation structural characteristics guidelines were developed for winter habitat: (1) sagebrush cover, and (2) sagebrush height.

The use of “big sagebrush” is used generically in this guideline. Refer to Winward (2004) for the species or subspecies of big sagebrush for a specific location. Many species of shrubs were included in non-sagebrush canopy cover portion of the guideline. In more arid locations, the non-sagebrush shrubs can include, but are not limited to, horsebrush (*Tetradymia canescens*), rabbitbrush (*Chrysothamnus* spp.), bitterbrush (*Purshia tridentata*), snakeweed (*Gutierrezia sarothae*), greasewood (*Sarcobatus vermiculatus*), and winterfat (*Ceratoides* spp.). In mesic locations the aforementioned shrub species can occur but the shrub community can be augmented by Gambel oak (*Quercus gambelii*), snowberry (*Symphoricarpos oreophilus*), serviceberry (*Amelanchier* spp.), and chokecherry (*Prunus* spp.). In addition, understory and overstory plant species may have a varying degrees of value as cover and/or food for sage-grouse (Appendix D, Table D-6).

Using the Guidelines

The vegetation structure guidelines we present (Tables A-1, A-2, and A-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 and not absolute values. We encourage the development of a rigorous mapping protocol so that these guidelines can be refined and used in specific breeding, summer-fall, and winter habitats. 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 this plan are meant to be adaptable. Understories and overstories can include many plant species that have value as cover and/or food to GrSG (see Table D-6 in Appendix D).

Table A-1. GrSG structural habitat guidelines: breeding habitat.

GREATER SAGE-GROUSE STRUCTURAL HABITAT GUIDELINES

BREEDING HABITAT^a				
Vegetation Variable	Greater Sage-Grouse (Colorado)		Connelly et al. (2000^c)	
	Arid^b	Mesic^b	Arid	Mesic
Sagebrush Canopy (%)^c	15 – 30	20 – 30	15 - 25	15 – 25
Non-sagebrush Canopy (%)^c	5 – 10	5 – 10	-	-
Total Shrub Canopy (%)^c	20 – 40	25 – 40	-	-
Sagebrush Height (cm)	30 – 60 [11.8 – 23.6 inches]	40 – 60 [15.7 – 23.6 inches]	30 – 80 [11.8 – 31.5 inches]	40 – 80 [15.7 – 31.5 inches]
Grass Cover (%)^d	10 – 20	20 – 40	-	-
Forb Cover (%)^d	5 – 15	15 – 30	≥ 15	≥ 25
Grass Height (cm)^e	15 – 20 [5.9 – 7.9 inches]	15 – 25 [5.9 – 9.8 inches]	> 18 [> 7.1 inches]	> 18 [> 7.1 inches]
Forb Height (cm)^e	5 – 15 [2.0 – 5.9 inches]	10 – 15 [3.9 – 5.9 inches]	-	-

^aBreeding habitat is defined as sagebrush communities delineated within 4 miles of a strutting ground. Breeding habitat includes strutting, nesting and early brood-rearing habitat usually from mid-March through late-June.

^bArid or mesic communities are as defined by Winward (2004).

^cCanopy cover measured according to Canfield (1941) and further described by Connelly et al. (2003^b).

^dUnderstory cover measured according to Daubenmire (1959).

^e Measured as the tallest vertical point where the bulk of the plant mass occurs regardless if the mass occurs in the leafy portion of the plant or in the inflorescence (see Appendix C, “Sage-grouse Habitat Monitoring Protocol”).

Table A-2. GrSG structural habitat guidelines: summer-fall habitat.

SUMMER-FALL HABITAT^a				
	Greater Sage-Grouse (Colorado)		Connelly et al. (2000^c)	
Vegetation Variable	Arid^b	Mesic^b	Arid	Mesic
Sagebrush Canopy (%)^c	10 – 25	10 – 25	10 – 25	10 – 25
Non-sagebrush Canopy (%)^c	5 – 10	5 – 15	-	-
Total Shrub Canopy (%)^c	20 – 35	20 – 40	-	-
Sagebrush Height (cm)	30 – 65 [11.8 – 25.6 inches]	35 – 70 [13.8 – 27.6 inches]	40 – 80 [15.7 – 31.5 inches]	40 – 80 [15.7 – 31.5 inches]
Grass Cover (%)^d	10 – 30	15 – 40	-	-
Forb Cover (%)^d	5 – 15	10 – 25	> 15	> 15
Grass Height (cm)^e	10 – 15 [3.9 – 5.9 inches]	10 – 20 [3.9 – 7.9 inches]	variable	variable
Forb Height (cm)^e	5 – 10 [2.0 – 3.9 inches]	5 – 15 [2.0 – 5.9 inches]	variable	variable

^aSummer-fall habitat is defined as those habitats that provide food and cover late in the summer when breeding habitat desiccates. These habitats include higher elevation mixed shrub communities, wet meadows, riparian areas and irrigated pasture crops that grouse inhabit from July through September. Grouse can move several kilometers to these habitats.

^bArid or mesic communities are as defined by Winward (2004).

^cCanopy cover measured according to Canfield (1941) and further described by Connelly et al. (2003^b).

^dUnderstory cover measured according to Daubenmire (1959).

^e Measured as the tallest vertical point where the bulk of the plant mass occurs regardless if the mass occurs in the leafy portion of the plant or in the inflorescence (see Appendix C, “Sage-grouse Habitat Monitoring Protocol”).

Table A-3. GrSG structural habitat guidelines: winter habitat.

WINTER HABITAT^a				
	Greater Sage-Grouse (Colorado)		Connelly et al. (2000c)	
Vegetation Variable	Arid^b	Mesic^b	Arid	Mesic
Sagebrush Canopy (%)^c	20 – 40	25 – 40	10 – 30	10 – 30
Sagebrush Height (cm)^d	20 – 40 [7.9 – 15.7 inches]	25 – 40 [9.8 – 15.7 inches]	25 – 35 [9.8 – 13.8 inches]	25 – 35 [9.8 – 13.8 inches]

^aWinter habitat is defined as sagebrush communities that are inhabited by grouse from October through February.

^bArid or mesic communities are as defined by Winward (2004).

^cCanopy cover measured according to Canfield (1941) and further described by Connelly et al. (2003b).

^dMeasured from ground level to the tallest stem (excluding inflorescence).