Greater Sage-Grouse

Conservation Plan

Colorado Division of Wildlife, Kathleen Tadvick, April 2007

Parachute-Piceance-Roan (PPR)

Final – April 29, 2008

Prepared by Parachute-Piceance-Roan (PPR) Work Group

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TABLE OF CONTENTS

IX. LIST OF TABLES

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EXECUTIVE SUMMARY

The Parachute-Piceance-Roan (PPR) Greater Sage-Grouse Conservation Plan informs and guides the activities of participants of the local PPR Greater Sage-Grouse Work Group and others who care to use the Plan. The Work Group came together in response to perceived needs: 1) to learn more about this sage-grouse population for the purpose of maintaining and improving their habitat in the face of potential listing of the bird as a threatened or endangered species, and 2) to develop a framework to guide management efforts and maintain the sage-grouse population while integrating existing and potential land use activities on public and private lands in the area. The Plan was cooperatively developed over a period of nearly 3 years by the Work Group on the basis of listening to each other's interests and concerns and striving to achieve a balance of interests that will allow various activities to continue while being aware of potential effects on the grouse and "working around" the grouse where possible. The Plan and participation in its implementation is strictly voluntary on the part of any persons, agencies, or companies, though any are free to include portions of it within their internal policies or mandates as appropriate.

The Parachute-Piceance-Roan population of Greater Sage-Grouse occupies the mid-to high elevation (7000 to 9000 feet) areas of the three drainages in the descriptive name. The area occupied by the birds currently is smaller than 50 years ago, when adjacent lower elevation country in the Rifle, Silt, DeBeque and Plateau Creek areas had resident birds. The current three year running average for high male counts is 195, which is larger than some remaining populations in Colorado, but relatively small compared to the Northwest Colorado or North Park populations. Over the years, it appears that the PPR birds are increasingly isolated by distance from the nearest populations of birds north of the White River and in the Meeker and Rangely areas. Many factors are thought to be contributing to the decline of sage-grouse populations. Several factors (primarily human activities) are identified as contributing to impacts on sage-grouse populations and their habitat. A number of human factors and natural processes play a role in influencing grouse habitat from year to year and decade to decade. Compared to other areas in Colorado, the PPR area is beginning to experience unprecedented levels and intensity of natural gas well development within the range of a sage-grouse population. Addressing impacts from this activity on sage-grouse populations is one of the major focal points of this Plan, and Was perhaps the most time-consuming and heavily analyzed part of the Plan.

The Plan's Introduction contains the purpose and guiding principles and describes the process used to bring the Work Group together to develop the Plan. A Conservation Assessment describes the biology and life history, distribution, abundance, and genetics of the Greater Sage-Grouse with the best available information known from across its range, and also brings together information that is known about the local population. The Conservation Assessment is intended to be the "building block" providing the best available science for informing development of conservation strategies.

The section "Conservation Strategies" address the primary topics of interest and concern in the PPR area and outline specific conservation actions for each strategy. The strategies specify who is to perform them and establishes a timeline for doing so. Over one-hundred specific actions are identified in the Conservation Strategies. Ensuring the continuing existence of the PPR Greater Sage-Grouse population will be a challenge. The efforts of the Work Group participants to work

together for the grouse are encouraging. This Plan is intended to provide a basis for the group to go forward to manage and conserve grouse in the area while also continuing or expanding other activities that are the particular mission or livelihood of the landowners involved, be they public or private.

I. INTRODUCTION

A. Purpose

This document (the Plan) establishes a process and a framework that will guide management efforts directed at improving sage-grouse habitat and increasing numbers of Greater Sage-Grouse (sage-grouse) in the Parachute Creek/Piceance Creek/Roan Creek area. The Plan's components include the Work Group's guiding principles, descriptions of the environment in western Garfield and Rio Blanco counties, a section on the biology of Greater Sage-Grouse and their habitat requirements, the conservation strategies developed by the Work Group, an outline of conservation actions and an implementation schedule.

The purpose of the Plan is to provide for coordinated management across jurisdictional/ownership boundaries and to develop the wide community support that is necessary to assure survival and improve the sustainability/longevity/vigor of Greater Sage-Grouse in the Parachute-Piceance-Roan area. Designed to be dynamic, the Plan will be flexible enough to include new information and issues, as well as results from previous conservation efforts. It is also designed to answer questions and improve data collection necessary for future resource management decisions.

The possibility for listing of the Greater Sage-Grouse under the Endangered provided some of the PPR Work Group's impetus to develop this Plan. Four petitions that would have affected GrSG in Colorado were submitted to the U.S. Fish and Wildlife Service (USFWS) to list the species (or a subspecies) as threatened or endangered under the Endangered Species Act (ESA). Three of these petitions were to list all GrSG as either endangered or threatened, and for all, listing the species was found "unwarranted" (U.S. Fish and Wildlife Service 2005). A court complaint was filed on July 14, 2006, from Western Watersheds Project, alleging that the USFWS 12-month finding is incorrect, arbitrary, and unwarranted by the facts. In December, 2007, the court granted the motion by the plaintiff and the USFWS will be required to review its earlier decision to not list the species. The fourth petition requested to list the eastern subspecies (*Centrocercus urophasianus urophasianus*) as endangered. The U.S. Fish and Wildlife Service found there was not substantial information that listing the subspecies was warranted, and specifically that there was insufficient evidence that the eastern sage-grouse is a valid subspecies or a "Distinct Population Segment" (U.S. Fish and Wildlife Service 2004). Regardless of the current status of GrSG petitions under the ESA, or of debate about the details of the species' status, sage-grouse conservation clearly deserves immediate attention by responsible conservation agencies.

B. Guiding Principles

- Involve the public in the planning and decision process.
- Maintain an atmosphere of cooperation and participation among public land and wildlife managers, private landowners, and other participants while respecting individual views and values.

- Implement conservation actions in a way that meets the needs of Greater Sage-Grouse while also considering and encouraging the maintenance of a stable, productive, and profitable agricultural economic base in Garfield and Rio Blanco counties.
- Make every effort to seek efficiency and integration of efforts, especially between agencies, in the implementation of conservation actions.
- Encourage voluntary participation in Plan implementation and Work Group activities; participation by anyone is strictly voluntary.
- Review, revise and update the Plan as necessary through the Work Group process.

C. Process

Agency and industry concern about the status of the GRSG in the PPR area was fueled by a pending ruling by the USFWS to list the GRSG as threatened or endangered. In November 2004, biologists from the Colorado Division of Wildlife (CDOW), the Bureau of Land Management (BLM) and consultants representing the natural gas energy companies met in Meeker, Colorado, to discuss data needs and issues affecting wildlife with the rapidly expanding energy industry in the Piceance Basin. It was agreed that there was a severe shortage of data for the Greater Sage-Grouse population. From December 2004 through March 2005, four additional meetings were held in Rifle to plan and schedule spring lek counts and other data collection projects. By March 2005 the group agreed that a working group should be formed by the CDOW to begin a conservation planning effort patterned after the successful work of completing the Northern Eagle/Southern Routt Greater Sage-Grouse Conservation Plan. Conservation Plans have also been prepared for GrSG populations in Middle Park, North Park and Northwest Colorado (Moffat, western Routt and part of northwest Rio Blanco counties).

The CDOW took the lead, provided briefings in April 2005 on the process to county commissioners in Mesa, Garfield and Rio Blanco counties and held public information meetings in June, 2005 at the Rock School on Piceance Creek, the Cowboy Chapel on Roan Creek and in Rifle. The public meetings provided information about the need for a conservation plan and to recruit participants for the planning process. Special effort was made to invite landowners, county representatives and energy-related industry officials to participate in the process. Every effort was made to identify and invite all potential stakeholders to participate in the process. A mailing list was developed and meeting announcements distributed to inform interested parties of Work Group meetings.

Monthly Work Group meetings were held from July, 2005 through July, 2007. The Work Group established a list of issues affecting sage-grouse in the area and worked through consensus to develop a Conservation Strategy (a “map” to guide management of sage-grouse and to provide guidance for on-the ground activities that may affect sage-grouse). A facilitator was hired to conduct the meetings and to help build consensus. This person had no vested interest in the outcome of the Plan and was there to build trust among the stakeholders and insure that all stakeholders had equal input into the Plan. The process was based on the recognition of mutual benefits, which were expressed in the goals, objectives, and actions. The Work Group agreed to use a four step process in designing the Conservation Strategy: (1) Issues were discussed and Conservation Actions proposed at a monthly meeting of the Work Group. (2) At each meeting, the Work Group reviewed and modified draft Conservation Actions. (3) The modifications were

mailed out (in most cases, e-mail was used) with meeting notes to everyone on the mailing list for review. (4) At subsequent meetings the Conservation Actions were discussed, sometimes further modified, and adopted. A tentative schedule was developed to discuss the different issues and the Work Group made every effort to invite key stakeholders for specific issues of interest. For example, recreation groups were contacted prior to the meeting in which conservation actions relating to recreation were developed. The same was done for issues including data availability, habitat quality, grazing, predation, industrial development and water projects. Meeting notices and summaries were mailed to all interested parties throughout the process. Although every stakeholder who expressed an interest was included in the mailing list, many of the interested parties did not attend the meetings for a variety of reasons. However, many stakeholders consistently participated throughout the duration of the Plan's development.

The initial idea was to call this group of GrSG the "Roan Plateau population". This name was not used to avoid confusion with the area described in the BLM's Roan Plateau EIS for development of the natural gas resource on the east end of the plateau, which is currently under public scrutiny and the source of much controversy. The term PPR (short for Parachute, Piceance, and Roan Creeks) is more cumbersome, but adequately describes the area (drainages) in which the birds reside. Another source of confusion is the term "Piceance Basin". Geologists use the term to describe the 6000 square mile subsurface gas field that is found under portions of Moffat, Rio Blanco, Garfield Mesa, Delta, Gunnison and Pitkin counties (Toal 2005). Biologists use the same label for the smaller hydrologic unit, i.e. all the terrain that drains into Piceance Creek and Yellow Creek in Garfield and Rio Blanco counties. In this report, we will attempt to clarify which term, biological or geological, applies to the point under discussion.

The draft Plan was issued in February, 2008 for public review and comment. Seventy-four comments were received, summarized by the DOW and all realistic and appropriate comments were incorporated into the Plan by agreement of the Work Group. A follow up draft was issued in March, 2008. Ten comments were received, reviewed by a "Comment Review Committee" and appropriate comments were again incorporated into the Plan. The final Plan was signed and became official April 29, 2008.

The Plan outlines future monitoring and evaluation efforts. Monitoring and evaluation are necessary to assess sage-grouse population and habitat trends in the area, assist in planning cooperative efforts to improve sage-grouse habitats, continually inform affected parties and USFWS and review additional issues as the landscape context changes. As such, this Plan should be viewed as flexible and dynamic, subject to review and revision by the Work Group as situations change and new information becomes available. As this is written, an "Annual Work Group Meeting" is anticipated for June each year, coinciding with the availability of the latest lek count data from April and May.

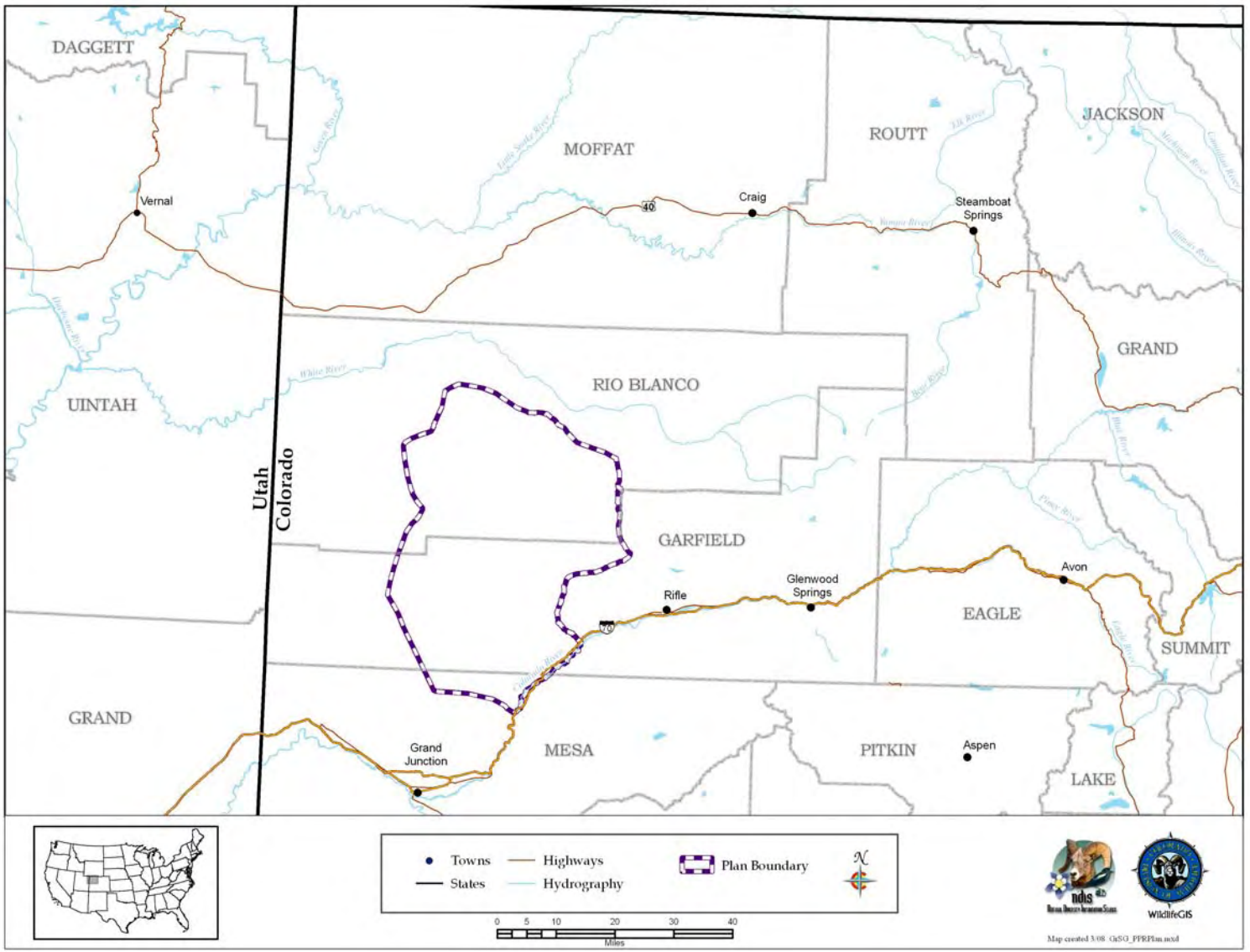

Figure 1. Location Map, Parachute-Piceance-Roan Area

II. CONSERVATION ASSESSMENT

Colorado Division of Wildlife, Kathleen Tadvick, April 2007

Male Greater Sage-Grouse inflating his air sacs.

In this section we provide the most current background information on Colorado GrSG biology, distribution, abundance, and genetics. We identify and describe pertinent mapping efforts, and we estimate current population size, degree of genetic isolation, and amount and status of habitat. We also catalogue recent conservation efforts for GrSG and their habitats.

A. Biology and Life History

1) Species Description

Sage-grouse, the largest grouse species in North America, were first described by Lewis and Clark in 1805 (Schroeder et al. 1999). They are known for their strong association with sagebrush habitat, using sagebrush for both food and cover at all times of year. The species was originally given the scientific name *Tetrao urophasianus* (Bonaparte 1827), but was later renamed *Centrocercus urophasianus* (Swainson and Richardson 1831). Aldrich (1946) described eastern (*C. u.urophasianus*) and western (*C. u. phaios*) subspecies, but Benedict et al. (2003) found no genetic support for this distinction. All sage-grouse were considered a single species until Gunnison sage-grouse (*C. minimus*) were recognized as a separate species (Young et al. 2000), with all other sage-grouse now termed “greater sage-grouse”. The 2 species are

differentiated morphologically, by size (Hupp and Braun 1991, Young et al. 2000) and plumage (Young et al. 2000), genetically (Kahn et al. 1999, Oyler-McCance et al. 1999), and behaviorally by differences in strutting behavior (Barber 1991, Young 1994, Young et al. 2000). The current ranges of the 2 species are not overlapping or adjacent (Schroeder et al. 2004).

Greater sage-grouse are sexually dimorphic in size and plumage. Adult males weigh 5.5 – 7.0 pounds, adult females are 2.9 – 3.8 pounds, yearling males range from 4.9 – 6.2 pounds, and yearling females weigh 2.6 – 3.5 pounds (Schroeder et al. 1999). All GrSG are brownish-grey, and have black bellies, dark brown primary feathers, long tails, and yellow-green eye combs, but other features vary. Males sport a contrasting white upper breast and black bib at the throat, long black filoplumes at the base of the neck, and 2 yellowish air sacs on the chest, which are most conspicuous when inflated during courtship displays.

The life history characteristics of GrSG and Gunnison's sage-grouse (GuSG) are very similar. In this section, if data are specific to GuSG, it is so noted. Otherwise, all references are for GrSG.

2) Food Habits

Unlike many other game birds, sage-grouse do not possess a muscular gizzard (Patterson 1952) and therefore lack the ability to grind and digest seeds. They only occasionally, by accident, consume grit (Rasmussen and Griner 1938, Leach and Hensley 1954). With the exception of some insects in the summer, the year-round diet of adult sage-grouse consists of leafy vegetation.

Sagebrush leaves are the primary food source during the early spring (Patterson 1952, Rogers 1964, Wallestad et al. 1975). In the pre-egg-laying period, females may select forbs that are generally higher in calcium and crude protein than sagebrush (Barnett and Crawford 1994). During the first 3 weeks after hatching, GrSG chicks focus on insects (beetles, ants, grasshoppers) as their primary food (Patterson 1952, Trueblood 1954, Klebenow and Gray 1968, Savage 1968, Peterson 1970, Johnson and Boyce 1990, Johnson and Boyce 1991, Drut et al. 1994*b*, Pyle and Crawford 1996, Fischer et al. 1996*b*). Johnson and Boyce (1990) demonstrated in laboratory studies in Wyoming that GrSG chick growth and survival rates increase with the quantity of invertebrates in the diet. They also found that invertebrate forage is required to sustain GrSG chicks until they are at least 21 days old.

Diets of 4 to 8-week-old chicks were found to have more plant material (approximately 70% of the diet) than those of younger chicks, of which 15% was sagebrush (Peterson 1970). Succulent forbs are predominant in the diet until chicks exceed 3 months of age, at which time sagebrush becomes a major dietary component (Gill 1965, Klebenow 1969, Savage 1969, Connelly and Markham 1983, Gates 1983, Connelly et al. 1988, Fischer et al. 1996*b*, Huwer 2004). In Moffat and Grand Counties in Colorado, Huwer (2004) used human-imprinted GrSG chicks to experimentally test the hypothesis that chick growth rates increase with forb abundance. She found that in known brood-rearing areas with <10% to >20% forb composition, chick growth rates increased with forb abundance.

Although insects are consumed by adult grouse (Patterson 1952, Rogers 1964, Wallestad et al. 1975), forbs and sagebrush leaves comprise a majority of the summer diet (Rasmussen and

Griner 1938, Moos 1941, Knowlton and Thornely 1942, Patterson 1952, Leach and Hensley 1954). Highly used forbs include common dandelion, prickly lettuce, hawksbeard, salsify, milkvetch, sweet clover, balsamroot, lupine, Rocky Mountain bee plant, alfalfa, and globemallow (Girard 1937, Knowlton and Thornley 1942, Batterson and Morse 1948, Patterson 1952, Trueblood 1954, Leach and Browning 1958, Wallestad et al. 1975, Barnett and Crawford 1994). The quantity and make-up of forbs in adult GrSG summer diets varies with location.

From late-autumn through early spring the diet of GrSG is almost exclusively sagebrush (Girard 1937, Rasmussen and Griner 1938, Bean 1941, Batterson and Morse 1948, Patterson 1952, Leach and Hensley 1954, Barber 1968, Wallestad et al. 1975). Many species of sagebrush may be consumed, including big, low, silver, and fringed sagebrush (Remington and Braun 1985, Welch et al. 1988, 1991, Myers 1992, Connelly et al. 2000*c*). GrSG have been shown to select differing subspecies of sagebrush for their higher protein levels and lower concentrations of monoterpenes (Remington and Braun 1985, Myers 1992). Sage-grouse can gain weight over the winter (Beck and Braun 1978, Hupp 1987, Remington and Braun 1988, Hupp and Braun 1989a), but in exceptionally harsh winters, fat reserves can decrease (Hupp and Braun 1989a). During particularly severe winters sage-grouse are dependent on tall sagebrush that remains exposed above the snow.

3) Life History and Movements

a) Breeding

Sage-grouse are charismatic birds known for their elaborate spring mating ritual, where males congregate and “dance” to attract mates on traditional “strutting grounds”, more generally referred to as "leks" (Patterson 1952, Gill 1965). During the display, males step forward with their tail feathers and filoplumes held upright, inflate their air sacs, and produce distinctive “plop” sounds (Schroeder et al. 1999). Lek sites are open areas that have good visibility (allowing sage-grouse a greater opportunity to avoid predation) and acoustical qualities so the sounds of display activity can be heard by other sage-grouse.

The sage-grouse mating system is polygamous (i.e., a male mates with several females). Adult males defend territories within the lek arena, sometimes exclusively (Dalke et al. 1963, Wiley 1973*a*, Gibson and Bradbury 1987, Hartzler and Jenni 1988), and sometimes with overlap among territories (Simon 1940, Scott 1942, Patterson 1952, Wiley 1973*a*, Gibson and Bradbury 1986, Gibson and Bradbury 1987). Males may maintain the same territory in successive years (Dalke et al. 1963, Hartzler and Jenni 1988, Gibson 1992). Defense of a territory may include chases and wing fights with other males (Simon 1940, Scott 1942, Wiley 1973*a*), and can result in injury (Patterson 1952). Subadult males do not establish territories or mate, though they may attend the lek (Patterson 1952, Eng 1963, Wiley 1973*a*).

In Colorado, strutting occurs from mid-March through late May, depending on elevation (Rogers 1964). Males establish territories on leks in early March, but the timing varies annually by 1-2 weeks, depending on weather condition, snow melt, and day-length. Males assemble on the leks approximately 1 hour before dawn, and display until approximately 1 hour after sunrise each day

for about 6 weeks (Scott 1942, Eng 1963, Lumsden 1968, Wiley 1970, Hartzler 1972, Gibson and Bradbury 1985, Gibson et al. 1991).

In Jackson County, Colorado, a seasonal peak of male attendance at leks occurred approximately 30 days following the peak of female attendance (Emmons 1980, Emmons and Braun 1984). Adult male sage-grouse seemed to show more fidelity to lek sites within a season than did yearling males. Emmons (1980) reported that yearling males visited 2-4 leks within a breeding season, while a majority of adult males visited only 1 lek. Emmons and Braun (1984) reported that inter-lek movements were more common than previously reported (Dalke et al. 1960, Wallestad and Schladweiler 1974). Emmons and Braun (1984) further reported that the adult and yearling seasonal lek attendance rates increased to 95-100% and then decreased later in the season.

Walsh (2002) reported much lower lek attendance rates in Grand County, Colorado, although he reported daily attendance rates rather than seasonal rates, and the research was conducted in only 1 breeding season. Lek attendance rate for adult males was 42.0% and ranged from 7.1 – 85.7%. Yearling male attendance rates were even lower at 19.3%, ranging from 0 - 38.5%. Yearling male attendance steadily increased through the season and there was a peak of male and female attendance in mid-April. Walsh (2002) also did not observe any inter-lek movements.

Females generally arrive on leks each morning after the males do, and depart while the males are still displaying. Both males and female juvenile GrSG in Colorado show some degree of natal lek site fidelity (Dunn and Braun 1985). Most females visiting the lek are bred by a few males occupying the most advantageous sites near the center of the lek (Scott 1942, Lumsden 1968, Wiley 1973*a*, Hartzler and Jenni 1988). When a female is ready to mate she invites copulation by spreading her wings and crouching (Scott 1942, Hartzler 1972, Wiley 1978, Boyce 1990). Males provide no parental care or resources and females generally leave the lek and begin their nesting effort immediately after mating.

b) Nesting

GrSG nests are not uniformly distributed within nesting habitat (Bradbury et al. 1989, Wakkinen et al. 1992), although some research indicates that 70-80% of all nests often occur within 2 miles of an active lek (Bradbury et al. 1989, Wakkinen et al. 1992). Research in Idaho has shown movements that range from 2.1-3.0 miles (Wakkinen 1990, Fischer 1994, Apa 1998). Radio telemetry research on GrSG in Colorado from 1978-2005 has illustrated that female movements are extensive, with 52% (n = 271/518) of the radio-marked females nesting within 2 miles of the lek of capture, and 80% (n = 417/518) within 4 miles of the lek of capture (Peterson 1980, Hausleitner 2003, A. D. Apa, CDOW, unpublished data, K. Giesen, retired CDOW unpublished data). In addition, female grouse have been documented moving as far as 15-20 miles from the lek where they were captured (assumed to be the lek upon which they bred; Connelly et al. 2000*c*). More specifically, movements of females from the lek of capture to nest were a little less extensive in some populations within Colorado. Sixty-five percent (n = 64/99) nested within 2 miles and 89% (n = 88/99) nested with 4 miles from the lek of capture (Peterson 1980, K. Giesen, retired CDOW, unpublished data) in North Park. In southern Routt/Northern Eagle 48% (n = 15/31) and 97% (n = 30/31) moved 2 and 4 miles from the lek of capture, respectively (L.

Rossi, CDOW, unpublished data). In northwest Colorado, 49% (n = 192/388) and 77% (n = 299/388) of females moved 2 and 4 miles from the lek of capture, respectively (Hausleitner 2003, A.D. Apa, CDOW, unpublished data).

Nests are typically shallow bowls lined with leaves, feathers and small twigs placed on the ground at the base of a live sagebrush bush (Schroeder et al. 1999). GrSG clutch size ranges from 6-10 eggs, with 7-9 being the most common (Griner 1939, Wallestad and Pyrah 1974, Connelly et al. 1993, Gregg et al. 1994, Schroeder 1997). In Moffat County, Colorado, GrSG clutch size averaged 5.7 eggs for yearling females and 7.0 eggs for adult females (overall average was 6.7 eggs; Hausleitner 2003). In addition, Peterson (1980) reported that the clutch of adult females was 7.0 eggs (range 6-9) and yearling clutches averaged 6.7 eggs (range 5-9). Incubation does not start until the last egg is laid and eggs are incubated 27 to 28 days (Patterson 1952, Peterson 1980).

GrSG have one of the lowest nest success rates of all the upland game bird species (Schroeder 1997), ranging from 63% in Montana to 10% in Oregon (Drut 1994, Connelly et al. 2000*c*). In Moffat County, nest success in 2001-02 ranged from 45-60% (Hausleitner 2003). GrSG nest abandonment is not uncommon if the hen is disturbed. While re-nesting is infrequent, it does occur (Patterson 1952, Eng 1963, Hulet 1983, Connelly et al. 1991). Peterson (1980) reported a 33.3% re-nesting rate (females that lost their first nest and attempted to re-nest), while Hausleitner (2003) reported lower re-nesting rates of 8 and 15% in 2001 and 2002, respectively. Clutch size of re-nesting attempts varies from 4-7 eggs (Schroeder 1997).

Although clutch initiation dates (date of first egg laid) can vary among years and locations, Hausleitner (2003) reported the mean clutch initiation date in Moffat County, Colorado as 26 April in 2001, and 21 April for 2002. Hatching begins around mid-May and usually ends by July. Most eggs hatch in June, with a peak between June 10 and June 20.

c) Survival

The survival rate of GrSG varies by year, sex, and age (Zablan 1993). Adult GrSG survival rates have been estimated from banding or radio telemetry studies (Table 1). There is evidence to suggest that adult female sage-grouse have higher survival rates than do adult males (Swenson 1986). This higher survival rate may be due to sexual dimorphism. Females have cryptic plumage and a more secretive nature, versus the more elaborate plumage and display activities of males (Schroeder et al. 1999). Seasonal female survival in Colorado was highest in winter (Hausleitner 2003). Predation, both on eggs and birds, appears to be a primary cause of mortality (Schroeder et al. 1999); human predation through sport harvest is also a cause of mortality. The availability of food and cover are key factors related to chick and juvenile survival. In Wyoming, survival of juveniles from hatch to fall was estimated to be 38% (June 1963).

Table 1. Annual Survival Rates of GrSG.

GrSG Sample	Survival Rate	Location	Study
Adult females	55%	Colorado	Zablan 1993
Females	75%	Idaho	Connelly et al. 1994
Males	60%	Idaho	Connelly et al. 1994
Females	67%	Wyoming	June 1963
Males	59%	Wyoming	June 1963
Adult Females (2001-2002)	65%	Colorado	Hausleitner 2003
Yearling Females (2001-2002)	71%	Colorado	Hausleitner 2003
Adult females (2002-2003)	48%	Colorado	Hausleitner 2003
Yearling Females (2002-2003)	78%	Colorado	Hausleitner 2003

d) Movements

Sage-grouse move seasonally among habitat types (Connelly et al. 2000*c*; see "Habitat Requirements" in this section). Depending on the dispersion of habitat across the landscape, this may result in the birds using broad landscapes throughout the year, moving great distances in some seasons, and exhibiting annual migratory patterns (Beck 1975, Wallestad 1975, Schoenberg 1982, Hulet 1983, Berry and Eng 1985, Connelly et al. 1988, Wakkinen 1990, Fischer 1994). If seasonal habitats are contiguous, the population may not show movement that could be considered migratory (Schroeder et al. 1999). The extent of movement in a given population varies with dispersion of cover types, topography, and severity of winter weather.

Connelly et al. (2000*c*) outlined 4 different seasonal movement patterns, 3 that are migratory and 1 that is nonmigratory. Nonmigratory populations do not move greater than 6 miles between or among seasonal ranges. Migratory populations may be "2-stage" if they migrate among distinct winter, breeding, and summer ranges, or "1-stage" if they migrate only between 2 different seasonal habitat ranges (Connelly et al. 2000*c*).

Research work in the PPR area by Hagen (1999) and Miller et al. (2007) strongly suggests that the current PPR population is non-migratory. It is not known to what extent, if any, birds formerly occupying the Colorado River Valley from DeBeque moved to or from the high plateaus of Roan and Parachute Creeks.

Chicks are precocial and leave the nest with the hen shortly after hatching. Females with chicks move to areas containing succulent forbs and insects, often in wet meadow habitat, where cover is sufficiently tall to conceal broods and provide shade. Groups of unsuccessful females and flocks of males follow similar habitat use patterns during late spring and early summer, but are less dependent on wet meadow areas than are females with broods.

As fall approaches, intermixing of broods and flocks of adults is common, and the birds move from riparian areas to sagebrush-dominated landscapes that continue to provide green forbs. As

late fall approaches, weather events trigger movements to winter areas. The timing of this movement varies, influenced by yearly weather conditions. Very little is known about dispersal of GrSG juveniles following brood breakup. Dunn and Braun (1985) found that females moved farther than males between their natal area lek and the lek attended in the following spring.

GrSG winter range in Colorado varies according to snowfall, wind conditions, and suitable habitat (Rogers 1964). Sage-grouse may travel short distances or many miles between seasonal ranges. Movements in fall and early winter (September-December) can be extensive, sometimes exceeding 20 miles. In North Park, Colorado, Schoenberg (1982) documented female GrSG moving more than 18 miles from winter to nesting areas. Hausleitner (2003) found that in Moffat County, Colorado, female GrSG moved an average of 6 miles from nesting areas to winter sites. The range of movements was extensive, and ranged from < 0.5-19 miles.

Flock size in winter is variable (15-100+), with GrSG flocks frequently comprised of a single sex (Beck 1977). Many, but not all, flocks of GrSG males can over-winter in the vicinity of their leks, and by March they are usually within 2-3 miles of breeding areas used the previous year. These movements depend on whether the population is non-migratory or moves between 2 or more seasonal ranges (Connelly et al. 2000*c*).

4) Habitat Requirements

Sage-grouse habitat requirements may differ by season (Connelly et al. 2000*c*). Connelly et al. (2000*c*) segregated habitat requirement into 4 seasons: (1) breeding habitat; (2) summer - late brood-rearing habitat; (3) fall habitat; and (4) winter habitat. In some situations, fall and summer-late brood-rearing habitats are indistinguishable, but this depends on the movement patterns of the population and habitat availability. The breeding habitat category includes lekking, pre-laying female, nesting, and early brood-rearing habitat. Summer-late brood-rearing habitat includes habitat used during this period by males, non-brooding females, and females with broods. Fall habitat consists of "transition" range from late summer to winter, and can include a variety of habitats used by males and females (with and without broods). Winter habitat is used by segregated flocks of males and females (Beck 1977). Management of sage-grouse habitats should include all habitat types necessary for fulfillment of life history needs.

For the purpose of this Plan, we have combined the summer-late brood-rearing and fall habitat into a single habitat category, "summer-fall", resulting in 3 overall seasonal habitats, rather than 4. Summer-late brood-rearing habitat in Colorado is typically characterized by high elevation mesic areas, cropland, wet meadows, and riparian areas adjacent to sagebrush communities. Grouse continue to use these locales as fall approaches and there is a slow conversion of the diet from forbs to sagebrush. As mentioned earlier, in many cases these 2 seasonal habitats are indistinguishable, but in the future, local information may provide additional insight as to when and where late-summer and fall habitats can be clearly separated.

All the seasonal habitats described here include habitat used by brooding females, unsuccessful females, and male flocks.

a) Breeding Habitat: Leks (March – mid-May)

Lek sites can be very traditional, with grouse displaying in the very same location from year to year. Some GrSG leks in Colorado are known to have been in use since the 1950's (Rogers 1964). Leks are usually located in small, open areas, adjacent to stands of sagebrush with 20% or greater canopy cover (Klott and Lindzey 1989). Openings are usually natural, including alkali flats and meadows within sagebrush, but they may also be created by humans, including (but not limited to) small burns, drill pads, irrigated pasture, and roads within sagebrush habitat (Connelly et al. 1981, Gates 1985).

Lek sites do not appear limiting (Schroeder et al. 1999), but they may vary in amount of escape cover and quality of sagebrush (Patterson 1952, Gill 1965, Connelly et al. 1988, Connelly et al. 2000*c*). The size of area needed for males to strut can vary greatly. Lek sites are usually flat to gently sloping areas of <15% slope in broad valleys or on ridges (Hanna 1936, Patterson 1952, Hartzler 1972, Giezentanner and Clark 1974, Wallestad 1975, Dingman 1980, Autenrieth 1981, Klott and Lindzey 1989). Lek sites have good visibility and low vegetation structure (Tate et al. 1979, Connelly et al. 1981, Gates 1985), and acoustical qualities that allow sounds of breeding displays to carry (Patterson 1952, Hjorth 1970, Hartzler 1972, Wiley 1973*b*, 1974, Bergerud 1988*a*, Phillips 1990). The absence of tall shrubs, trees, or other obstructions appears to be critical for continued use of these sites by displaying males.

Sites chosen for display are typically close to sagebrush that is > 6 inches tall and has a canopy cover $\geq$ 20% (Wallestad and Schladweiler 1974). Usually leks are located in the vicinity of nesting habitat (Wakkinen et al. 1992), and are in areas intersected by high female GrSG traffic (Bradbury and Gibson 1983, Bradbury et al. 1986, Gibson et al. 1990, Gibson 1992, 1996). These sagebrush areas are used for feeding, roosting, and escape from inclement weather and predators. Males are usually found roosting in sagebrush stands with canopy cover of 20-30% (Wallestad and Schladweiler 1974).

Daytime movements of adult male GrSG during the breeding season do not vary greatly. Wallestad and Schladweiler (1974) found daily movements ranged between 0.2 and 0.8 miles from leks, with a maximum cruising radius of 0.9 to 1.2 miles. Ellis et al. (1987) reported that dispersal flights of male GrSG (to day-use areas) ranged from 0.3 – 0.5 miles, with the longest flights ranging from 1.2 – 1.3 miles. Carr (1967) recorded a cruising radius for male GrSG that ranged from 0.9-1.1 miles. Rothenmaier (1979) found that 60-80% of male GrSG locations were within 0.6-0.7 miles of a lek. Emmons (1980) reported that male dispersal distances to day-use areas of 0.1 miles were common and that 67% of all use areas were greater than 0.3 miles from the lek. In addition, Schoenberg (1982) found that male daily movements averaged 0.6 miles, but ranged from 0.02-1.5 miles.

b) Breeding Habitat: Pre-laying (late-March – April)

Connelly et al. (2000*c*) recommend that breeding habitat should be defined to include pre-laying habitat, but little is known or understood about pre-laying habitat. It has been suggested that pre-laying sagebrush habitat should provide a diversity of understory vegetation to meet the nutritional needs of females during the egg development period. For pre-laying females in

Oregon, Barnett and Crawford (1994) suggested that the habitat should contain a diversity of forbs that are rich in calcium, phosphorous, and protein.

c) Breeding Habitat: Nesting (mid-April – June)

GrSG prefer to nest under tall (11-31 inches) sagebrush (Connelly et al. 2000*c*). Peterson (1980) found in North Park, Colorado that nest shrubs averaged approximately 20 inches. In Moffat County, Colorado, this value is slightly higher and ranges from 30-32 inches (Hausleitner 2003). Often, the actual nest bush is taller than the surrounding sagebrush plants (Keister and Willis 1986, Wakkinen 1990, Apa 1998). In northwestern Colorado, the nest bush was nearly 10 inches taller than surrounding shrubs (Hausleitner 2003). The canopy cover of sagebrush around the nest ranges from 15-38% (Patterson 1952, Gill 1965, Gray 1967, Wallestad and Pyrah 1974, Keister and Willis 1986, Wakkinen 1990, Connelly et al. 1991, Apa 1998, Connelly et al. 2000*c*). Sagebrush canopy cover around nests in northwestern Colorado had a similar range of values, and averaged 27% (Hausleitner 2003).

Good quality nesting habitat consists of live sagebrush with sufficient canopy cover, and substantial grasses and forbs in the understory (Connelly et al. 2000*c*, Hausleitner et al. 2005). Few herbaceous plants are growing in April when nesting begins, so residual herbaceous cover from the previous growing season is critical for nest concealment in most areas, although the level of herbaceous cover depends largely on the potential of the sagebrush community (Connelly et al. 2000*c*).

Nearly all nests are located beneath sagebrush plants (Patterson 1952, Gill 1965, Gray 1967, Wallestad and Pyrah 1974), and GrSG nesting under sagebrush plants have higher nest success than those that nest under plants other than sagebrush (Connelly et al. 1991). Herbaceous vegetation is also important in sage-grouse nest sites (Connelly et al. 2000*c*). Grass heights are variable and, as measured across the West, range from 5-13 inches (Connelly et al. 2000*c*). In addition, horizontal grass cover measurements are also variable and range from 4-51% cover. These measurements are similar to data from northwestern Colorado; Hausleitner (2003) reported that grass heights at nests ranged from 5-6 inches, grass cover averaged approximately 4%, and forb cover averaged about 7% (Hausleitner 2003).

Although not clearly understood, it is also believed that understory herbaceous cover (horizontal and vertical) is important for GrSG nesting habitat. In multiple studies, nest sites had taller and more grass cover, and less bare ground, than did random sites (Klebenow 1969, Wakkinen 1990, Sveum et al. 1998*b*, Holloran 1999, Lyon 2000, Slater 2003). In Oregon, both forb and tall grass cover appeared related to nest initiation, re-nesting, and nest success rates (Coggins 1998).

d) Breeding Habitat: Early Brood-Rearing (mid-May – July)

Early brood-rearing habitat requirements are very similar to those for nesting habitat. Early brood-rearing habitat is found relatively close to nest sites (Connelly et al. 2000*c*), but individual females with broods may move large distances (Connelly 1982, Gates 1983). Early brood-rearing habitat is typically characterized by sagebrush stands with canopy cover of 10-15% (Martin 1970, Wallestad 1971), and with understories that exceed 15% herbaceous cover (Sveum

et al. 1998*a*, Lyon 2000). In Moffat County, Colorado, sagebrush stands averaged approximately 11% canopy cover, and herbaceous understories averaged about 14% horizontal cover (Hausleitner 2003). High plant species diversity (sometimes also referred to as species richness) is also typical in early brood-rearing habitat (Dunn and Braun 1986, Klott and Lindzey 1990, Drut et al. 1994*a*, Apa 1998). Sagebrush heights ranged from 6-18 inches in Washington and Wyoming (Sveum et al. 1998*a*, Lyon 2000), and averaged about 23 inches in Moffat County (Hausleitner 2003). Adjacent shrub areas of 20-25% canopy cover have been reported as preferred for escape and day roosting (Wallestad 1971, Dunn and Braun 1986), but night roosting sites in Moffat County, Colorado had only 4% sagebrush canopy cover and sagebrush height was 20 inches (Hausleitner 2003).

In early summer, the size of the area used by GrSG appears to depend on the interspersion of sagebrush types that provide an adequate amount of food and cover. Females and broods may select riparian habitats in the sagebrush type that have abundant forbs and moisture (Gill 1965, Klebenow 1969, Savage 1969, Connelly and Markham 1983, Gates 1983, Connelly et al. 1988, Fischer et al. 1996*a*). Females with broods remain in sagebrush uplands as long as the vegetation remains succulent, but may move to wet meadows as vegetation desiccates (Fischer et al. 1996*b*). Depending on precipitation and topography, some broods may stay in sagebrush/grass communities all summer while others shift to lower areas (riparian areas, hay meadows or alfalfa fields) as upland plant communities desiccate (Wallestad 1975).

For the PPR, broods are generally not found in the alfalfa fields, hay meadows, or riparian areas in the lower valleys and canyons; they probably use mesic upland sites and headwater riparian areas. Local rancher Tim Uphoff can recall only a few instances over four decades that he's seen birds along the West Fork of Parachute Creek.

e) Summer - Fall Habitat (July – September)

As sagebrush communities continue to dry out and many forbs complete their life cycles, sage-grouse typically respond by moving to a greater variety of habitats, and generally more mesic habitats (Patterson 1952). Sage-grouse begin movements in late June and into early July (Gill 1965, Klebenow 1969, Savage 1969, Connelly and Markham 1983, Gates 1983, Connelly et al. 1988, Fischer 1994). By late summer and into the early fall, females with broods, non-brood females, and groups of males become more social, and flocks are more concentrated (Patterson 1952). This is the period of time when GrSG can be observed in atypical habitat such as farmland and irrigated habitats (Connelly and Markham 1983, Gates 1983, Connelly et al. 1988).

From mid-September into October, GrSG prefer areas with more dense sagebrush (>15% canopy cover) and late green succulent forbs before moving to early transitional winter range where sexual segregation of flocks becomes notable (Wallestad 1975, Beck 1977, Connelly et al. 1988). During periods of heavy snow cover in late fall and early winter, use of mountain and Wyoming big sagebrush stands is extensive.

f) Winter Habitat (October-February)

GrSG winter habitat use depends upon snow depth and availability of sagebrush, which is used almost exclusively for both food and cover. Used sites are typically characterized by canopy cover >25% and sagebrush >12-16 inches tall (Schoenberg 1982), and are associated with drainages, ridges, or southwest aspects with slopes < 15% (Gill 1965, Wallestad 1975, Beck 1977, Robertson 1991). In Colorado, <10% of sagebrush habitat is used by GrSG during deep snow conditions (Beck 1977) because most of the sagebrush is buried under the snow. When snow deeper than 12 inches covers over 80% of the winter range, GrSG in Idaho have been shown to rely on sagebrush greater than 16 inches in height for foraging (Robertson 1991). Doherty et al. (2008) found that females preferred landscapes with extensive sagebrush habitat and gentle to flat terrain, and avoided areas with conifers, woody riparian zones, and rough terrain.

Lower flat areas and shorter sagebrush along ridge tops provide roosting and feeding areas. During extreme winter conditions, GrSG will spend nights and portions of the day (when not foraging) burrowed into "snow roosts" (Back et al. 1987). When snow has the proper texture, snow roosts are dug by wing movements or by scratching with the feet.

Hupp and Braun (1989*b*) found that most GuSG feeding activity during the winter occurred in drainages and on slopes with south or west aspects in the Gunnison Basin. In years with severe winters resulting in heavy accumulations of snow, the amount of sagebrush exposed above the snow can be severely limited. Hupp and Braun (1989*b*) investigated GuSG feeding activity during a severe winter in the Gunnison Basin in 1984, where they estimated <10% of the sagebrush was exposed above the snow and available to sage-grouse. In these conditions, the tall and vigorous sagebrush typical in drainages were an especially important food source for GuSG.

Although no specific research has been conducted on winter habitat characteristics or food habitats of Greater Sage-Grouse in the Parachute-Piceance-Roan area, information collected in other parts of Colorado and throughout their range can be used to predict habitat use and food requirements in this area.

Connelly et al. (2000) summarizes the characteristics of productive sagebrush habitat for average western sites used by Greater Sage-Grouse in Table 2. Hausleitner (2003) has more specific information for Moffat County, Colorado breeding and brood-rearing habitat. Some of the vegetation values are higher in Moffat Co. than rest of the U.S., which may also be the case for Rio Blanco and Garfield Counties.

Table 2. Characteristics of Sagebrush Rangeland Needed for Productive Greater Sage-Grouse Habitat (after Connelly et al. 2000, Hausleitner 2003).

CONNELLY ET AL. 2000 GUIDELINES	Breeding (April – June)		Brood-rearing (June – August)		Winter[e]	
	Height	**Canopy**	**Height**	**Canopy**	**Height**	**Canopy**
MESIC SITES[a]:						
-sagebrush	15.7-31.5 inches (40-80 cm)	15-25%	15.7-31.5 inches (40-80 cm)	10-25%	9.8-13.8 inches (25-35 cm)	10-30%
-grasses and forbs	>7.1[c] inches (>18 cm)	≥25%[d]	variable	>15%	N/A	N/A
ARID SITES[a]:						
-sagebrush	11.8-31.5 inches (30-80 cm)	15-25%	15.7-31.5 inches (40-80 cm)	10-25%	9.8-13.8 inches (25-35 cm)	10-30%
-grasses and forbs	>7.1[cf]	≥15%	variable	>15%	N/A	N/A
% Area[b]	>80		>40		>80	

[a] Mesic and arid sites should be defined on a local basis; annual precipitation, herbaceous understory, and soils should be considered (Tisdale and Hironaka 1981, Hironaka et al. 1983).
[b] Percentage of seasonal habitat needed with indicated conditions.
[c] Measured as "droop height"; the highest naturally growing portion of the plant.
[d] Coverage should exceed 15% for perennial grasses and 10% for forbs; values should be substantially greater if most sagebrush has a growth form that provides little lateral cover (Schroeder 1995).
[e] Values for height and canopy coverage are for shrubs exposed above snow.
[f] Specific to nest sites.

Table 2 Continued:

MOFFAT COUNTY DATA (Hausleitner 2003)	**Breeding (April – June)**		**Brood-rearing (June – August)**		**Winter[e]**	
	Height	**Canopy**	**Height**	**Canopy**	**Height**	**Canopy**
MESIC SITES[a] (Danforth Hills):						
-sagebrush (nest and brood sites)	31.1 inch (79 cm) avg. nest bush height	26% (nest sites)	22.9 inch (58 cm) height at brood sites	10.6% at brood sites	No Winter Data	No Winter Data
-sagebrush (random sites)	22.9 inch (58 cm) avg. random sagebrush height	32% (random sites)	17.3 inch (44 cm) height at random sites	14% at random sites	No Winter Data	No Winter Data
-grasses and forbs (nest and brood sites)	5.9-7.1 inch (15-18 cm) avg. grass height at nests	3.7% grass 7.7% forbs 11.4% total canopy at nest sites	8.0 inch (20.3 cm) grass height, 4.4 inch (11.2 cm) forb height at brood sites	6.5% grass 8.0% forb 14.5% total canopy at brood sites	No Winter Data	No Winter Data
-grasses and forbs (random sites)	7.3 inch (18.6 cm) avg. grass height at random sites	7.9% grass 8.1% forbs 16.0% total canopy at random sites	6.7 inch (17.1 cm) grass height, 3.2 inch (8.2 cm) forb height at random sites	5.9% grass 3.8% forb 9.7% total canopy at random sites	No Winter Data	No Winter Data

Table 2 Continued:

MOFFAT COUNTY DATA (Hausleitner 2003)	**Breeding (April – June)**		**Brood-rearing (June – August)**		**Winter[e]**	
	Height	**Canopy**	**Height**	**Canopy**	**Height**	**Canopy**
ARID SITES[a] (Axial Basin)						
-sagebrush (nest and brood sites)	31.1 inch (79 cm) avg. nest bush height	26% at nest sites	As for mesic sites above	As for mesic sites above	No Winter Data	No Winter Data
-sagebrush (random sites)	17.7 inch (45 cm) avg. random sagebrush height	23% at random sites	As for mesic sites above	As for mesic sites above	No Winter Data	No Winter Data
-grasses and forbs (nest and brood sites)	5.9-7.1 inch (15-18 cm) avg. grass height at nests	3.7% grass 7.7% forbs 11.4% total canopy at nest sites	As for mesic sites above	As for mesic sites above	No Winter Data	No Winter Data
-grasses and forbs (random sites)	5.1 inch (13 cm) grass heights at random sites	4.8% grass 4.7% forbs 9.5% total canopy at random sites	As for mesic sites above	As for mesic sites above	No Winter Data	No Winter Data

B. Distribution and Abundance

1) Distribution

a) Historic Distribution

The historic distribution of GrSG is closely tied to and largely reflects the distribution of sagebrush, particularly big sagebrush, and to some extent, silver sagebrush (Braun 1995, Schroeder et al. 2004). Direct observations and specimens of GrSG prior to the 1900s are limited in number and may not be adequate for drawing a historical distribution map. Instead, a map of historic sagebrush distribution can provide a reasonable and more thorough approximation of GrSG distribution.

Beginning in 1957, CDOW's Glenn Rogers began to gather and update information on sage-grouse distribution in Colorado. One of his objectives was to determine the historic and current distribution of the species in the state. He conducted interviews of CDOW field personnel and landowners, flew fixed-wing aircraft searches, and counted known strutting grounds (leks). From his five-year effort, Rogers (1964) drew a map that estimated the historic sage-grouse range in Colorado (Fig. 2). In the PPR area, the map shows occupied areas west to the Utah line, on both sides of the Colorado River from roughly Silt to DeBeque, on both sides of Colorado State Highway (CSH) 13 from Rifle to Meeker, and south of Rifle.

Braun (1995) repeated the process in the early 1990's, using a literature review, interviews and field work to determine sage-grouse occupied range. He reported his findings by county and provided a map of the birds' distribution at that point in time. He estimated that "both distribution and abundance of sage-grouse in Colorado have decreased more that 50% since the early 1900's". Figure 2 also shows Braun's 1995 map over the historic distribution reported by Rogers (1964).

Schroeder et al. (2004) presented a "pre-settlement" map (Fig. 3) of sagebrush habitat, targeting a period before pioneers of European descent inhabited the area. The map is based on a vegetation map by Kuchler (1985) and 7 GrSG "core" habitat types identified by Schroeder et al. (2004). Some of these "core" habitats are considered grasslands (of various plant species), but only local portions of these habitats known to be dominated by sagebrush were included in the pre-settlement map (Schroeder et al. 2004). In addition, 6 "secondary" habitat types, which may be of importance to GrSG under certain conditions, were included in the map if they were in currently or previously known occupied habitat, or if they were within 6 miles of core habitat (Schroeder et al. 2004). The vegetation data layer used by Schroeder was adequate for depicting rough historic range, but many inaccuracies became apparent at a statewide level with more robust vegetation datasets for comparison.

In Colorado, sagebrush was historically distributed in a discontinuous pattern, interrupted by topography and forested habitat (Braun 1995). GrSG occupied some portion of 13 counties in Colorado (Braun 1995, Schroeder et al. 2004). The Colorado portion of the historical map by Schroeder et al. (2004) was adjusted based on finer scale knowledge of local topography and the current distribution of habitat. Specifically, we used data from the Colorado Vegetation

Classification Project (CVCP, Colorado Division of Wildlife 2004*b*), a geographic information system (GIS) data set that uses recent satellite imagery and field verification to classify vegetation into specific categories. What appear to be minor differences in mapping at the rangewide scale have more significance at the statewide scale, so a more precise data set is valuable.

Several small additions were made to the Colorado portion of the historic distribution map in Schroeder et al. (2004), where sagebrush currently occurs in the CVCP (Colorado Division of Wildlife 2004*b*), and where no evidence exists that vegetation other than sagebrush was historically present (Fig. 3). A few areas that are very small even at the state scale were added, but are not identified in the figure or table. Some areas, known to have no historical sagebrush occurrence, were also deleted from the map.

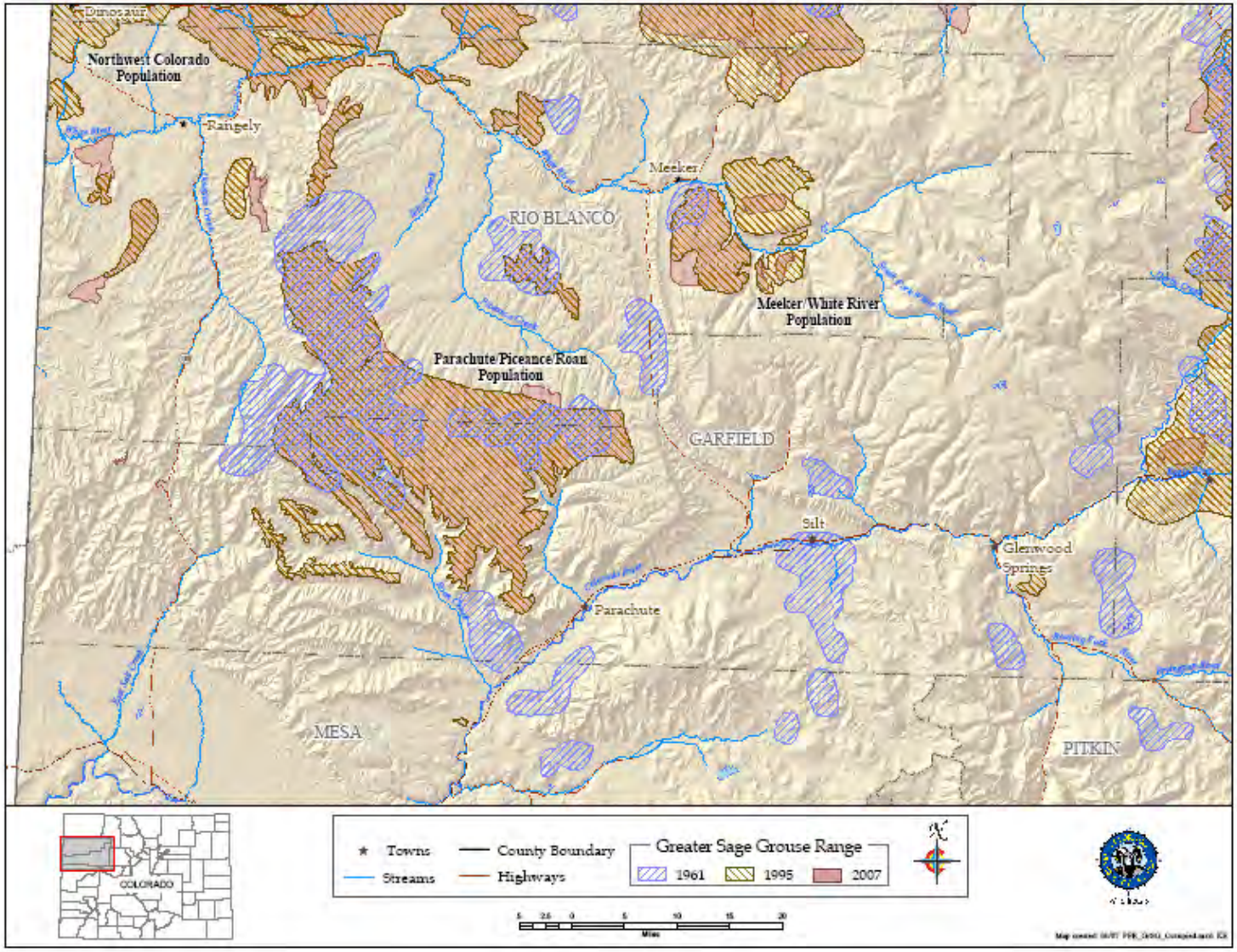

Figure 2. Known GrSG Distribution in Colorado, 1961-2007

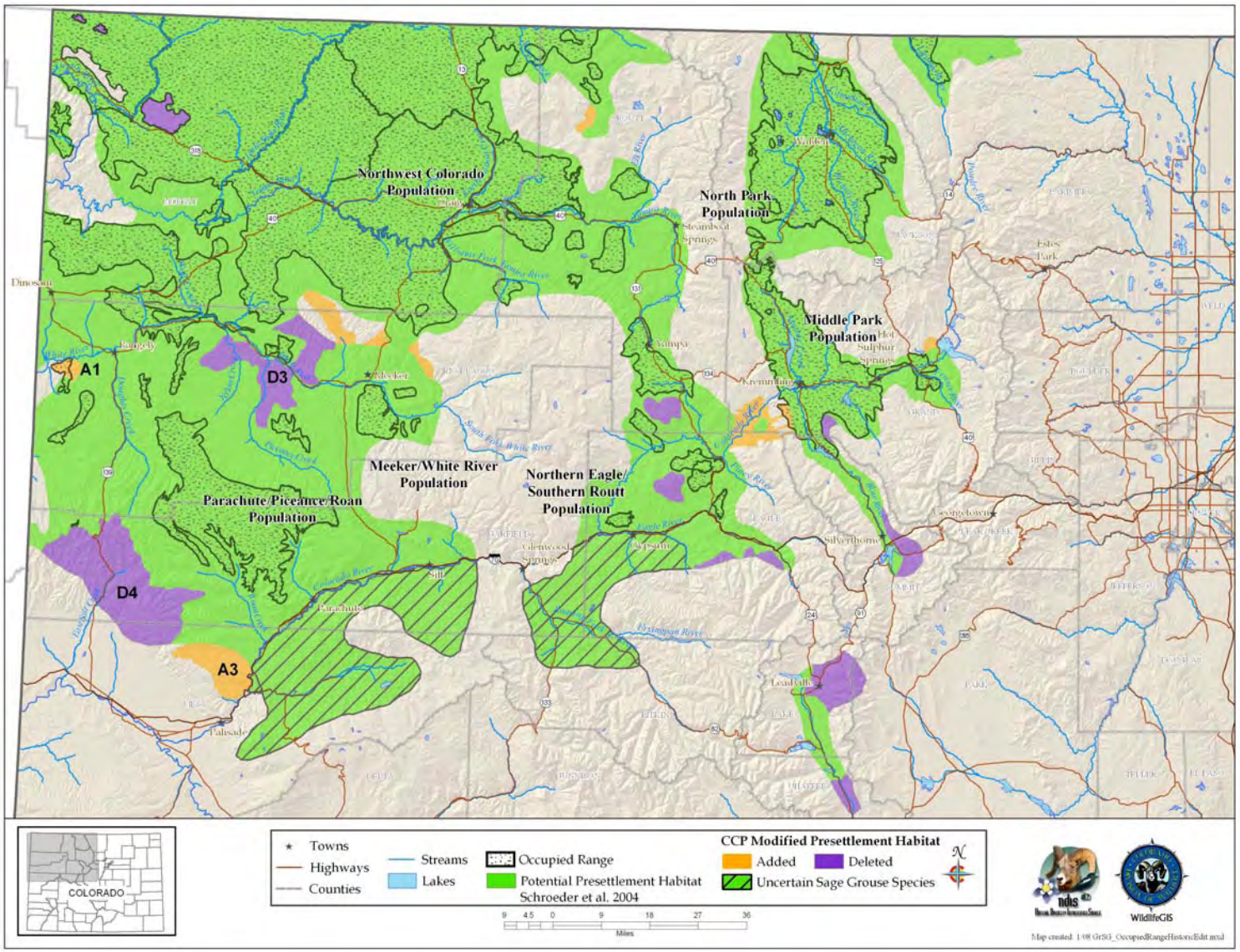

Figure 3. Historic GrSG Distribution in Colorado

The historic Colorado GrSG distribution map (Fig. 3) is based on Schroeder et al. (2004), but has been modified in 3 ways: (1) areas were added; (2) areas were deleted; and (3) areas were identified as range of "uncertain" sage-grouse species.

1. Areas Added to Historic Map

Areas added to the historic map were locales in which sagebrush occurs within the CVCP, (Colorado Division of Wildlife 2004*b*), and no evidence exists to indicate sagebrush was not in those areas historically. Areas were also added that have recently been identified as being potential habitat, based on the occurrence of sagebrush understory that could be enhanced with restoration treatments. The CVCP project mapped vegetation classes using finer resolution data than Schroeder et al. (2004) did when they broadly depicted historic habitat throughout the former range of the species. Hence, exclusions that seem minor at a rangewide scale have more significance at a statewide scale.

(A1) Shavetail Park, south of White River near the Colorado/Utah state line: area is currently occupied by sage-grouse and contains sagebrush.

(A2) Three areas around Strawberry Creek and Nine Mile Gap, north and northwest of Meeker, are mapped as potential habitat and contain sagebrush communities.

(A3) South Shale Ridge (Winter Flats & Deer Park), northwest of Colorado River, is mapped as potential habitat. Large areas of sagebrush communities are in the area, as well as piñon-juniper with sagebrush understory, indicating piñon-juniper encroachment into a former sagebrush site.

Other small areas that are difficult to see at the depicted scale were added to the historic map. The pre-settlement map was adjusted in these areas to include currently occupied or potential sage-grouse habitats.

2. Areas Deleted from Historic Map

Areas were deleted from the historic map due to them having non-GrSG habitat (according to CVCP vegetation classes), elevation constraints, and topography that led to conclusions of no occupation of sagebrush communities either presently or historically. For instance, some of the areas are in spruce-fir forests, in the alpine, or on steep, south-facing shale cliffs. The scale differences between the Schroeder et al. (2004) historic range mapping effort and the CVCP explain these discrepancies.

(D3) NWCO population and Piceance portion of Parachute – Piceance – Roan population (PPR): this area includes Black Mountain and North Ridge, near the White River, where elevation and vegetation types, predominantly thick piñon-juniper, exclude present or historic sage-grouse use.

(D4) PPR: this area includes a portion of the Bookcliffs, north of the Grand Valley, which is a steeply rising mountain range made up of shale cliff faces on the south side and piñon-juniper, spruce-fir, and aspen on top.

3. Uncertain Sage-grouse Species - Added

Schroeder et al. (2004) identified the 2 polygons shown as "Uncertain Sage-grouse Species" as being pre-settlement habitat for Gunnison sage-grouse, based upon 12 museum specimens (Table 3). The Statewide Steering Committee questioned the accuracy of the inclusion of these areas as GuSG pre-settlement habitat instead of GrSG habitat because the museum specimens were not actually reviewed by Schroeder et al. (2004). The CDOW requested and received photographs of the museum specimens that were from Garfield County (Table 3), but the photos were not conclusive in identifying the specimens (A. D. Apa, CDOW, personal communication). Morphological measurements or ancient DNA analysis of the specimens are needed to accurately determine species. Until this is accomplished, the SC has agreed to refer to these areas as pre-settlement habitat for "Uncertain Sage-grouse Species". The Statewide Steering Committee and the PPR Work Group do not intend for any historical GrSG habitat in these 2 areas to be managed as potential GrSG habitat until or unless it is proven that the museum specimens in question are GrSG.

A small area in the Colorado River/Plateau Creek triangle was added to the Uncertain Sage-grouse Species western-most polygon to account for existence of sagebrush communities and the area being mapped as potentially suitable habitat.

Table 3. Museum Specimens Collected for Area Identified in Fig. 3 as "Uncertain Sage-grouse Species".

SEX	AGE	NUMBER	DATE	SPECIFIC LOCATION	COLLECTION	COLLECTOR
Female	Adult	DMNH-27087	7/12/1905	Between Colter and Spitzer's Neck near Grand River	Denver Museum of Natural History	A. H. Felger
Female	Adult	DMNH-27088	7/12/1905	Between Colter and Spitzer's Neck near Grand River	Denver Museum of Natural History	A. H. Felger
Male	Unknown	AM-315107	3/7/1906	Garfield County	Agassiz Museum, Harvard University	J. E. Thayer
Male	Unknown	AM-315106	3/22/1906	Garfield County	Agassiz Museum, Harvard University	J. E. Thayer
Female	Unknown	FMNH-131312	10/27/1902	Newcastle, Garfield County	Field Museum-Chicago	H. W. Marsden, L. B. Bishop (9295)
Female	Unknown	FMNH-131313	10/27/1902	Newcastle, Garfield County	Field Museum-Chicago	H. W. Marsden, L. B. Bishop (9296)
Male	Unknown	FMNH-131315	9/14/1903	Newcastle, Garfield County	Field Museum-Chicago	H. W. Marsden, L. B. Bishop (9792)
Female	Unknown	FMNH-131314	9/15/1903	Newcastle, Garfield County	Field Museum-Chicago	H. W. Marsden, L. B. Bishop (9791)
Female	Unknown	FMNH-131316	9/15/1903	Newcastle, Garfield County	Field Museum-Chicago	H. W. Marsden, L. B. Bishop (9793)
Unknown	Juvenile	AM-272666	7/7/1904	Newcastle, Garfield County	Agassiz Museum, Harvard University	From Peabody Museum
Male	Unknown	AMNH-353699	9/15/1903	Newcastle, Garfield County	American Museum of Natural History	Unknown
Female	Unknown	AMNH-353700	9/15/1903	Newcastle, Garfield County	American Museum of Natural History	Unknown

b) Current Distribution

Colorado is on the southeastern edge of the current GrSG rangewide distribution (Fig. 4). It is, nevertheless, solidly within the range of the species, unlike some areas where populations were historically very limited in distribution and have since been extirpated (e.g., Nebraska; Fig. 4). Although GrSG distribution within Colorado has diminished (Braun 1995), the loss of range has been substantially less than in a number of other states, including Idaho, Oregon, and Washington. Thus, maintaining habitat and populations in Colorado will be important to conservation of GrSG on a rangewide basis.

A closer view of the Colorado, Utah, and Wyoming region (Fig. 5) appears to indicate that some Colorado GrSG populations cross state borders. Radio telemetry research has confirmed that GrSG in NWCO are part of a tri-state population (A. D. Apa, CDOW, personal communication). Although this is not surprising, it does underscore the need for agencies to coordinate population and habitat management efforts among the 3 states. The current tri-state distribution map (Fig. 5) is based on Schroeder et al. (2004), except that current GrSG distribution in Colorado is based on a more detailed Colorado habitat mapping effort. Differences in map scale and data resolution between Schroeder et al. (2004) and the Colorado data are likely responsible for the apparent discontinuities in distribution that occur along state borders (Fig. 5).

GrSG currently occur in 6 separate areas in the northwestern quarter of Colorado (Fig. 6; there is also a small group of birds that occur in the Laramie River Valley that are part of a larger Wyoming population). We term these areas "populations", without implying that the populations are genetically distinct, or that they are completely isolated from each other. Rather, these "populations" are identified separately because they are, in most cases, physically separated to some degree, and individual local work groups have grown up around these separate GrSG areas to manage the "local" GrSG. Although many of the challenges facing GrSG are similar throughout the state, both biological and sociological issues may differ in importance among the different populations and local work groups.

The populations occur in portions of 9 Colorado counties: Eagle, Garfield, Grand, Jackson, Larimer, Moffat, Rio Blanco, Routt, and Summit. The most abundant and widely distributed population is the Northwest Colorado (NWCO) population, centered in Moffat County (Fig. 6). In some populations, we have identified "zones", or smaller areas within the population that are described separately and may be managed differently. In NWCO, the zones are based on GrSG management units used by the local Work Group. In the Northern Eagle – Southern Routt Counties population (NESR), 2 zones are described, based on the path of the Colorado River. The "Routt" zone lies north of the Colorado River and the "Eagle" zone lies south of the Colorado River. Note that this line of demarcation is close to, but not identical to the line between Eagle and Routt counties. A small numbers of GrSG occur in Larimer County (Laramie River population).

The current overall range mapped by CDOW biologists and field personnel is also presented in Figure 7. It shows a further contraction in the range of the PPR population. The three maps provide a visual representation of the loss of overall range by the population during the 1900's. Some of the early maps do not include much of the area we now include in the PPR population

area, likely due to the difficulty of getting around in that remote country during the soft snow and muddy spring conditions when grouse are most visible.

The primary range contraction has occurred on the southern end of the population. Assuming for this discussion that the grouse formerly found on both sides of the Colorado River were what are now known as Greater Sage-Grouse (there is not agreement on this in among sage-grouse experts; definitive proof one way or another is not known at the time of this writing), the range of what is now referred to in this Plan as the Parachute-Piceance-Roan population probably once extended below the Bookcliffs/Roan Plateau to the Rifle, Silt, Harvey Gap and Newcastle areas north of the river, and south of the river in Divide Creek, west to DeBeque, and across the "Sunnyside" area from DeBeque toward Collbran in the Plateau Creek Valley. Active leks were counted in the vicinity of Harvey Gap, north of Silt, and Hunter Mesa south of Rifle. Sage-grouse in these areas disappeared during the 1960's, most likely due to loss of large expanses of sagebrush to agriculture (hay production and dryland farming). Grouse were present in the Plateau Valley more recently, but were gone by the 1980's, with no one factor apparent as an obvious cause.

On the western flanks of the former range, contraction has been more limited; three sage-grouse were seen on Kimball Mountain in the Roan Creek drainage in 1980; despite repeated observations over the years, primarily from fixed-wing aircraft, no GrSG were observed there again until June 2007, when 4 chicks were seen. To the north, one strutting grouse was seen on 4A Mountain in 1981, with no other sightings until 2006, when 2 males and one female were seen on one flight, and one female on a different flight that same spring. As recently as early 1989, sage-grouse were known in the low country west of DeBeque; three grouse were shot there by poachers who were subsequently apprehended by District Wildlife Manager Joe Gumber. Work Group member Chris Clark has a picture of 25-30 sage-grouse in winter on Colorado Highway 139 south of Rangely in winter during the mid-1990's. These birds could have come from the Cathedral Bluffs area of the PPR population, or from the Zone 6 sub-population of the NW Colorado population (see Fig. 7).

On the north, "gaps" appear to have opened up between grouse considered to part of, or at least addressed in the context of, the Northwest Colorado Work Group, with some small areas south of the White River. The northern boundary of the PPR population is drawn at Yellow Creek and the birds in Zone 6 of the NW population occupy the upper reaches of the Duck Creeks near Calamity Ridge. Undoubtedly there is, or was historically, interchange between the two populations.

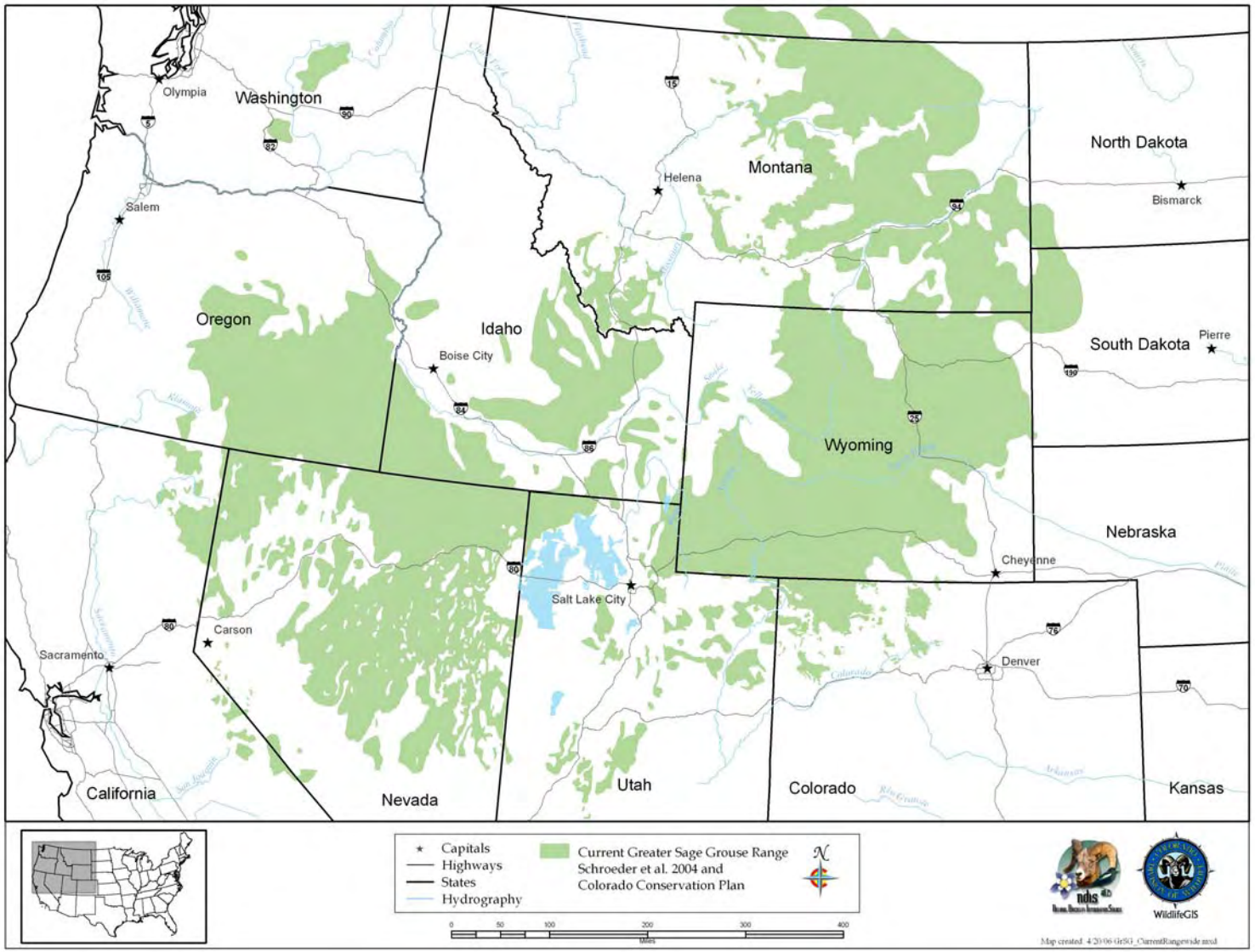

Figure 4. Current GrSG Distribution, Rangewide

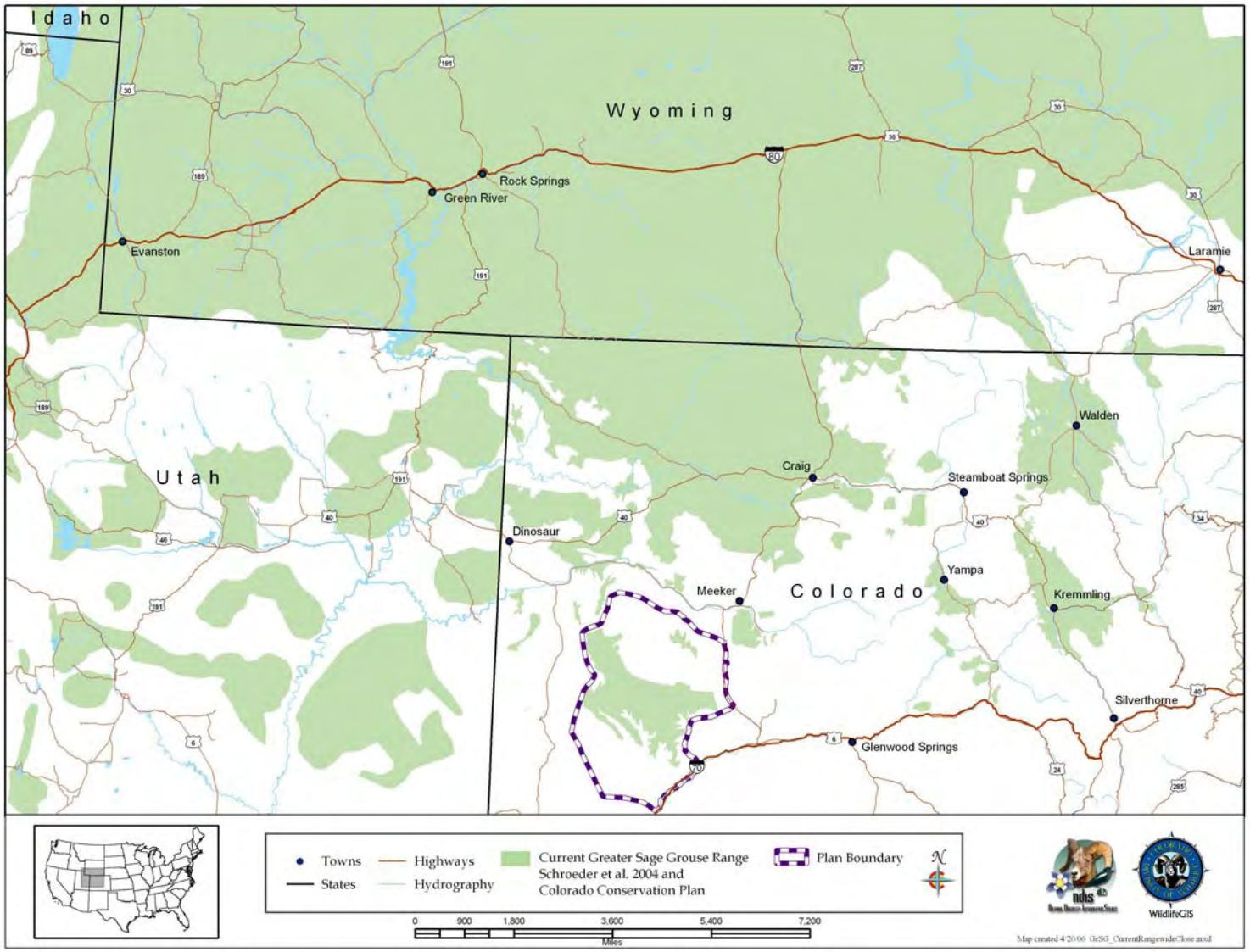

Figure 5. Current GrSG Distribution, Colorado, Utah and Wyoming

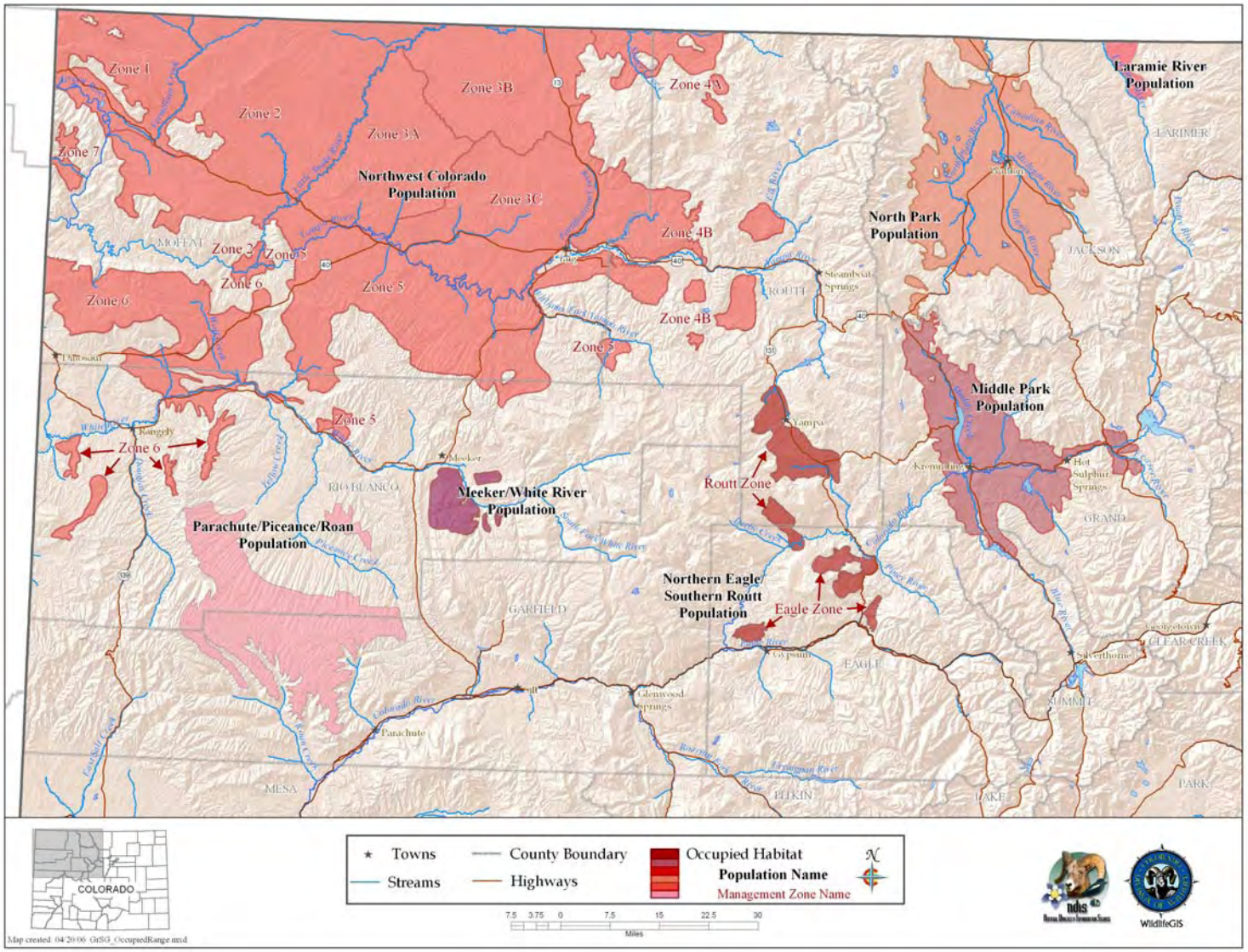

Figure 6. Current GrSG Distribution, Colorado

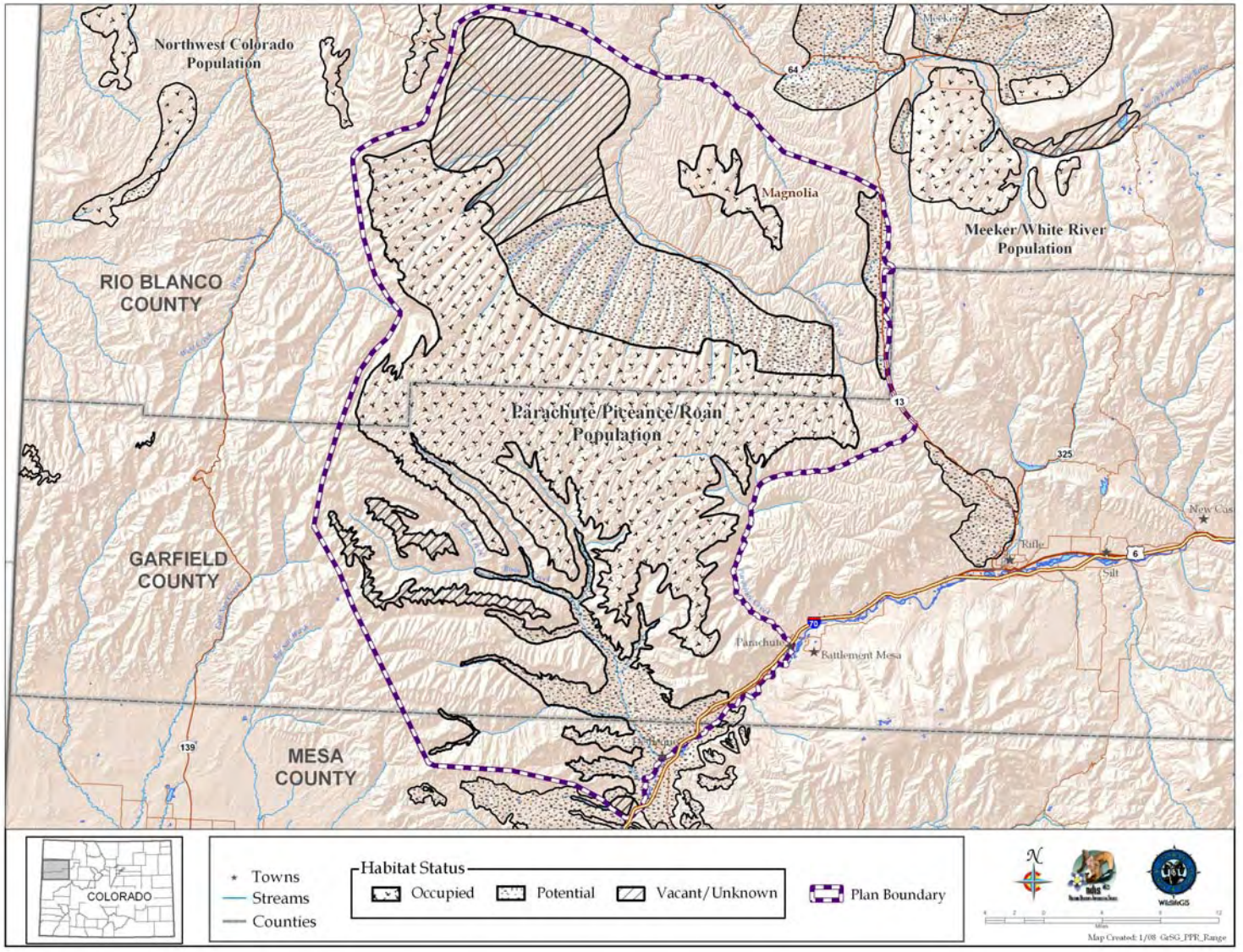

Figure 7. Current GrSG Distribution, Garfield, Mesa & Rio Blanco Counties, Colorado

2) Abundance

a) Lek Counts and Population Estimation

Inventory and monitoring of wildlife populations is an obvious prerequisite to conserving them, and is especially important when quantitative goals for species conservation have been developed. What is not obvious is how to accomplish inventory, and what level of resources is appropriate to commit to this task, since resources devoted to inventory and monitoring will not be available for other critical conservation tasks. Having accurate and precise estimates of GrSG numbers does not in and of itself improve the species' status.

Population trends of sage-grouse have been monitored across the western U.S. using variations on a lek count methodology first described by Patterson (1952), who studied sage-grouse in Wyoming. Patterson speculated that the maximum number of males counted over 3 or 4 counts spread throughout the display period might be a useful index of sage-grouse population trends. Wildlife managers have monitored populations of many species through the use of indices, where a count or measurement is made of some characteristic of a population that is both convenient to measure and is thought to be related to abundance. With birds, indices are often based on vocalizations made during the breeding season, such as pheasant "crow" call counts, dove coo-count indices, and bobwhite whistling counts (Lancia et al. 1994). Anderson (2001) noted the weaknesses of this type of sampling, which may be convenient for wildlife managers, but does not lead to defensible estimates of population size or status. The index, whether it is pheasant crows or the number of male sage-grouse counted on a lek, has an unknown relationship to the larger population of interest.

As a result of the publication of Patterson (1952), the lek count became the standard for sage-grouse population monitoring. Patterson (1952) based the census on the belief that all males regularly attend leks. His suggested maximum of 3 or 4 counts made sense under this assumption, because given normal environmental variables associated with lek counts (e.g., cold temperatures, snow and predator harassment), it might take 3 or 4 trips to get a "good" count of all the males present.

The lek count protocol proposed by Patterson (1952) has weaknesses. Dalke et al. (1963:833) thought lek counts provided a reasonably accurate method of determining breeding population trends, but noted the high degree of variability in daily counts and suggested a "…need for more refined census methods as sage-grouse management becomes more intensive in the future." Jenni and Hartzler (1978:51) used and supported the technique but speculated that high variance in counts was because "…some un-established birds wandered about visiting different leks on different mornings."

Beck and Braun (1980) presented a critical review of the practice of using lek counts to assess population trends or size. They pointed out that without information on the total number of leks in an area, attendance patterns of adult and yearling males, inter-lek movements, and the relationship between the maximum count and the population size, nothing could be concluded about population size or trends from lek counts. Despite these criticisms, the Western States Sage Grouse Committee essentially codified lek counts as a means to assess population trends two years later when it published its Sage Grouse Management Practices (Autenrieth et al. 1982).

The publication advises caution in the interpretation of counts because of the high level of variance in the data, but no additional aid in interpretation of lek count data is given. The committee's most recent guidelines (Connelly et al. 2000*c*) also suggest viewing lek data with caution, but state that lek counts (per Autenreith et al. 1982) provide the best index to breeding population levels. In an extension of that assumption, Connelly et al. (2000*c*) reaffirm specific statements from Connelly and Braun (1997) that suggest there has been a 17 - 47% decline in breeding populations across their range.

Applegate (2000) and Anderson (2001) pointed out that index data cannot be extrapolated to estimates of animal density or abundance unless the proportion of the total population that is counted in the index method is known. For sage-grouse populations, this depends on (1) the proportion of leks that are known and counted; (2) the number and timing of counts conducted; (3) time of day in which counts are conducted; (4) lek attendance rates by yearling and adult males; and (5) the sex ratio of the population. All of these parameters are likely to vary significantly spatially and over time, yet when population estimates are derived from lek count data these parameters are assumed to be fixed constants.

Lek count data have been used to make inferences about sage-grouse population trends for at least 50 years, without any credible scientific investigation into the relationship between lek counts and population size. Because of the interest in having population estimates for sage-grouse (and because of the lack of other efficient methods for population estimation of sage-grouse), it is now a common practice to use lek data to estimate the size of various populations of sage-grouse. Multiple untested assumptions are often made in using lek count data to estimate sage-grouse population size (Table 4). These usually include assumptions regarding population sex ratio, an estimate of the percentage of leks that are counted, and the percent of males in the population that are counted at leks. The Washington State Recovery Plan for Greater Sage-grouse (Stinson et al. 2004) also mentions that males could make inter-lek movements, but does not address this in its estimates (Stinson et al. 2004).

Table 4. Untested assumptions made in using lek count data to estimate sage-grouse population size. (In some cases the population estimate made was used to bracket one end of range of estimated population sizes.)

Region/Source	Assumptions		
	Sex Ratio M:F	**Percentage of all leks that were located and counted**	**% of males (associated with the lek) that are actually counted**
Middle Park, CO / local plan (MPCP 2001)	1:2	90 %	75%
North Park, CO / local plan (NPCP 2001)	1:2	90 %	75%
Northern Eagle - Southern Routt Counties, CO/ local conservation plan (NESRCP 2004)	1:2.2	Not described	53%
Gunnison Basin, CO / local conservation plan (GBCP 1997)	1:2	80 %	(50 – 100 %) used 75 %
Nevada / statewide conservation plan (Neel 2001)	1: 1.5-2.3	80 %	75 %
Washington / statewide conservation plan (Stinson et al. 2004)	1:1.6	100 %	100 %

b) Assumptions Made in Sage-grouse Population Estimation from Lek Counts

Here we examine 4 assumptions made in estimating population from lek counts.

(1) *Percent of Leks Counted.* Lek counts may be useful as a trend indicator. Under this assumption it is believed that a constant percentage of leks are detected. It is not necessary to know what the percentage of leks detected is, but to estimate population size, either all leks must be counted, or the proportion of the total that is counted must be estimated (lek detection probability).

Numerous studies have documented that lek densities can vary considerably over time. Bradbury et al. (1989) found a persistent excess of large and small lek sizes. Within an area, lek numbers seem to increase roughly in proportion to population size (Cannon and Knopf 1981). Core or "traditional" leks increase in size, while satellite leks appear and disappear as populations increase and decrease. Thus, it is probably not reasonable to assume that the proportion of leks detected is constant over time unless search effort increases proportionally as populations increase. Managers and researchers are also far more likely to detect and count a higher proportion of leks at low population densities than at high densities. It is probably also

not reasonable to assume potentially active leks are of "average" size, because potentially active leks are more likely to be satellite leks and thus smaller. Lastly, because detectability may be a function of number of males, larger leks may be more noticeable.

(2) Inter-lek Movements. Attendance by males at more than 1 lek is problematic, because birds may be counted multiple times at different leks, thus inflating population estimates, or they may not be counted at all if they are attending a different lek when counts occur. The ability of lek counts to serve as an index to population trends will not be affected by inter-lek movements if the movements are relatively constant from year to year. Unfortunately, inter-lek movements are both significant and variable. Dalke et al. (1963) reported inter-lek movements by individual (banded) adult males varied by year from 22 - 47%. Dunn and Braun (1985) recorded no marked birds moving between leks in 1982, but 14 of 91 (15%) were observed at 2 or more leks in 1983. Emmons and Braun (1984) reported all (11) juvenile males attended from 2-4 leks during the breeding season, while inter-lek movements of adults were infrequent (3 of 11; 27%).

(3) Lek Attendance. Population estimates from lek count data assume that a constant proportion of males, often 75%, are detected by the maximum of 3-4 counts (e.g., Table 4). There is considerable evidence that lek attendance is highly variable due to age, social status, weather, body condition, and parasite load or disease. Patterson (1952:152) suggested that all males regularly attended leks, although the only data he presented to support this assertion was: "All these marked birds were identified morning after morning occupying the same territory on the strutting ground." He was examining marked birds with respect to territoriality in this reference, and the marking referred to birds he captured on leks and dyed, or birds he identified by tail feather patterns. Dalke et al. (1963:820) didn't calculate attendance rate for banded birds, but indicated that "…banded males were ordinarily absent from the strutting grounds from 1 to 3 days at a time…", and "The less dominant males were irregular in their visitations. The dominant males were present almost daily under all conditions." Dalke et al. (1963:822) also noted, "Banded males were often seen in the sagebrush adjacent to the strutting grounds," although this was attributed to trapping disturbance. Hartzler (1972) documented males with almost daily lek attendance and others that only sporadically attended leks in Montana. Wiley (1973*a*) stated that there was an abundance of males that didn't attend leks, and he further speculated (Wiley 1974) that attendance patterns of males were likely to be a function of density (lek size). Dunn and Braun (1985) reported daily attendance rate of marked adult males was only 43%, ranging from 3-96% for individual males. Daily attendance by yearling males was only 33% (Dunn and Braun 1985).

One bias in assessing attendance based on observations of banded birds is that apparent low attendance may be caused by mortality of banded birds. Emmons and Braun (1984:1023) studied male sage-grouse lek attendance with the objective "…to examine the daily attendance patterns on leks of male sage-grouse during the breeding season," but lumped attendance across 5-day, 15-day, or season-long averages. Although their data indicated significant within-year and across-year variation even when lumped into 5-day intervals, they did not report what fraction of radio-marked males would be detected by normal counting protocols. Since 93% of the birds they based their attendance rates on were trapped while night-roosting on leks, it is probable they (and others) caught highly territorial, dominant males who regularly attend leks, and thus it is likely the estimate of lek attendance may be biased high.

The physical condition of sage-grouse can also affect their attendance at leks. Hupp and Braun (1989a) found that sage-grouse had depleted lipid and protein reserves following a severe winter in Colorado. This, and snow cover, caused the birds to largely delay initiating display activities until late April. There was substantial variation in lipid reserves across 3 years, which could impact lek attendance and display rates. The authors noted substantially higher variation in lek counts within a season for GuSG than for GrSG in North Park.

Boyce (1990) reported that males with avian malaria were significantly less likely to attend leks than males without malaria, and that malaria varied spatially and temporally across 11 leks in southeast Wyoming. Thus, disease prevalence has the potential to impact attendance rates and lek counts, and variability in disease prevalence may increase variability in attendance rates.

Walsh et al. (2004) studied attendance rates of radio-marked and color-banded male and female sage-grouse captured during winter in Middle Park, Colorado during 1 mating season. They found male daily attendance rates were highly variable (7-86% for adults, and 0-42% for yearlings), and influenced by age, date, and time of day. They documented that counts conducted between half an hour after sunrise and 1.5 hours after sunrise (typical when managers count more than 1 lek in a morning) detected only 74% and 44% of the actual high count of adults and yearlings for that day, respectively.

(4) Sex Ratio. Most population estimates derived from lek counts assume 2 females/males in the breeding population (e.g., Table 4). This assumption is based on long-term wing data obtained by determining sex and age of wings obtained at wing barrels or check stations (CDOW, unpublished report). It is apparent both from wing data and from population modeling that sex ratios vary markedly from year to year. This is because males encounter higher mortality rates as they mature and enter the breeding population (Zablan et al. 2003). Therefore the sex ratio will be a function of the age structure of the population; older age-structured populations will have high female-to-male sex ratios because this differential mortality will have had longer to operate. Following years of above average recruitment, populations will have female-to-male sex ratios closer to 1:1, since yearling and first-year adults will dominate the population and will have experienced little differential mortality. Sex ratios for all age classes (immature, yearling, and adult) of GrSG from wing data (CDOW, unpublished report) yielded varying sex ratios. In Middle Park from 1976 – 1993, wing data yielded 1.5 ± 0.5 females/male. In Northwest Colorado wing data yielded 1.6 ± 0.4 females/male from 1976 – 1998. In North Park, from 1974-1998 wing data yielded a sex ratio of 1.7 ± 0.3 females/male. More specifically in Northwest Colorado, Cold Springs, Blue Mountain, and Central Moffat County wing data yielded sex ratios of 1.8 ± 0.5, 1.4 ± 0.4, and 1.6 ± 0.3 females/male, respectively. We assume that a constant sex ratio is not defensible since it masks annual variability in nature. The long-term (1974 – 1998) average sex ratio for all GrSG age classes in Colorado was 1.6 ± 0.4 females/male, which is significantly lower than the 2.0 females/male that is typically used in population estimation equations.

c) Alternative Methods of Population Estimation

Given the unreliability of the assumptions used, how do estimates derived from them compare to other, more rigorous estimates? Using mark-recapture statistical techniques, Walsh (2002)

estimated the size of adult and yearling male and female GrSG populations in Middle Park during 1 breeding season. He compared them to population estimates derived from lek counts using standard assumptions (90% of leks are known and counted, 75% of males are counted, and there are 2 females/male in the population). He found that adjusted lek count estimates underestimated population size from mark-recapture estimates by 28%, because attendance rates were much lower than assumed and there were more females (2.3/male) than assumed.

Stiver, using mark-recapture techniques, estimated there were 53 male and 115 female GuSG in San Miguel County in Colorado in the spring of 2003 (J. Stiver, University of Nebraska, personal communication). Extrapolation from the maximum of 4 lek counts using standard assumptions listed above yielded estimates of 41 males and 82 females, underestimating the mark-resight estimates by 23 and 29 %, respectively. The maximum of 4 counts of males represented only 53% of the male population (as estimated by mark-resight), well below the assumed 75%. Thus, estimates of population size extrapolated from lek count data using standard assumptions appear to significantly underestimate population sizes.

Mark-recapture methods have shown promise in developing population estimates with confidence intervals, but the difficulty in capturing and marking the proportion of the population necessary (Walsh 2002) suggest it will be practical only for small populations. Recent research (Wilson et al. 2003) has explored using individual DNA as a marker, eliminating the need to handle and mark individual birds. The CDOW is exploring the utility of using DNA assayed from fecal droppings (collected on leks) as a mark-recapture technique. CDOW will also explore the practicality of using other methods to estimate lek and/or population density such as line-transects (Burnham et al. 1980). CDOW will continue to test the assumptions about male attendance and sex ratios implicit in estimating population size from traditional lek counts.

d) Conclusions

It is not defensible to generate breeding population estimates for sage-grouse from lek counts by assuming that (1) all (or some fraction of) leks are known; (2) potentially active leks are of average size; (3) the maximum of 3 or 4 counts represents 75% of the males in the population; (4) there are exactly 2 (or any fixed ratio) females per male in the population; and (5) there is no variability in the assumptions across time, space, or population size. Unfortunately, that does not diminish the need for population estimates. It is difficult to evaluate past population trends, or to assess where we are relative to population targets or population viability without estimates of current population size. Either new methods need to be developed, or assumptions used to extrapolate from lek counts need to be evaluated and refined.

Estimating population size of GrSG by whatever means will be expensive and potentially disruptive to individual sage-grouse at varying levels. In the long-term, annual estimates of population size are probably unnecessary and may be counter-productive from the standpoint of diverting resources and impacting birds. Currently annual lek counts represent the only method for monitoring trends in GrSG populations, and should be continued until better, more precise estimates can be obtained. Therefore, even though we recognize the lack of statistical reliability, we estimate population sizes from lek counts. They are the only long-term index available to document trends. However, for the purposes of this Plan, to eliminate at least one parameter with

unknown variability (sex ratio), we estimate breeding males only. In our estimates we make the following assumptions:

1) All leks are known and counted (estimate is thus conservative, if some leks are unknown).
2) The maximum of 3-4 counts represents 53% of males in each population (Stiver, University of Nebraska, unpublished data).

The formula that incorporates these assumptions follows:

C = maximum male count on lek

$$\text{Estimate of males in population} = \frac{C}{0.53}$$

e) Estimated Number of Males in Colorado GrSG Populations

Using 2007 lek count data and the assumptions listed for this Plan, we generated estimates of the current number of males in each GrSG population (Table 5).

Table 5. Colorado GrSG 2007 Lek Counts and Population Estimates

Population	Male High Count (Total for all leks)	Estimated Number of Males in Population	% of Total Estimated Males in Colorado
Middle Park (MP)	214	404	4.6
Meeker – White River (MWR)	8	15	0.2
Northern Eagle – Southern Routt Counties (NESR)	86	162	1.9
North Park (NP)	912	1,721	19.8
Northwest Colorado (NWCO)	3,218	6,072	69.7
Parachute – Piceance – Roan (PPR)	178	336	3.9
Laramie River – No information	--	--	--
TOTAL	**4,616**	**8,710**	**100.0**

f) Decline of Greater Sage-grouse

In Colorado, GrSG historically occurred in at least 13 counties (Braun 1995). GrSG have been extirpated in Lake and Chaffee counties, and for 2 other counties sage-grouse have also been lost, although whether they were GrSG or GuSG is not certain (see Fig. 3). Braun (1995) suggested that Greater Sage-Grouse are currently found in 9 Colorado counties. He considered populations with more than 500 breeding GrSG (totals of males and females in the spring) as persistent, and concluded that persistent populations were found in Jackson, Moffat, Rio Blanco, and Routt counties. Populations Braun (1995:6) considered "at risk" of extirpation include Larimer, Grand, Summit, Eagle, and Garfield counties.

Although Braun (1995) considered the populations in 4 counties secure, he did not cite any original reference to clarify or justify the basis for "500 breeding individuals" constituting a secure population. Following further review of the literature (in an attempt to support or refute the validity of the 500 breeding male benchmark) this Plan will assume that the 500 breeding individual estimate was derived from Franklin (1980) and Soulé (1980). Those authors proposed that a population (or "effective" population) of 500 is sufficient for long-term maintenance of genetic variability in a population. Lande (1988) suggests that this number was quickly adopted as the basis of management plans for captive and wild populations. Additionally, Lande (1995*a*) suggested that in experiments with fruit flies (*Drosophila melanogaster*), a population size of 5,000 is necessary rather than the Franklin-Soulé number of 500. Lande (1995*a*) cautioned using the value of 5,000 because of differences among characters and species in genetic mutations and environmental fluctuations.

Later, Connelly and Braun (1997:230) suggested that grouse populations in Colorado were "at risk," although earlier Braun (1995:6) concluded that the major populations in Colorado were "persistent." Connelly and Braun (1997:230) did not provide any definition of the term "at risk". Connelly and Braun (1997) also argued that breeding populations (males/lek) of sage-grouse decreased by 33% across GrSG range, and males/lek declined by 31% and chicks/hen declined by 10% in Colorado since 1984.

Braun (1998) further emphasized the population decline in Colorado and reported an 82% decline in lower Moffat County (all of Moffat County excluding the Cold Springs and Blue Mountain areas), in the three-year average of the number of strutting males counted on leks between 1978-80 and 1996-98. Braun (1998) concluded that there had been a 57% decrease in the number of active leks during the same time period. More recent and updated calculations (Fig. 8) suggest that the declines are not as severe as suggested by Braun (1998). Counts of strutting have been conducted in the same areas. If the 1978-80 timeframe is used as the "benchmark," the current lek counts illustrate a 25% decrease in the number of strutting males, a 20% increase in the number of active leks, and a 38% decrease in the number of males/lek in the latest 3-year running average (Figs. 8 and 9).

Although there has been a decline in the number of males counted from the 1978-1980 period, the decline in Moffat County has not been as severe as Braun (1998) concluded. These dramatic shifts in numbers of strutting males may be a result of the hypothesized cyclic nature of greater sage-grouse populations (Rich 1985, Braun 1998). Braun (1998) suggested that the strutting

male counts (males/lek) in Jackson County support the hypothesis of cyclic highs on 10-year intervals. Essentially no research has been conducted on this subject.

Simple calculations of the percent of change are instructive, but the lack of severity of the decline is also supported by Connelly et al. (2004). Connelly et al. (2004) reported that Colorado sage-grouse populations increased at an average rate of 4.3% from 1986-2003. In addition, although the number of grouse counted on strutting grounds is lower (0.7-1.6 times) than counted in the late 1960s and early 1970s, Colorado GrSG populations have been increasing in the last 17 years and there is no suggestion of a dramatic overall decline the last 39 years (Connelly et al. 2004).

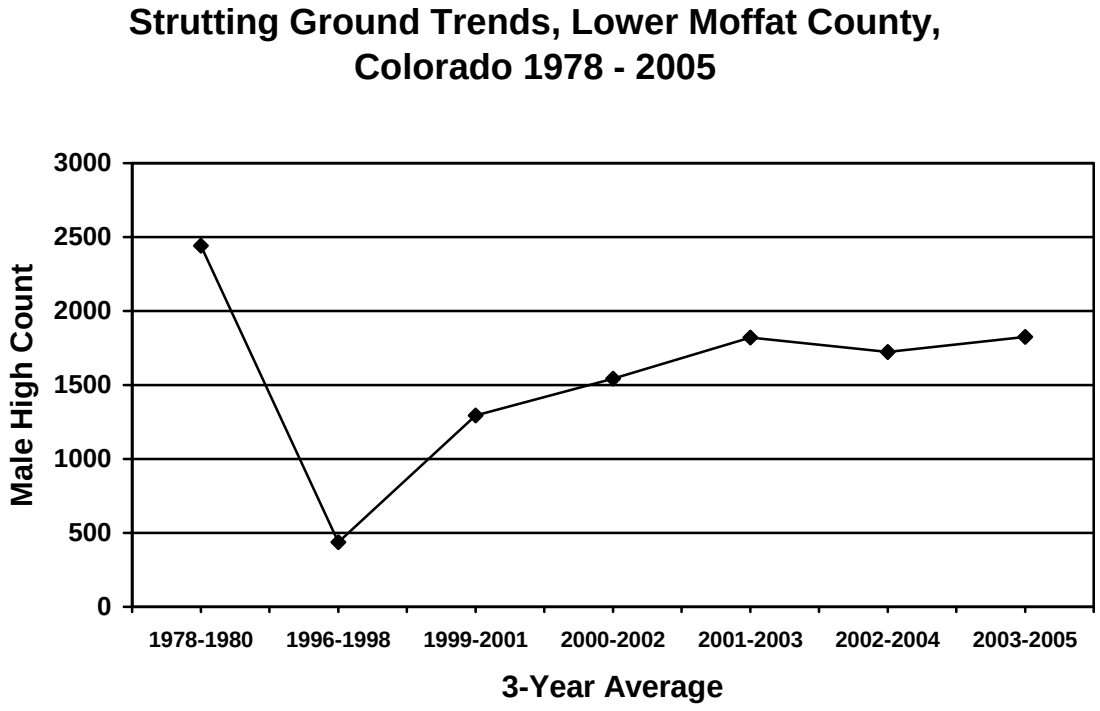

Figure 8. Trends in the Annual Total High Count of Males, Lower Moffat County, Colorado, 1978-2005.

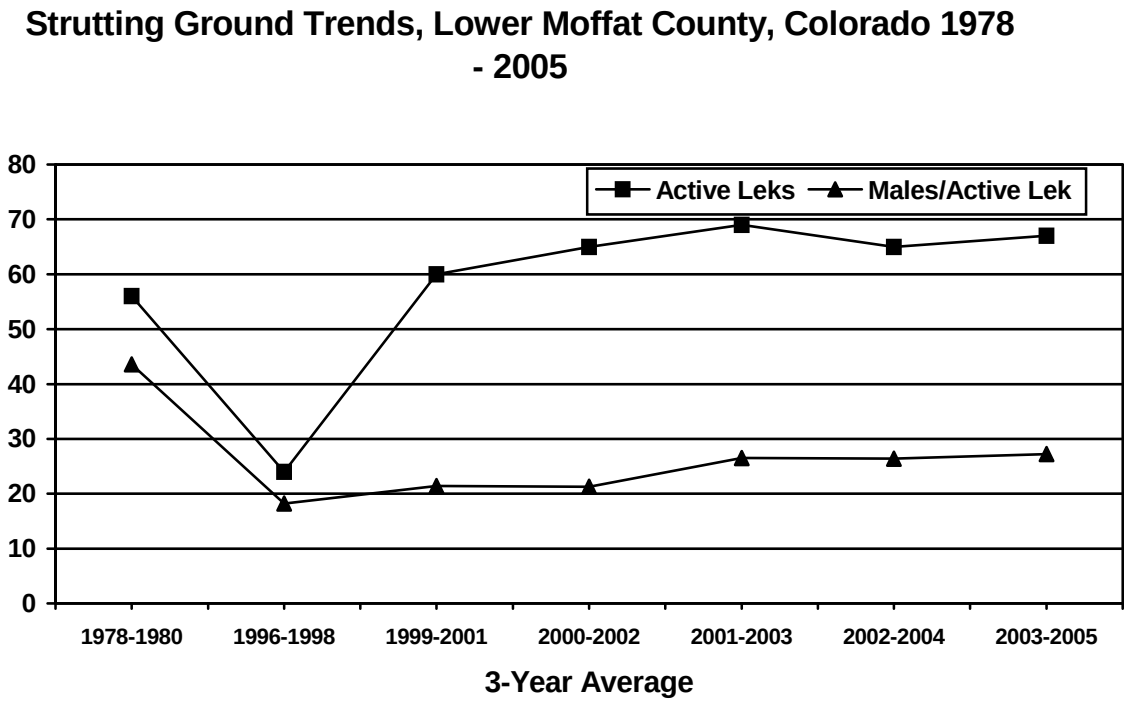

Figure 9. Known Active Leks and Males/Active Lek, Lower Moffat County, Colorado, 1978 - 2005

C. Genetics

The distribution of genetic variation among populations across the entire range of GrSG has been unknown, despite increasing pressure on managers to make difficult decisions about which populations may be, from a species conservation perspective, more "important" than others. The identification of any genetically discrete groups of GrSG is paramount in the development of GrSG management plans. If conservation plans include strategies to augment populations by translocating birds from outside populations, it is imperative to understand if and how the populations vary genetically. In addition, because GrSG distribution continues to become more fragmented (resulting in smaller and more isolated populations), it is important to determine the relative amount of genetic diversity contained in each population. Populations with relatively low levels of genetic diversity can suffer from inbreeding effects and can be more susceptible to parasitic agents and disease.

Genetic data can provide information relevant to an understanding of gene flow, isolation, genetic diversity, and the evolutionary history of a species. Further, it can facilitate a cohesive management strategy that takes genetic distinctiveness into account, based in part on a clear picture of the entire "genetic landscape" of a species. This increases the efficiency of management decisions and adds to their scientific foundation.

Previous population genetic studies of sage-grouse have focused on assessing taxonomic status (Kahn et al. 1999, Oyler-McCance et al. 1999, Benedict et al. 2003). These studies provided useful taxonomic information and knowledge of the distribution of genetic variation locally, yet they lacked the range-wide perspective necessary to make management decisions regarding GrSG at the species level.

A recently completed analysis of the PPR population compared with 5 other Greater Sage-grouse populations in Colorado (Laramie River not included) revealed that the genetic make-up of PPR is generally consistent with the other 5 populations (Oyler-McCance, 2007). Using mtDNA sequence data, 5 of the 8 haplotypes found in PPR (66% of the PPR birds) were also found in the other populations in Colorado. Of the three PPR haplotypes not found in Colorado, 2 (EU and W) were found in the neighboring states of Utah and Wyoming. One haplotype was unique to PPR (New3) and at relatively high frequency (20%). Two other Colorado populations (Blue Mountain and Cold Springs) each also had a unique haplotype representing 10 and 8% of the populations respectively (Oyler-McCance et al. 2005a). The PPR population had a much higher sample size (65 compared to ~ 20 in the other populations) and the sampling method was different (trapped birds in PPR vs. hunter killed birds in the rest of the Colorado birds), which may influence the potential for relatedness among samples. Additionally, the PPR population did have similar levels of genetic diversity (both in the number of haplotypes and in haplotypes diversity) as the other Colorado populations, and again, a higher sample size likely resulted in more haplotypes being identified. Nonetheless, it appears that the PPR population does not suffer from low diversity and appears to have diversity levels that are comparable to the other Colorado populations. The mtDNA neighbor-joining network, which was constructed using F_{ST} genetic distances among populations, suggests that PPR is more closely related to North Park, Cold Springs, and Blue Mountain, than to Middle Park and Eagle. The fact that PPR is not shown to have branch lengths longer than the other Colorado populations suggests that it is not genetically distinct from all other Colorado Greater Sage-grouse populations.

The microsatellite data are relatively concordant with that of the mtDNA data. The STRUCTURE analysis found that the most appropriate number of discrete genetic clusters (K) was 1 given the data from these 6 populations, suggesting that there was little genetic structure within the data. Pairwise population R_{ST} tests, based on allele frequencies of populations, revealed a few significant differences among populations yet these differences were primarily between Cold Springs and the other populations. This finding is highlighted with the microsatellite neighbor-joining network that shows Cold Springs as the most genetically distinct population. This network suggests that PPR is more closely related to Middle Park and Eagle, contrary to the network built with mtDNA data. This discrepancy is likely due to the different patterns of inheritance of these two types of genetic markers (maternal vs. bi-parental). An additional factor that could lead to minor differences between the two data sets has to do with the number of loci sampled (sampling error). While the mitochondrial genome represents one locus, multiple sites were sampled in the nuclear genome. Levels of genetic diversity in PPR were again similar to what had been previously been reported for populations in Colorado (Oyler-McCance et al. 2005a). The levels of mean observed heterozygosity in PPR were the lowest reported in Colorado yet the values are only slightly lower than those reported elsewhere (0.55 as opposed to 0.61-0.69). This could be due to a number of factors including smaller population sizes, increased fragmentation among sagebrush habitat resulting in sampled birds being more

related, or merely due to the different sampling method used in this study (trapped birds vs. hunter killed birds).

1) Summary

The study by Oyler-McCance et al. (2005) documented the distribution of genetic variation across the entire range of GrSG. They found that isolation by distance has left an imprint on GrSG gene pools, and that local adaptation is a realistic possibility for the species that should be considered in decisions involving translocations. They argue that this genetic data used in conjunction with large scale demographic and habitat data will provide an integrated approach to conservation efforts for GrSG. For Colorado, there appears to be a genetic line of demarcation (north to south) between Colorado GrSG populations, suggesting that if translocations are undertaken, birds should be moved north – south, and not east – west.

In summary, the Greater Sage-Grouse in PPR do not appear to be substantially different from other Greater Sage-grouse sampled in Colorado. There is some level of uniqueness (as represented by the new haplotype found in 20% of the PPR birds) yet this is not unusual as both Cold Springs and Blue Mountain also contained haplotypes that were unique to that particular population. Additionally, the levels of genetic diversity in PPR do appear to be comparable to other populations although they were reported to have the lowest levels of observed heterozygosity levels.

D. Greater Sage-grouse Habitat Mapping Efforts

1) Colorado Conservation Plan (CCP) Habitat Mapping

CDOW is using the Wildlife Resource Information System (WRIS) and GrSG habitat use data to map GrSG habitat. The following habitat definitions were used during the initial mapping portion of this project, and appear in maps in the PPR Plan. Future mapping should also focus on distinguishing between areas that are "Suitable and Vacant", vs. those that are "Suitable but Unknown". In addition, initial mapping of these habitats was done at a fairly coarse level and is not suitable for project-level planning. More detailed mapping will be necessary for specific projects.

Occupied Habitat: Areas of suitable habitat known to be used by GrSG within the last 10 years from the date of mapping. Areas of suitable habitat contiguous with areas of known use, which do not have effective barriers to sage-grouse movement from known use areas, are mapped as occupied habitat unless specific information exists that documents the lack of sage-grouse use. This category can be delineated from any combination of telemetry locations, sightings of sage-grouse or sage-grouse sign, local biological expertise, GIS analysis, or other data sources.

Vacant or Unknown Habitat: Suitable habitat for sage-grouse that is separated (not contiguous) from occupied habitats that either (1) has not been adequately inventoried, or (2) has not had documentation of grouse presence in the past 10 years.

Potentially Suitable Habitat: Unoccupied habitats that could be suitable for occupation of sage-grouse if practical restoration were applied. Soils or other historic information (photos, maps, reports, etc.) indicate sagebrush communities occupied these areas. As examples, these sites could include areas overtaken by piñon-juniper or converted to rangeland.

2) BLM State Habitat Mapping

A mapping effort was also initiated by the Colorado BLM in 2002, through a contract with the Colorado Natural Heritage Program (CNHP), as part of a national agency mapping effort. With the help of other agency biologists, the Colorado BLM completed a statewide habitat risk map. BLM and CDOW biologists (primarily) hand-edited spatial information about sagebrush and sage-grouse habitats on 1:100,000 topographic maps based on Basin-wide vegetation inventory data and local knowledge of the area. They identified existing sage-grouse habitat in Colorado that appears to be in good condition, as well as habitat that is "at risk." For those habitats considered to be at risk, biologists identified the specific issue(s) potentially affecting the habitat (e.g., weeds, fire, lack of fire), and whether the "risk" threatened habitat quality or might result in habitat loss and/or fragmentation. In identifying habitat quality ("good" or "at risk"), biologists also considered whether the habitat quality in a habitat polygon was likely to significantly degrade within 5 years if no management actions were taken. CNHP organized, compiled, facilitated and produced the results of this mapping effort. These maps were not included in this Plan due to their large size; they are available at local BLM field offices.

Four habitat quality risk factors were identified: (1) weed invasion; (2) piñon-juniper encroachment; (3) old and even-aged sagebrush overstory; and (4) poor herbaceous understory condition. Six factors causing habitat loss or fragmentation were noted: (1) weed domination; (2) piñon-juniper replacement; (3) oil and gas development; (4) powerline infrastructure development; (5) subdivisions (human development); and (6) existing or proposed land-uses (ranging from land exchange to agricultural conversion).

For each polygon, any occurrence of sage-grouse was noted, and site-specific comments (e.g., wildfire, gravel pit, weed infestation associated with oil field) were recorded. The BLM habitat map will be updated every 5 years to reflect changes in habitat due to management, new information, or a consequence of nature (e.g., drought, fire, disease). These maps are expected to help identify and prioritize BLM budget, conservation actions, and management for sage-grouse on public lands. The maps will also be made available to other agencies and local work groups to use as a tool in sage-grouse management proposals and decisions.

In addition, BLM has developed a national sage-grouse mapping effort designed to provide range-wide information about the location, status, and trend of GrSG habitats, and the influence of a variety of land-uses/disturbances on those habitats. This modeling effort is not intended to portray quality of existing habitat, but rather to depict relative connectivity of existing sagebrush ecosystems across the West. Colorado GrSG habitats fall within 2 regions covered by this project, the Wyoming Basins Region in the northwest portion of the state, and the Colorado Plateau Region. This project was spearheaded by the National Science and Technology Center in Denver. BLM, CDOW, and other biologists had an opportunity to review and validate some of the modeling assumptions that were used in this GIS mapping exercise. These maps may be

useful in prioritizing proposed GrSG projects in the state, and identifying those areas with habitat fragmentation issues. These data sets may be updated in the future as new activities or habitat modifications occur across the landscape.

3) PPR Vegetation Mapping

In order to develop landscape-scale conservation strategies specific to the PPR, the BLM (White River Field Office) initiated a 3 year, landscape-level greater sage-grouse habitat inventory for the Piceance Basin in the summer of 2006. The PPR population is unique because the available habitat is naturally fragmented due to topography and because sagebrush parks are often interspersed with mountain shrubs. The habitat inventory is being conducted on both public and private land and will provide critical local information on the quantity and quality of available sage-grouse habitat in the PPR at a scale not possible from state or national mapping efforts. Specifically, the habitat inventory will provide: 1) a biologically-based estimate for the number of acres of sage-grouse habitat in the Piceance Basin, 2) the spatial arrangement of suitable habitat and unsuitable habitat, and 3) the quality of available habitat (i.e. herbaceous understory, encroachment from pinyon/juniper, etc).

The primary objective of the Piceance Basin sage-grouse habitat inventory is to create a relatively simple landscape-scale map of the different vegetation types found within potential sage-grouse habitat. Since the map is GIS-based, it can easily be shared, updated, and overlaid with other landscape features such as leks, roads, well pads, etc. We plan to use the habitat inventory map as a means to: 1) determine the suitability of specific areas as potential sage-grouse habitat, 2) prioritize areas in need of habitat restoration, and 3) evaluate land uses that may impact either suitable habitat or restoration efforts. More information on this project is included in Appendix F.

E. Parachute-Piceance-Roan Populations: Status and Distribution

1) Area Description

The Parachute – Piceance - Roan population is located within the area bounded by the towns of Meeker, Rifle, Palisade, and Rangely (Fig. 1). Currently occupied habitat within this area lies in 2 patches: (1) the larger western Roan Plateau and Cathedral Bluffs area; and (2) the smaller Magnolia area.

The Roan Plateau lies at the headwaters of the Douglas, Parachute, Piceance, and Roan Creeks, and forms a divide between the White and Colorado Rivers. The physiography of the plateau area varies from south to north. The top of the plateau appears to be a broad, rolling plain, but to the south in the Parachute and Roan Creek drainages, the plateau drops off abruptly into the deep canyons of these creeks and their tributaries. The ridgetops between the canyons are broad (up to 2.5 miles wide) and relatively level. Similarly, the west side of the area drops off extremely abruptly at the Cathedral Bluffs into East Douglas Creek. In contrast, the terrain drops fairly gently into the tributaries of Piceance Creek Basin to the north and east; this area is dissected by numerous relatively shallow parallel canyons, with relatively narrow ridgetops in between.

The majority of the birds in the PPR population inhabit the higher elevations (7000-8900 ft.) of the Parachute, Piceance, and Roan Creek drainages. Some of the headwater areas of East Douglas Creek (Cathedral, Lake and Soldier Creeks) are within this area as well. A small group of birds inhabit the Magnolia area, in the higher elevations (approximately 6500-7500 feet) of Greasewood and Collins gulches, north of Piceance Creek. The maximum elevation of approximately 8950 feet occurs on the west side of the Square S Summer Range (CDOW property) at the headwaters of Brush Creek and Soldier creeks. Precipitation within occupied habitat in the PPR ranges from 16-25 inches per year, varying primarily with elevation (Fig. 11).

Vegetation cover also varies from south to north. On the southern, lower ends of the ridges between Parachute and Roan Creeks and their tributaries, mountain shrub communities (a mix of serviceberry, Gambel's oak, bitterbrush, and big sagebrush) dominate, interspersed with patches of big sagebrush and aspen, depending on topography. Aspen pockets are found on north to northeast facing slopes, and sagebrush appears along gentle slopes in the bottoms of washes. Ridgetops to the north are dominated by big sagebrush, and aspen pockets are found on the northern slopes, occasionally on the ridges. This situation holds along the highest ridges forming the White River - Colorado River divide, as well as along the Cathedral Bluffs to the north. In the Piceance Creek drainage, mountain shrub is a lesser component, found on north-facing slopes only, with big sagebrush on ridgetops, and as one travels north or northeast downs these ridgetops, piñon and juniper woodlands are more prevalent, and appear to be encroaching into the sagebrush as time has passed over the years. The Magnolia area is similar in this regard. In the PPR population area, sage-grouse are largely restricted to sagebrush-covered ridges and plateaus at higher elevations, whereas slopes with mountain shrubs and narrow valley bottoms (even those with some sagebrush) are not used (Fig. 12).

Mountain shrub communities, particularly serviceberry, are more common and extensive in PPR than elsewhere in GrSG range. Serviceberry is well-established in the PPR, with dense areas of serviceberry occupying the lower and drier ridges within occupied habitat. Big sagebrush is the dominant shrub species in the highest elevations of occupied GrSG habitat, but is interspersed with serviceberry in many locations. While PPR sage-grouse have been demonstrated to use the margins of serviceberry stands for nesting and brood-rearing habitat, higher lek counts occur where sagebrush is the dominant shrub.

Landownership within Occupied Habitat is approximately 65% private and 35% public (see Table 6 and Fig. 10) and overall 46% and 54% respectively. On the south side, in the Parachute and Roan drainages, approximately 90% is private, and a large portion of that is owned by large energy corporations. To the north in the Piceance Basin, a majority is in public ownership, particularly at the lower elevations, with the exception of canyon bottoms along streams, which tend to be privately held. The traditional land-use in the area has been domestic livestock grazing. However, the potential for large-scale energy resource development has been recognized since the discovery and patenting of oil shale claims in the 1920s. The presence of oil shale and natural gas in the area accounts for the large proportion of ownership by energy companies. Currently, natural gas development is rapidly expanding in the area as pipelines tied into national supply networks have been constructed and prices have risen. Residential development is not a factor in the area at this time, although there is the possibility that worker camps will be constructed within sage-grouse habitat as gas development increases, due to the

remote locations of this activity from towns and the difficult nature of travel in this rugged country.

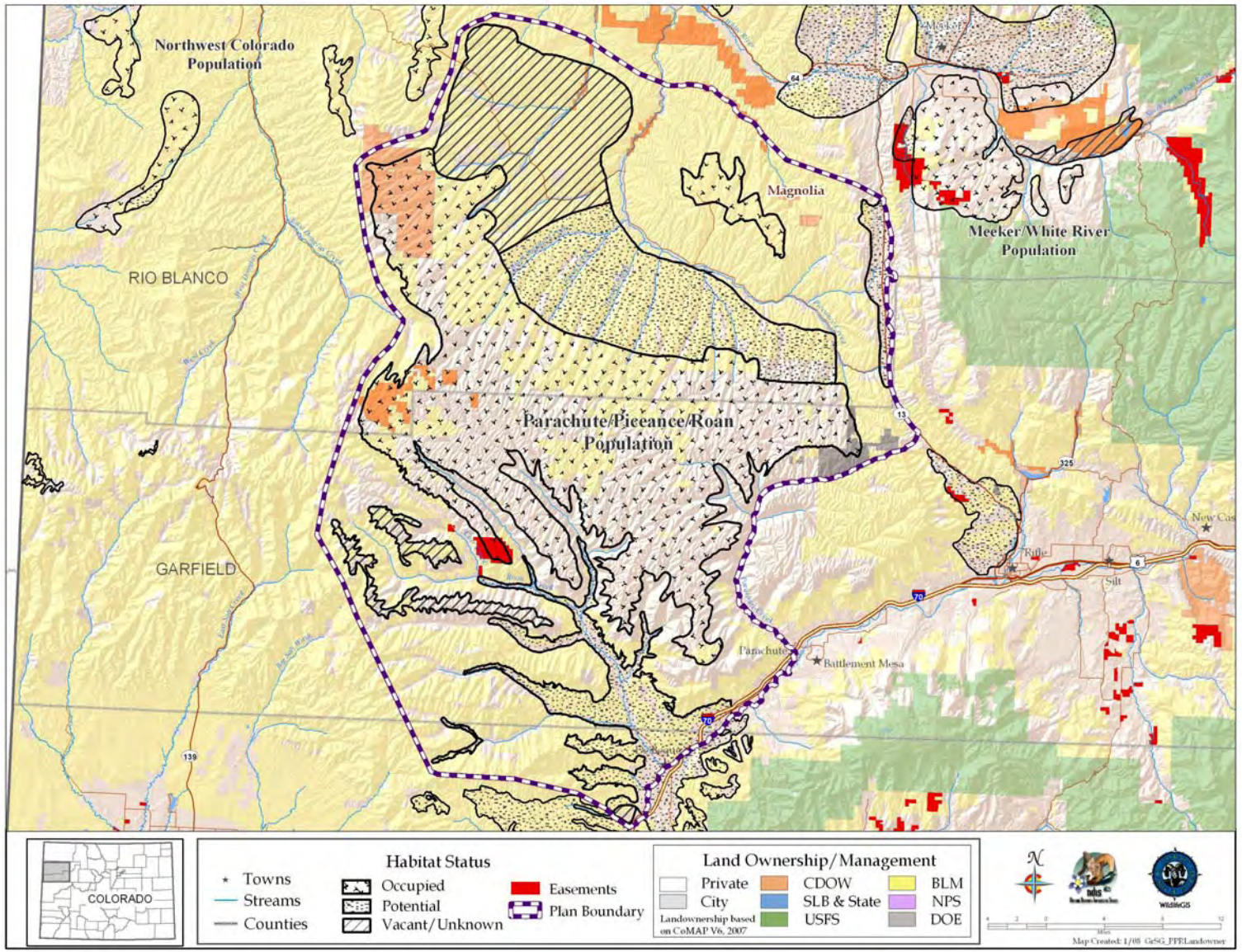

Figure 10. Land Ownership/Management in PPR Plan Area

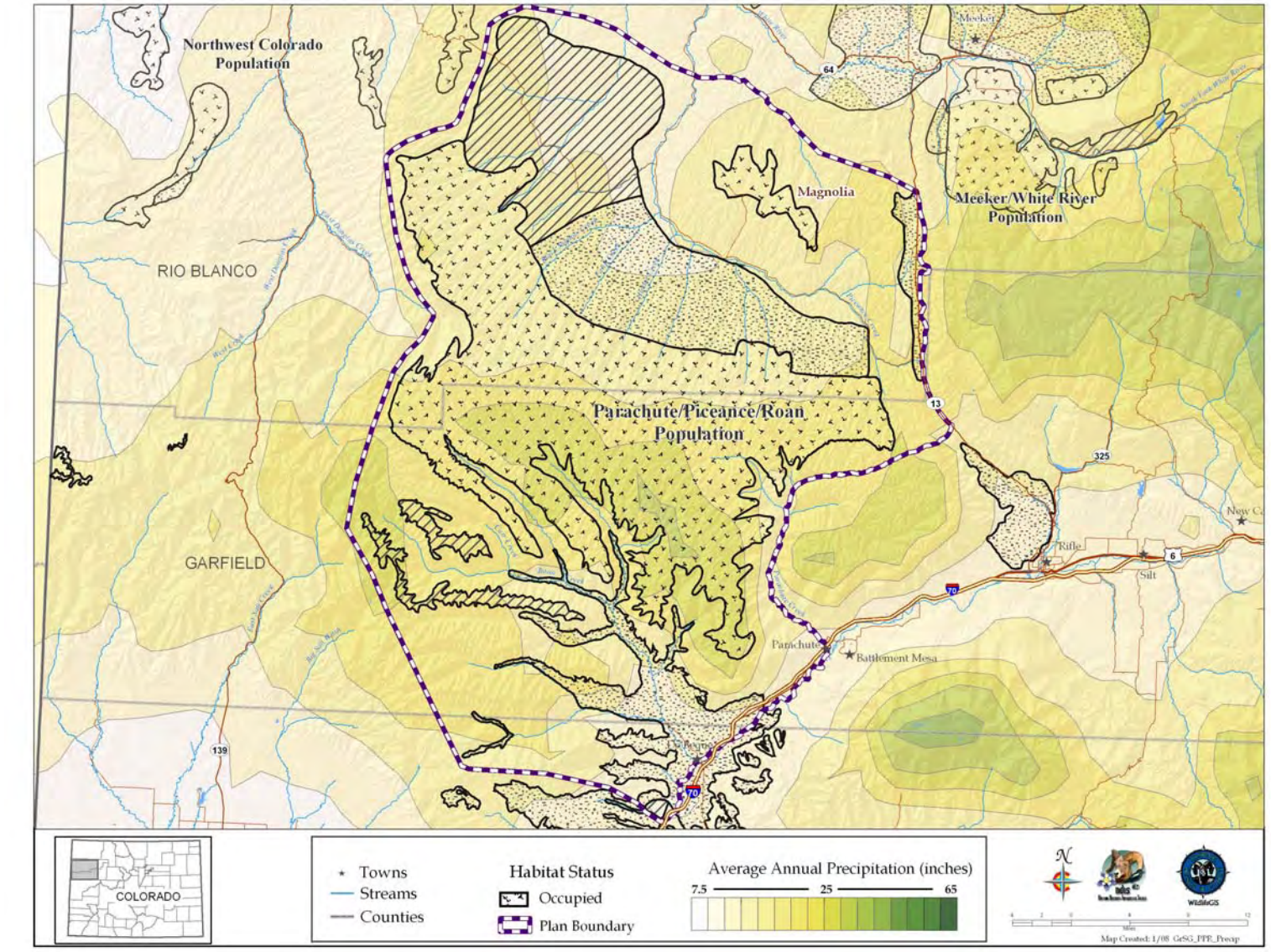

Figure 11. Average Annual Precipitation in PPR Plan Area

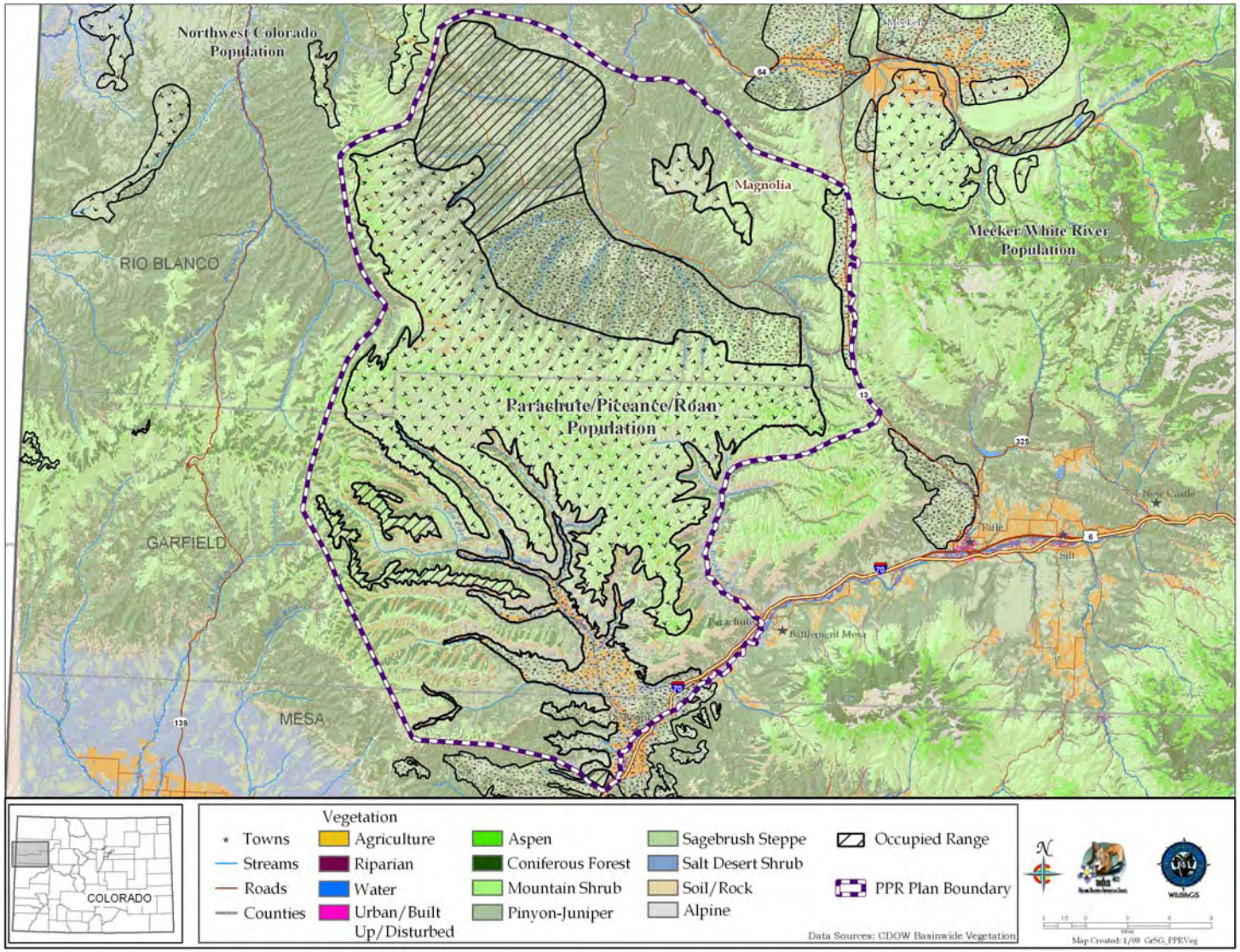

Figure 12. Vegetation in PPR Plan Area

The Parachute/Piceance/Roan population of GrSG is found in Rio Blanco and Garfield counties in northwest Colorado. The majority of the population is found south of Piceance Creek, but a small group of birds remain near the Magnolia Energy Camp at the head of Greasewood Gulch in T2S R96W.

Piceance Creek has numerous tributaries separated by long narrow ridges that generally run south to north and southwest to northeast. Valleys between the ridges are rarely greater than 500 feet deep. The ridge tops vary in width from 500 yards to 2 miles and from ¾ mile to over 20 miles in length. The Roan Creek and Parachute Creek drainages are characterized by deep canyons often exceeding 1000 feet with nearly vertical walls and several spectacular waterfalls.

The current Wildlife Resource Information System (WRIS) map on the CDOW website (Natural Diversity Information Source [NDIS] 2007. http://ndis.nrel.colostate.edu/wildlifespx.asp?SpCode=041201) for the PPR population includes 304,588 acres of Occupied Habitat, 99,683 acres of Vacant/Unknown Habitat, and 221,788 acres of Potentially Suitable Habitat (Table 6).

Habitat for the PPR population is naturally fragmented because the birds live in sagebrush communities on ridgetops that are separated by deep drainages. In addition, the elevation on precipitation and temperature and soils interact to produce an extremely diverse vegetative mosaic. Many areas on the ridges and surrounding slopes are hard to classify in terms of vegetative composition – standing in one spot, one could literally reach out and touch the major components of three or even four major vegetation communities – sagebrush, serviceberry, Gambel's oak, pinyon pine, juniper, and aspen. This terrain and vegetation mosaic makes the PPR habitats distinct from the habitats of other GrSG populations in Colorado. Classic GrSG habitat provides large expanses of sagebrush on gently rolling terrain. The area is considered semi-arid with a wide range of temperatures and weather conditions. Climatalogical data were taken from the NOAA website (http://www.wrcc.dri.edu/summary/Climsmco.html) for two sites closest to the range occupied by the population of birds: one at the Altenbern Ranch in Roan Creek (58 years of data) and the other at the Little Hills facility owned by the Colorado Division of Wildlife (CDOW) on the Dry Fork of Piceance Creek (43 years of data). The data for both sites was averaged with mean annual precipitation at 15.14 inches, average annual snowfall at 59.4 inches, mean maximum temperature 61.9 degrees F and mean minimum temperature 27.3 degrees F. In the general area, snowfall accounts for about 50% of the total precipitation. The lowest temperature recorded was -48 degrees F and the highest was 104 degrees F. The average annual precipitation at the upper elevation where the majority of the birds live should equal or slightly exceed that observed at the two weather reporting stations which are at lower elevations.

Soil type, elevation, slope and aspect determine the vegetation at any given site. Three subspecies of big sagebrush (*Artemesia tridentata*) can be found in the area, with basin big sagebrush (*A. t. tridentata*) most common in the drainage bottoms below 6500 feet in elevation. Wyoming big sagebrush (*A.t. wyomingensis*) is found on ridges between 6200 and 6600 feet in elevation, and mountain big sagebrush (*A. t. vaseyana*) is prevalent at elevations above 6800 feet (Cottrell and Bonham 1992).

Juniper (*Juniperus spp*.) and Pinyon pine (*Pinus edulis*) are intermingled in woodlands from the lowest elevations along Piceance Creek to about 6800 feet, depending on aspect. Big sagebrush, Utah serviceberry (*Amelanchier utahensis*), Gambel's oak (*Quercus gambelii*) and antelope bitterbrush (*Purshia tridentata*) are common on the ridgetops, even at the highest elevations. Groves of aspen (*Populus tremuloides*), spruce (*Picea spp*.) and Douglas fir (*Pseudotsuga menziesii)* are found on north-facing slopes with adequate moisture. Above 8000 feet, a good understory of forbs and grasses persist through most summers (Krager 1977).

As shown in Table 6 below, the majority of "Occupied" GrSG habitat is in private ownership (65%). Large tracts of private land are owned by the energy companies (petro-corporations). The majority of public lands in the area are administered by the BLM. No United States Forest Service or State Land Board lands occur in the area. The CDOW owns several parcels in the Piceance Basin. The largest parcel is the Square S Summer Range which is located at the western edge of the PPR population.

Land uses are relatively similar across most ownership types in the area. Federal, state and private lands are grazed with domestic livestock to varying extents, gas development has been begun or will occur across most ownerships depending on mineral ownership, wildlife go where they can, and water developments occur where there is water. The one exception is recreation, which is far more limited in extent on most private lands as compared to federal or state lands. Some hunting recreation does take place on a fairly controlled basis on certain private ownerships.

Table 6. PPR Greater Sage-Grouse Habitat by Land Ownership

Ownership	Occupied Habitat Acres (% of total occupied)	Vacant/Unknown Habitat Acres (% of vacant/unknown)	Potentially Suitable Habitat Acres (% of total potential)	Total Acres (% of total)
BLM	97,839 (32%)	80,470 (81%)	143,622 (65%)	321,931 (51%)
BOR	0 (0%)	0 (0%)	474 0(%)	474 0(%)
CDOW	6,272 (2%)	4,515 (5%)	667 (0%)	11,454 (2%)
U.S. Dept. Energy	1,264 (0%)	0 (0%)	193 (0%)	1,457 (0%)
Private	199,212 (65%)	14.698 (15%)	76,675 (35%)	290,585 (46%)
Total (acres)	304,430	99,525	221,630	625,902

In addition to development of the natural gas resource, experiments are on-going to determine the feasibility of commercial production of oil shale. As reported in the High Country News (March 4, 2002) "Northwestern Colorado has been viewed for a century as a potential oil treasure. By some calculations, the Piceance (pee'-awnce) Basin alone contains 300 billion barrels of recoverable petroleum, equal to 48 percent of Middle Eastern reserves. Yet no one has

been able to extract profitably the keragen, a waxy petroleum, from the shale." More than 70% of the total oil shale acreage in the Green River Formation, including the richest and thickest oil shale deposits, is under federally owned and managed lands (Oil Shale & Tar Sands Programmatic EIS Information Center. http://ostseis.anl.gov/guide/oilshale/index.cfm).

Currently, the BLM has issued leases for 5 experimental operations in Colorado's Piceance Basin to test different technologies to extract oil from the shale deposits.

Facilities to extract sodium bicarbonate have been built in the Piceance Basin (hydrologic) from underground nacolite deposits; only one of the facilities is still in operation.

Grazing by domestic sheep and cattle started in the area in the 1870's. Currently, there are few sheep and a fraction of the cattle numbers that were historically driven to the summer range at higher elevations and then wintered along the bottoms in the three major drainages.

2) Population Information

Leks in the PPR are concentrated at high elevations and remote locations, particularly in the Parachute - Roan portion of this population. Many of these leks are inaccessible from the ground during optimal periods for lek counts due to snow and mud conditions. This makes consistent lek counts difficult to accomplish, complicating comparison of data among years. Aerial lek counts have been the only possible method for counting sage-grouse on leks for some of the PPR. These aerial counts have historically been conducted by fixed-wing aircraft, which results in reduced sightability of birds and less consistent counts from year to year. CDOW has used helicopter surveys in 2005, 2006, and 2007 to count leks in this population. These counts have resulted in substantially higher counts that so far appear more consistent among years.

Extensive field work in 1975-77 provided the first complete look at sage-grouse distribution and numbers in the PPR (high male count = 234 in 1976; Krager 1977). Lek counts conducted by CDOW in the spring 2005, (the most exhaustive count completed since 1976), yielded a high male count of 180 birds, followed by high counts of 226 and 178 in 2006 and 2007, respectively (Fig. 13). Because of the limited amount of consistent data available, it is too soon to describe any trend in this population. Note that, for the purposes of documenting trends, we report only the number of GrSG males counted, not the total population size (see Fig. 13).

Going forward from 2007, the primary trend indicator will be the 3-year running average of high male lek counts. A three-year running average dampens annual fluctuations in annual counts that may be caused by variables such as weather conditions affecting the birds or the conduct of count flights, variations in observer expertise, and lek accessibility. The triangle on the graph on the next page represents the first data point of the three-year running average (195 males)

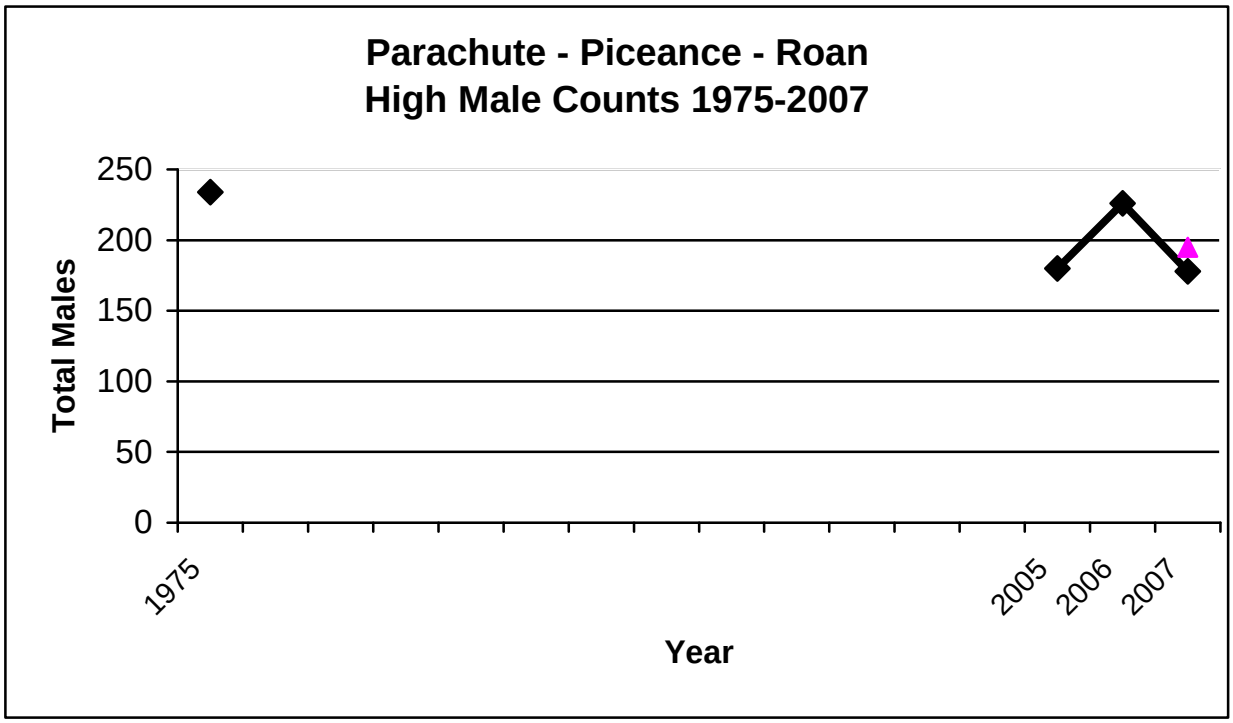

Fig. 13. Lek Count Data for PPR GrSG Population, 1975-2007
The data point for 1976 was estimated from categorical data (4 categories: 1-2, 3-5, 6-15, 15+), and though the specific value is approximate, the data are considered reliable. Data collected in the interim years are not reliable because of the difficulty in obtaining lek count data in the PPR area, and varied effort and different methods in conducting lek counts during those years. The triangle in the graph represents the first year of the 3-year running average of high male lek counts.

3) Historic Information

a) Historic Distribution

Rogers (1964) described a "light" population of sage-grouse on the Bookcliff (Roan) Plateau from Wagonwheel Ridge at the headwaters of Parachute Creek, west to Douglas Pass (this includes the headwaters of Douglas, Parachute, Piceance, and Roan Creeks.) He also noted sage-grouse in areas to the northwest, northeast, and south of the town of Rifle, as well as east and south of DeBeque in the Roan, Wallace, and Sunnyside drainages near the Mesa County line. Anecdotal information from local long-term residents of DeBeque, Colorado indicates that greater sage-grouse may have occupied lower areas of the Roan Creek valley during winter periods during the 1930s and 1940s. Following a severe winter storm that brought deep snow and sub-freezing temperatures in February of 1989, a small group of GrSG were observed by the CDOW in an area dominated by big sagebrush in the Castle Rock area, about 3.5 miles southwest of DeBeque in Mesa County (J. Gumber, retired CDOW, personal communication).

The Gunnison Sage-grouse Rangewide Steering Committee (2005) questioned whether sage-grouse previously found south of the Colorado River in the DeBeque-Collbran-New Castle area

are GrSG or GuSG. No published evidence exists to prove this one way or another, but a river as small as the Colorado would not present a barrier to travel by sage-grouse. Sage-grouse are strong fliers and have the ability to cross a river the size of the Mississippi. Regardless, sage-grouse have been extirpated south of the Colorado River in Garfield and northeastern Mesa counties, as well as north of the Colorado River and east of Parachute Creek in Eastern Garfield County.

b) Population Monitoring

Rogers (1964) reported only three strutting grounds (leks) in Garfield County and two in Rio Blanco County. In Garfield County, one lek was near Harvey Gap Reservoir, one on West Coulter Creek and one on Hunter Mesa south of Rifle. There have been no birds in those areas for decades. In Rio Blanco County, the known leks were 84 Mesa, south of Duck Creek, and Oil Wells, Little Hills near the present-day Magnolia Energy Camp. Birds are present in only one of those five areas today, but the total number of known leks is now over 80.

Much of the difficulty in obtaining counts in the mid-1900's was a shortage of field personnel to search for and inventory leks and the difficulty in reaching much of the area occupied by the birds during the breeding season. The old adage, "You can't get there from here" applies to much of the PPR in the late winter/early spring. Many of the leks were "discovered" by searches in fixed-wing aircraft in the 1970's. Ron Krager (1977) found 28 "new" (previously unreported) leks flying systematic searches along ridges during the breeding seasons of 1975-77.

Appendix E includes a map of currently known leks and lek status definitions. Many of the lek locations were plotted on USGS topographic maps from the front seat of a fixed-wing aircraft flying at 100 mph, so lek locations may not be exact. Some work remains to ground-truth lek locations, eliminate duplication and determine current status. This appendix also contains CDOW definitions of lek status: active, inactive, historic and potentially active.

After Krager's work in the 1970's, lek inventories were conducted each spring, some by ground counts but most by fixed-wing aircraft. In some years, scheduling and weather problems precluded the flights, so the data set is lacking, especially when you consider that CDOW guidelines for lek counts call for a minimum of 3 counts of each lek between March 15 and May 15. In some years, only lek "activity" checks were conducted to determine if the lek site had been visited by GrSG that spring; numbers of birds on leks was not determined. More than anything else, the data set reflects the difficulty in reaching the lek sites for accurate counts. To inventory the leks of the PPR population requires a greater effort than anywhere else in Colorado. In most areas of the state, CDOW field personnel can access leks by vehicle and complete multiple counts of each lek each spring, while the PPR leks require aerial surveys which are more difficult, weather-dependent, and less accurate.

During the winter 2005-06, the ad hoc committee that preceded formation of the working group determined that a more aggressive inventory effort should be conducted. Because of the access issues described above, it was decided that multiple helicopter flights would provide the best data. Over $21,000 was donated to the CDOW by energy-related companies. Six helicopter flights were conducted, three on each side of the drainage divide, plus three fixed-wing flights

were conducted for the southern portion of the population. Flying both fixed-wing and helicopter counts allowed for comparison of the efficacy of each method. The increased effort and the use of the helicopter resulted in the observation of many more birds on the lek, and discovery of several new lek locations. The same inventory effort, with the helicopter flights paid for largely by industry, was conducted in 2006. The donations collected in early 2005 paid for the 2005 and the majority of the 2006 helicopter flights.

The following list provides a comparison of the advantages of each aircraft:

- Helicopters are more maneuverable. The approach to the lek can easily be made from varying directions, which provides the observer numerous angles of light/view to detect the grouse, without flushing the birds from repeated flyovers.
- Helicopters can approach the lek more slowly and allow the observer(s) more time to view the birds.
- Helicopters can fly lower and closer to the lek providing a better view of the grouse– the fixed wing aircraft stays 500-700 feet off the surface while the helicopter can hover if necessary below 300 feet.
- Fixed wing aircraft generally tend to flush birds even at higher aircraft altitudes, probably due to the raptor-like shape of the fixed-wing aircraft.
- Fixed wing counts provide more consistency of data. Only two years of data from helicopter counts are available, but the data set from fixed wing counts covers many years.
- Distances between the leks can be covered more quickly with the fixed wing.
- Fixed wing flights are much less expensive. In 2005, DBS Helicopters from Rifle provided the aircraft at a cost of $875 per flight hour; in 2006, Heliquest Helicopters from Grand Junction flew the counts at a cost of $750 per hour. The 2007 flights were done with Olathe Spray Service at $644.00/hr. The DOW regional fixed wing aircraft (Cessna 185) can be operated at a cost of $150 per flight hour (2005 estimates).
- More accurate lek locations (UTM coordinates) can be determined with a helicopter. It's difficult to obtain the exact coordinates from a fixed wing aircraft that is moving 80-100 mph.

Data from lek counts on the south side allow comparison of fixed-wing and helicopter counts. In 2006 as well as in 2005, the counts on the south side of the Piceance-Roan/Parachute Divide were flown with both the fixed-wing aircraft and helicopter. In 2005, the high count with the helicopter was 84 birds while 45 birds were observed from the fixed-wing; this computes to 87% more birds being seen from the helicopter. In 2006, the high count was 154 birds observed from the helicopter and 83 from the fixed-wing; thus 86% more birds were seen from the helicopter. It seems clear that use of the helicopter results in many more birds observed. The downside is the expense; at current prices it costs approximately $12,000 to fly the six counts each spring with the helicopter while the CDOW fixed-wing aircraft requires no additional expenditure.

4) Local Conservation Plan

Efforts to develop a local conservation Plan began in the summer of 2005. Informational meetings were held in Roan Creek, Piceance Creek, and Parachute in June 2005, and a Work Group was formed in July, 2005. Work Group meetings have been held monthly since then, and

work on the Plan is progressing steadily, with expected Plan completion in early 2008 (PPRCP 2008). The most complex issue the Work Group has addressed is energy and mineral development (and associated infrastructure). Other issues include grazing, predation, habitat quality, recreation, piñon-juniper encroachment, and water development. Strategies have been developed for all issues and final preparation of the Plan is in progress.

The Work Group has decided that it will not set a specific population goal or target because of the lack of a consistent, long-term data set, a lack of perspective as to how current data fits into a long-term trend, and a general sense of uncertainty both about the past population numbers and projected natural gas development in the area. The data problems are discussed below. The lack of perspective comes from looking at the graph of counts from 2005-2007 (Fig. 13). Three data points on a graph cannot provide a realistic, defensible indication of where we've been, upward or downward trend, or even where this population is in relation to other populations in Colorado. This general uncertainty comes from concerns revolving around potential federal listing of the bird, the Population Viability Analysis in the Statewide Conservation Plan and the potentially gloomy potential forecasts put forth therein. The Work Group is acutely aware of the potential problems facing sage-grouse in the area and is dedicated to addressing these problems. At this time, the Work Group will not establish population objectives until sufficient data is collected.

Instead, the group intends to conduct a detailed annual analysis of what has gone on during the previous year followed by recommendations on addressing issues that appear to be negatively influencing grouse and/or their habitat. More details on this process later in this narrative.

Determination of a population objective for the Parachute-Piceance-Roan population of Greater Sage-Grouse is a difficult issue compared to some other Colorado populations. Lek count data, the flawed but primary method of estimating a population, are far more intermittent and variable for this population than for others in NW Colorado. North Park has thirty+ years of consistent data; NW Colorado has nine years, etc. Essentially, there are very few years of quality lek count data for this population: 1976 (flawed as well, but more complete than anything prior to 2005), and 2005 to the present. This Plan contains strategies to improve data collection (see "Data Collection and Management" section).

The lack of a long-term quality data set presents difficulties in attempting to determine a population objective. One reason for setting a population objective is to have some kind of objective or goal to maintain or strive for. It's also inherently interesting to know how things are going from one year to the next with a wildlife population that is of interest. When looking at these types of numbers, it's natural to wonder what is "normal." When there is concern for a species' long term survival, and petitions to list a species as "Threatened" or "Endangered," questions of past and present population levels become more urgent. This is the situation as this Plan is being written in no small part to address concerns for this sage-grouse population.

What we know about the PPR population is that in 1976, a minimum of 204 males were counted; in 2005, 184 males were counted, 226 in 2006, and 178 in 2007. These are really the only years that something remotely approximating an "apples to apples" comparison can be made (though even this is a stretch, since the 1976 counts were with fixed wing aircraft only, and not all known leks were counted). In all of the other years beginning with the first counts in 1962, there

isvariation in the amount of effort, the type of count (ground, fixed wing aircraft or helicopter), the number of leks visited, the number of times leks were visited, whether any effort was made at all, etc. All of those years are "oranges" to the "apples" of 1976 and 2005 onward. A graph representing the numbers of males counted over the years from 1962 to the present is totally misleading and ultimately meaningless and is not presented here.

So what can we say about males lek counts over the years? We can say there were probably around 234 males in 1976 (as estimated from categorical data); we don't know if that represents a high or low number compared to the years around it, or before that or after that until 2005. We can say that there were more males on leks in 1976 than in 2005-2007. We can speculate that since the some of the leks that had birds in 1976 on the northwestern end of the population no longer have birds, and most of the other general areas of leks continue to have birds, that it stands to reason that if the total area of occupied habitat has decreased, there would be fewer birds now than in 1976. But we still don't know whether 1976's 234 males represent a high, medium, or low number for years prior to 2005. As if there isn't enough variability, the comparison between numbers in 1976 and recent (2005 on) is confounded by different count methods (fixed wing aircraft in 1976, helicopters recently). Comparisons between fixed wing counts and helicopter counts in the years 2005-2007 suggest that a fixed wing flight counts roughly 60% of the birds seen on helicopter flights, which could mean the 1976 number could have been substantially higher if helicopters had been used on the count. For a detailed explanation of how the 1976 number was determined, see Appendix D.

The Work Group decided during its deliberations over the draft Plan that Conservation Action 4d. (p. 92) should apply not only to energy-related activities, but to any disturbance activity that may appear to be leading to a downward trend in lek counts. Where a 3 year consecutive downward trend in lek counts (as measured by the 3-year running average) is seen in the area as a whole and/or portions of the area, consider aggressively pursuing additional strategies to address population sustainability including:

- options for increasing GrSG female survival;
- shorter duration of disturbances and expedition of reclamation:

See "Population Augmentation" strategy section of Statewide Plan for GrSG.

5) Completed Conservation and Habitat Actions

Table 7. GrSG Habitat Projects Reported in PPR GrSG area (CDOW, unpublished reports)

General Location or Ownership	**Project Description and Purpose**	**Acres Treated (if applicable)**	**Project Completed By**	**Year Completed**
Habitat surrounding Magnolia Lek	Hydroaxe used to control encroaching tall shrubs	50	CDOW	2000-2002
Piceance SWA	Dixie harrow; sagebrush thinning to enhance nest cover and brood forage	1,200	CDOW	2000-2002
Near Magnolia Lek	Brush beating for understory restoration	500	BLM	2000-2002
Piceance SWA	Understory enhancement: reseeding with palatable forbs	400	CDOW	2000-2002
Barnes Ridge	Large natural gas/soda ash pipeline corridor reclaimed with grasses and palatable forb species	87 (8 miles of corridor)	Industry	2000-2002
N/A	Field collection of native forbs for germination description and native seed stock development	N/A	Upper Colorado Environmental Plant Center, NRCS	2003
BLM, Wolf Ridge	Prescribed burn in juniper encroachment area	280	BLM	2004
Skinner Ridge / Colorado Nature Ranch (now Kessler Canyon Ranch)	Sagebrush and serviceberry treatments (brush hog), to reduce shrub overstory for nesting and brood-rearing habitat	N/A	NRCS, ranch, CDOW	2005 and ongoing
Boies Burn (ridge between Eureka and Yankee Gulches)	Prescribed burn in heavy pinyon encroachment area. Nov. 2007 attempt unsuccessful; will continue.	600+	BLM	2007 and ongoing
Barnes & Bailey Ridges	Selective removal of pinyon seedlings/saplings	550	BLM, EnCana	2007

Table 7. GrSG Habitat Projects Reported in PPR GrSG area (CDOW, unpublished reports)

General Location or Ownership	**Project Description and Purpose**	**Acres Treated (if applicable)**	**Project Completed By**	**Year Completed**
Jackrabbit Ridge Experimental Lek Creation	Clearing of sagebrush and rabbitbrush to open an area to see if GrSG might begin to strut there.	0.5	CDOW, UnoCal (EnCana)	2001; GrSG droppings found, no strutting thus far.
Mud Springs Lek Clearing	Clearing/broadening opening around active lek	0.15	CDOW, Chevron	2001
Bar D Ridge Lek Clearing	Clearing/broadening around active lek and adjacent 20+ yr. old well pad (never drilled)	0.4	CDOW, Chevron	2001

6) Easements

No easements specifically for sage-grouse or sage-grouse habitat exist in the area covered by the conservation Plan effort. A conservation easement, originally secured through the Rocky Mountain Elk Foundation, exists in the south portion of Brush Mountain (Roan Creek), within GrSG occupied range (Fig.11). There are at least 2 easements in former GrSG range in the Plateau Valley in Mesa County (south of the Colorado River) in areas at the margins of what may have been historic range for whichever species of grouse used the area. Total easement acreages for the area are 1,355 acres in occupied habitat and 1,808 acres in potentially suitable habitat.

F. Issues and Threats

Issues and threats are discussed in the next section, "III. Conservation Strategies for the PPR Plan."

III. CONSERVATION STRATEGIES FOR THE PPR PLAN

Strategy Overview
The working group identified the following issues/threats for the PPR population. The following section provides an elaboration of the issue or threat as it applies to the local population of GrSG, then lists conservation strategies that were developed through negotiation and consensus by the working group.

A. Data Availability
B. Habitat Change
C. Grazing
D. Predation
E. Energy Industry and Mineral Development
F. Recreation
G. Water Project Development and Water Management

A. Data Availability

1) Issues Related to Data Availability

Problem Definition: lack of consistent historic information on population numbers, seasonal habitat use & movements, lack of coordination within and between agencies.

The issues intended to be resolved by the following actions are described previously in Section II. E. 4) Local Conservation Plan, and revolve around the lack of a consistent long-term data set of lek counts. The intent is to continue lek counts at least the level of effort begun in 2005.

2) Conservation Actions Relating to Data Availability

Goal:	Objectives:	Actions:	Who:	When:
Improved knowledge based on data to better inform wildlife manger(s), landowner(s) and public on decisions impacting Sage-grouse in this area.	1. Establish a consistent, coordinated lek count effort for Greater Sage-Grouse throughout the conservation Plan area.	1a. Continue helicopter counts begun in 2005	CDOW	Ongoing

Goal:	Objectives:	Actions:	Who:	When:
		1b. Check each lek at least 3 times, 7-10 days apart, late March through mid-May	CDOW & other stakeholders assisting with counts	Annually
		1c. Begin count ½ hour before sunrise (in air, at first lek); end no later than 2 hours after sunrise.	CDOW	Ongoing
		1d. Continue fixed-wing aircraft counts annually to maintain a data set.	CDOW	Ongoing
		1e. Investigate development of a detectability index between the two methodologies.	CDOW	Ongoing
		1f. Review count methodology used by other state wildlife agencies, and develop written helicopter survey protocol for counts in this area.	CDOW share with Work Group stakeholders	Feb. 15, 2009
		1g. Report current count data to Work Group in June of each year with comparison to previous years.	CDOW	At annual June Work Group meeting
		1h. Report data on three year "running average." (2005-2007, 2006-2008, 2007-2009, etc.)	CDOW report to the Work Group	At annual June Work Group meeting
		1i. Pursue funding to ensure the continuation of helicopter counts in the future	CDOW & Work Group stakeholders	Annually
	2. Establish a Geographic Information System GIS for Greater Sage-	2a. Establish who is responsible for handling updating various types of data in system	CDOW, BLM, Natural Resources Conservation Service	January 2009

Goal:	Objectives:	Actions:	Who:	When:
	Grouse information that can be shared and used relatively easily by members of the Work Group. Information would include soils, vegetation, various grouse information, rainfall/snow cover data, past and future land treatments, etc.		(NRCS), CO Oil & Gas Commission (COGCC), Energy Companies, Landowners, etc.	
		2b. Determine who will "house" and maintain the system. Establish agreements if necessary.	CDOW & stakeholders in Work Group	January 2009
	3. Consider establishing a system to incorporate incidental grouse sightings or other evidence into the GIS established in Objective 2.	3a. Investigate the possibility of CDOW or another agency using a software program such as "BIOTA" to compile, manage, and analyze grouse information, or perhaps set up an internet-based system similar to the CDOW's Amphibian and Reptile Atlas, or the Cornell Laboratory of Ornithology's "E-Bird" system.	CDOW	January 2009

B. Habitat Change

1) Issues Related to Habitat Change

The Work Group identified goals, objectives, and conservation actions for the issue of habitat change to move toward the desired quantity of and quality of sage-grouse habitat in areas appropriate for sagebrush-grassland plant communities. The goal is to improve or sustain the quantity and quality of habitats to benefit both sage-grouse and livestock.

Habitat changes differ in the lower, central portions of Piceance Creek area as compared to the Parachute and Roan area, due to the differing elevations and associated plant communities. .In the lower elevation areas of Piceance Creek, sagebrush areas on relatively narrow ridge tops are likely diminishing in size and total area due to encroachment of pinyon and juniper woodlands into sage areas currently or formerly used by Greater Sage-Grouse. On the south side of the area, in Parachute and Roan Creeks, the sage-covered ridgetops are wider and higher in elevation. Adjacent vegetation types are aspen forest and serviceberry shrublands. Sage-grouse are using areas where serviceberry is a greater component of the shrubs; the extent to which this type of area is preferred by the grouse over sagebrush-dominant areas is open to question, as is the question of whether serviceberry is stable or increasing in the southern areas.

"Habitat" and the vegetation types that comprise it change constantly in response to short-term influences such as annual precipitation and long-term influences such as gradual ecological succession (aging and eventual replacement of a plant community). In addition, events such as drought, storms, fire (or lack thereof), flooding, landslides, and human management activities may have long-term influences as well. Although we do not have detailed information and mapping on specific changes, some of the following events are known to have happened over the last 100-120 years:

- Changes from one vegetation type to another; in particular, changes from sagebrush-grassland communities to mixed sage-grass/pinyon-juniper woodland types in the Piceance Creek watershed. Sagebrush-grass communities across the conservation Plan area may differ in terms of their long term stability. The lower elevation ridgetops on the Piceance side likely tend toward pinyon-juniper woodland over time in the absence of disturbance such as fire. On the higher ridgetops on the Roan and Parachute sides, sagebrush-grass vegetation probably tends to maintain itself over the long-term; these sites may be too dry for aspen, and too wet, high, or cold for pinion and juniper. Encroachment of serviceberry may be a factor here, however.
- The abandonment or change of hay meadows to native range.
- The loss of wet meadow riparian areas due to stream-channel down-cutting and water diversions.
- Changes in age, structure, and density of sagebrush.
- Changes in the understory (grasses and forbs) in sagebrush communities.
- The invasion of noxious weeds.
- Changes in climatic conditions.

Characterizing specific areas as good, poor, or mediocre in terms of sage-grouse habitat is a site-specific exercise and will need to be completed in the field. Some areas with poor understory vegetation or poor sagebrush growth may be a result of naturally poor site conditions and, thus, are not likely to respond to habitat manipulation. On the other hand, some areas may be productive sites that have been preferred by wild and/or domestic livestock resulting in modified plant communities. Some of these potentially productive sites may benefit from active vegetation management. All conservation actions listed below are voluntary. However, the hope is that landowners and land managers will take action to improve or sustain the quantity and quality of sage-grouse habitat in the conservation Plan area. Appendix A lists some possible funding sources to cost-share with landowners on habitat improvement projects

2) <u>Conservation Actions Relating to Habitat Change</u>

Goal:	**Objectives:**	**Actions:**	**Who:**	**When:**
Develop vegetation resource goals that provide the desired quantity and quality sage-grouse habitat on a landscape level that benefits both livestock and sage-grouse.	1. Define healthy vegetative communities for the local environment and develop management practices to achieve healthy rangeland & sage-grouse habitat.	1a. Develop a list of best management practices that will help achieve the vegetative community goals for sage-grouse habitat. The list will be adaptive to allow for practices, as new information becomes available.	CDOW, BLM, NRCS, Landowner & user groups	2006 or upon Plan completion.
		1b. Inventory and develop mapping database (GIS). Include specific information on soils (where possible), sage-grouse habitat and, historical habitat treatments, etc.	CDOW, BLM, NRCS	Beginning 2006
		1c. Educate and encourage landowners and land managers to use the best management practices for vegetative communities and sage-grouse habitat.	Landowners, Colorado State University (CSU) Extension, NRCS, CDOW, BLM	Ongoing

Goal:	Objectives:	Actions:	Who:	When:
		1d. Provide expert assistance on management recommendations to willing landowners and land managers. If acceptable to landowner, provide opportunity for Work Group to participate in site visit.	CSU Extension, NRCS, CDOW, Partners for Wildlife	Ongoing
		1e. Monitor effectiveness of best management practices as they are applied. Provide updates and results of best management practices to Work Group.	CDOW, BLM, NRCS	Ongoing
	2. Develop goals for healthy habitat for the different seasonal needs of sage-grouse. Use local knowledge and available research to define the seasonal needs and habitat requirements. Take appropriate voluntary actions to improve sage-grouse habitats.	2a. Improve areas of poor quality nesting habitat by actions such as the following (pending inventory results); i. Seed area with grasses and forbs, go heavy on forbs if brood-rearing occurs in the area. Light disking & interseed, or drill seed	CDOW, BLM, NRCS, Landowners, & users	Ongoing
		ii. If sage is too dense, consider thinning by roller-chopping, light disking, Dixie Harrow, Lawson Aerator or other methods. Apply best management practices on a case by case basis. Use Connelly et al. (2000) guidelines as reference-page 19.	CDOW, BLM, NRCS, Landowners & users	Ongoing
		iii. Encourage multi-species plantings of grasses and forbs.	CDOW, BLM, NRCS, Landowners & users	Ongoing
		iv. Retain residual cover through fall and winter into nesting season.	CDOW, BLM, NRCS, Landowners	Ongoing

Goal:	Objectives:	Actions:	Who:	When:
			& users	
		2b. Improve brood-rearing habitats by actions such as the following (pending inventory results).	CDOW, BLM, NRCS, Landowners & users	Ongoing
		i. Restore riparian systems.	CDOW, BLM, NRCS, Landowners & users	Ongoing
		ii. Raise water table – raise channel bottom from deeply incised gullies.	CDOW, BLM, NRCS, Landowners & users	Ongoing
		iii. Restore old ponds/Construct new ponds in areas lacking water, while minimizing potential for promoting mosquito breeding habitat at elevations below 8,000 feet.	CDOW, BLM, NRCS, Landowners & users	Ongoing
		iv. Preserve irrigated hay meadows.	CDOW, BLM, NRCS, Landowners & users	Ongoing
		2c. Improve Lek Areas by actions such as the following (pending inventory results).	CDOW, BLM, NRCS, Landowners & users	Ongoing
		i. Mechanically treat historic lek areas where sagebrush density has increased.	CDOW, BLM, NRCS, Landowners & users	Ongoing
		ii. Clear new lek sites.	CDOW, BLM, NRCS, Landowners & users	Ongoing

Goal:	Objectives:	Actions:	Who:	When:
		2d. Improve Winter Habitat by actions such as the following (pending inventory results).	CDOW, BLM, NRCS, Landowners & users	Ongoing
		i. Manage for vigorous stands of sagebrush in known critical winter range (based on current knowledge, telemetry study may provide more detailed information).	CDOW, BLM, NRCS, Landowners & users	Ongoing
		2e. Identify and map key seasonal habitat areas.	CDOW, BLM, NRCS, Work Group, landowners & users	Initial data in Fall 2006 then annually
	3. Manage for interconnected vegetative communities that minimize habitat loss.	3a. Plan proposed treatments in context of past treatments and other proposals on adjacent ownerships to maintain continuity of healthy vegetative communities.	Landowners & users, BLM, CDOW, NRCS	Ongoing
	4. Determine limiting habitat conditions within the landscape. *If any of the following are found to be limiting, the recommended actions are suggested:*			
	4a. Lack of suitable quantity or quality of vegetative cover resulting from past events or actions (e.g., drought, diseases,	i. Carefully consider further reduction in sagebrush acreage in key seasonal habitat areas (would not necessarily preclude thinning or other treatments if appropriate)	Landowners & users, BLM, CDOW, NRCS	Ongoing

Goal:	Objectives:	Actions:	Who:	When:
	spraying, brush beating, intentional burning, or wildfire, excessive herbivore (any animal that eats plants) etc.)	ii. Restore Sagebrush –allow re-establishment over time if underway.	Landowners & users, BLM	Ongoing
		iii. Manage for interconnection of sagebrush stands – some degree of interspersion of sage with grass areas is desirable, as is interspersion of sagebrush stands of different ages.	Landowners & users, BLM, CDOW, NRCS	Ongoing
		iv. Allow for adequate sagebrush management to meet sage-grouse habitat requirements.	Landowners & users, BLM	Ongoing
	4b. Large expanses of old dense sagebrush with little understory.	i. Consider thinning by roller-chopping, light disking, Dixie Harrow, Lawson Aerator, mowing, herbicide applications or other methods.	Landowners & users, BLM, CDOW, NRCS	Ongoing
		ii. Consider treatments of varying patch sizes and shapes to create a mosaic of open areas interspersed with sagebrush.	Landowners & users, BLM, CDOW, NRCS	Ongoing
		iii. When planning sagebrush treatments, treat older more dense sagebrush while allowing sagebrush regeneration in other areas. (Sagebrush treatments in winter range areas may not be appropriate.)	Landowners & users, BLM, CDOW, NRCS	Ongoing
	4c. Sagebrush is giving way to another vegetation type (e.g. pinyon-juniper (P-J), serviceberry and noxious or	i. Mechanically remove vegetation while retaining the sagebrush community: a. Chainsaw vegetation if widely scattered or rough terrain (draws) b. Roller-chop vegetation–	Landowners & users, BLM, CDOW, NRCS	Ongoing

Goal:	Objectives:	Actions:	Who:	When:
	invasive weeds).	destroys/mulches, some larger sage, thins sage, can seed simultaneously c. Hydro-Axe vegetation– mulches more finely than roller-chopping d. May require continuous management every 10-15 yrs, unless seedling/saplings shorter than sage are hand cut		
		ii. Prescribed Burning a. Probably solves P-J problem longer term, but sage does not resprout and will not recover for 15-20 years or more. b. Burns should be planned for small areas to allow for continued dominance of sagebrush in landscape. For example, small burns up draws may help restore some riparian vegetation and water table while retaining sagebrush on uplands.	Landowners & users, BLM, CDOW, NRCS	Ongoing
		iii. Herbicide Treatment	Landowners & users, BLM, CDOW, NRCS, CSU Extension, County Weed Supervisor	Ongoing
		iv. Consider and mitigate the potential for undesirable species invasion when planning and implementing habitat treatments.	Landowners & users, BLM, CDOW, NRCS, CSU Extension, County Weed Supervisor	Ongoing

Goal:	Objectives:	Actions:	Who:	When:
		v. Encourage landowners to seek assistance from county weed supervisor and extension when treating noxious weeds.	Landowners & users, BLM, CDOW, NRCS, , CSU Extension, County Weed Supervisor	Ongoing

C. Grazing

1) Issues Related to Grazing

Grazing animals are part of the landscape. Some grazers are wild and some are domestic. The animals can have positive or negative effects on the landscape, depending on land use objectives. In considering grazing and sage-grouse, the effects of wild and domestic grazers cannot easily be separated, so the Work Group is addressing both in this section.

The Work Group does not believe that any one factor, including grazing, is the sole reason for sage-grouse decline in the area. There is a lack of credible scientific evidence that directly links grazing (wild or domestic) with declines in sage-grouse numbers (Crawford et al. 2004). Having said that, the Work Group does not desire to see this species disappear from the area and will work with the CDOW and other interested parties to make sure that grazing practices are compatible with sage-grouse to the extent possible.

Domestic and wild ungulate grazing are dominant land uses on public and private lands in Rio Blanco & Garfield counties. Sound grazing management promotes the use of forage resources, while having a neutral or positive effect on plant vigor. The Work Group recognizes that drought is a critical factor in grazing management as it relates to pounds of available forage for both domestic and wild ungulates. Proper livestock grazing and wildlife management can maintain and perhaps enhance desirable plant communities by preventing the invasion of noxious weeds, improving the palatability of vegetation, and promoting residual cover. Proper grazing can also increase plant diversity and improve riparian areas. Improper grazing has the potential to reduce the availability of food and cover for sage-grouse by affecting the composition and structure of grasses, forbs, and shrubs. It is important to consider sage-grouse habitat needs when evaluating big game population objectives and livestock stocking rates.

Currently, the primary grazers in the conservation Plan area are deer, elk, cattle, wild horses and domestic sheep. (For purposes of this discussion, "grazing" includes browsing unless otherwise specified.) Over the last 50 years, numbers of deer, cattle, and sheep have declined or remained stable in varying proportions, while elk numbers have increased and wild horse numbers have fluctuated and are above BLM objectives.

The CDOW manages deer and elk populations toward objectives set in herd management plans, also known as Data Analysis Unit Plans (DAU Plans). The purpose of a herd management plan is to provide objectives for managing a big game species in a specific geographic area that includes the species' seasonal movements. These objectives are based on sound wildlife management principles, as well as the desires of landowners, residents, land management agencies and other interested publics. Herd management plans must ultimately be approved by the Colorado Wildlife Commission and are reviewed every 10 years and changes are made if warranted. A traditional herd management plan contains two primary goals: a "herd objective," (i.e., the number of animals the area should contain) and the sex ratio of males to females in that herd. Population estimates are derived using computer model simulations that involve estimations for mortality rates, hunter harvest, wounding loss and annual production. These simulations are then adjusted to align on measured post-hunting season age and sex ratio

classification surveys. Cattle and sheep numbers are determined by landowners on their own lands, and in conjunction with BLM on public lands. Current domestic sheep grazing occurs primarily in the Cow Creek-McCarthy Gulch area west of Rio Blanco.

Wild and domestic grazing animals follow the same general pattern, that is, they use lower elevations in winter, moving to higher elevation ranges as spring turns to summer, and back to lower elevations in the fall as winter approaches. In the PPR area, sage-grouse currently occupy the higher elevations areas year-round. Grazing animals are generally spending mid-spring to early winter in these higher elevation areas (up to 9000'). Domestic livestock are usually fed hay in winter and early spring in pasture areas; deer and elk move freely unless restricted by snow depth.

Two key issues relate to grazing and sage-grouse are: 1) the potential impact of herbivores on grouse nesting and hiding cover depending on the timing of grazing; (grazing in grouse nesting areas from late summer through early spring can remove grasses that could provide nesting cover in early spring before new growth provides cover) and 2) the potential for wild herbivores to negate the benefits of a domestic livestock grazing plan intended to leave cover for grouse.

a) Domestic Livestock Grazing

Healthy and productive public and private rangelands are the foundation of a profitable and sustainable ranching industry and abundant wildlife. Many ranches depend on public land grazing for economic viability, and many species of wildlife, including sage-grouse, depend on private lands during one or several periods during their annual life-cycle. Private ranches contribute some of the highest quality sage-grouse habitat in western Garfield and Rio Blanco counties.

Emphasis should be placed on maintaining these lands as viable economic units to preserve large and significant areas of privately owned habitat. The alternative is habitat fragmentation and increased human impacts when agricultural lands are sold for development. It is important to recognize that many ranches with significant private land holdings depend on public land grazing allotments for the viability of their operations. Therefore management decisions on public land can influence private land use patterns.

b) Wild Ungulate Grazing

This issue is closely related to the issue of domestic livestock grazing. The question revolves around whether or not the extent and timing of grazing by wild ungulates, (particularly elk) can negatively affect sage-grouse and their habitat. First, are elk eating vegetation that might otherwise provide food, hiding, or nesting cover for sage-grouse? Second, could foraging elk negate positive grazing management actions taken on public or private lands meant to leave cover for sage-grouse?

Many agree that these scenarios are possible, and that there are areas where the first occurs. There may be other areas where elk are not a problem (case by case basis). The second point arises from the concerns of ranchers that altering domestic grazing practices at inconvenience

and expense to their operation may yield no positive effect for sage-grouse habitat if elk negate the benefit.

In addition to being closely related to the livestock grazing issue, the issue of elk management and herd numbers is particularly contentious. Various attempts and efforts have not resulted in significant reductions of the elk herd. The winter of 2003-2004 exhibited a decrease in elk numbers so some of the efforts may be working. Reducing elk numbers is beyond the scope of this conservation Plan. The Parachute-Piceance-Roan Conservation Plan area overlaps several different deer DAUs, but the primary DAU of interest is elk unit E-10, which comprises the lower White River basin and the north side of the Colorado River Basin from Rifle to the Utah state line. The herd objective for DAU E-10 is 8,000-10,000 elk, while the current population estimate is 8,000 animals.

Regarding deer, the DAU picture is more complicated and overlaps large areas outside of the grouse conservation Plan area. There is not the same concern about deer grazing/browsing having negative effects on sage-grouse, as with elk. There are places where wintering deer can severely trim back sagebrush foliage, but these tend not to be areas that are important to sage-grouse nesting; there could be impacts to sage-grouse wintering habitat if there is overlap between deer and grouse winter ranges. This is not known to be the case in the conservation Plan area.

Deer DAU D-7 includes Piceance and Yellow Creeks, and Maybell on the west, and ranges to Steamboat Springs, Oak Creek and Yampa on the east. It is a huge area, and attempting to estimate the number of deer in the Piceance and Yellow Creek areas is very difficult. However, CDOW biologists estimate there are 5,000 resident deer and 5,000-8,000 wintering deer in this area. This compares to wintering deer numbers thought to be in the neighborhood of 50,000 deer in the 1950's and 1960's, when Piceance Creek was considered the largest migratory deer herd in the world. The current herd objective for all of D-7 is 67,500, the current population estimate is 72,000 deer post-hunt 2007.

The southern end of the conservation Plan area is part of the much smaller deer DAU D-41, which is wholly comprised of the Roan and Parachute Creek drainages. The herd objective here is for 16,500 deer, and it is estimated that post-hunt 2007 there were 9,600 deer, well short of the objective.

Current CDOW herd management objectives attempt to stabilize elk herds in this area.

It is difficult to quantify specific issues related to grazing of wild and domestic animals. On one hand, sage-grouse have adapted to existing ranching and livestock grazing systems because the grouse still exist at these sites. However, it will never be known whether the pre-domestic grazing (prior to 1870) GrSG population was higher or lower, thus making the issues and impacts of grazing an important part of the strategy for sage-grouse conservation. Few studies have directly addressed the effect of livestock or wildlife grazing on habitat use by sage-grouse. Thus, rangeland and wildlife biologists must rely on indirect evidence as it relates to grazing and sage-grouse (Crawford et al. 2004). This leaves the central issue of what it is about grazing that is good, neutral or detrimental towards sage-grouse recovery. The Conservation Actions related

to Livestock Grazing are meant to address this issue, and the Conservation Actions relating to other ungulates are intended to address the wildlife component of the grazing issue.

c) Other Wildlife Issues

The Work Group discussed the potential effects of grass consumption and cutting by ground squirrels in the Plan area. Many range managers contend that ground squirrels consume large quantities of range grasses and, therefore, conduct extensive control programs on rangelands (Fagerstone and Ramey 1996). Grinnell and Dixon (1918) estimated that 200 California ground squirrels consumed as much forage as one steer. Shaw (1920) estimated that Columbian ground squirrels consumed 187% of their weight daily and that consumption by 385 Columbian ground squirrels would be equivalent to one cow and 96 squirrels equal to one sheep.

Fagerstone and Ramey (1996) suggest careful evaluation before undertaking control programs. Ground squirrels may have positive roles in grassland ecosystems, particularly as prey for other wildlife species, as well as soil loosening and redistribution, aeration, and nutrient cycling.

2) Conservation Actions Relating to Domestic Livestock Grazing

Goal:	Objectives:	Actions:	Who:	When:
Continue to foster a sustainable and economically viable ranching community while also providing high quality sage-grouse habitat.	1. Maintain and enhance large scale open range habitats to provide both sage-grouse habitat and livestock forage.	1a. Encourage private, local, state, and federal policy makers to consider the importance of the economic viability of ranching (both public and private land) in providing sage-grouse habitat. Examples include: managing elk populations, county planning.	Work Group	Ongoing
		1b. Educate stakeholders about grazing systems and grazing strategies for improved grouse habitat and survivability.	Work Group	Ongoing
		1c. Document (monitor) herbaceous plant cover before and after domestic livestock grazing to determine if the removal of the herbaceous plant cover is a result of wildlife grazing or other environmental factors.	BLM, NRCS, CDOW, Private Landowners& users & land managers, Industry	Ongoing
		1d. Continue to enhance and maintain improved rangeland (public and private) by using all available tools to land managers. These tools include, but are not limited to, timing and intensity of domestic grazing, weed control, fire, water development, vegetation management, and wildlife population management.	CSU Extension, CDOW, NRCS, BLM, Private landowners & users & land managers, Industry	Ongoing
	2. Improve, if possible, livestock &vegetative	2a. Fund further research that scientifically shows how or if domestic grazing and wild ungulate grazing affects grouse	Universities, CDOW, NRCS, CSU Extension, Landowners &	Upon completion of Plan

Goal:	Objectives:	Actions:	Who:	When:
	management for sage-grouse habitat and livestock forage sustainability.	populations during breeding and nesting.	users & land managers, Industry	
		2b. Develop watering systems away from riparian areas on both private and public land to better disperse livestock and wildlife while also providing moist areas for broods.	Private Landowners & users & land managers, BLM, CDOW, HPP, NRCS, Industry	Ongoing
		2c. Manage livestock movement through use & rotation/placement of salt or minerals to benefit sage-grouse.	Private Landowners & users & land managers, BLM, NRCS, Industry	Ongoing
		2d. If research and/or range conditions show that grazing system changes or vegetative management would benefit sage-grouse, propose those changes to grazing systems on a case-by-case basis. If grazing changes are needed, consider elk/wildlife numbers first before adjusting livestock numbers.	CSU Extension, BLM, CDOW, landowners & users & land managers, NRCS, HPP, Industry	As necessary
		2e. Identify and develop cost-share programs to help landowners implement actions to benefit sage-grouse.	NRCS, BLM, HPP, CDOW, Non-Profits, Partners for Wildlife, Industry	Ongoing

3) Conservation Actions Relating to Wild Ungulate Grazing

Goal:	Objectives:	Actions:	Who:	When:
In conjunction with sustainable livestock interests & sport hunting industries, ensure that grazing by other ungulates is not adversely affecting sage-grouse habitats.	1. Determine the extent of the effects elk may be having on sage-grouse habitat.	1. Identify, monitor, and map big game/sage-grouse conflict areas.	CDOW, BLM, Private Landowners & users & land managers, Work Group, Industry	Upon completion of Plan
	2. Manage other ungulate populations to meet desired sustainable plant communities that provide sage-grouse habitat.	2a. Strive to reach elk harvest objectives on public and private land.	CDOW, BLM, Private Landowners & users & land managers, Work Group, Industry	Ongoing
		2b. Review and encourage coordination of big game herd objectives in future DAU plans and modify as necessary to improve conditions for sage-grouse.	CDOW, Work Group	Within DAU planning schedule or as needed
		2c. Manage big game population levels and habitat to minimize or avoid resource conflicts on grouse habitats. This could include enhancing big game habitat elsewhere to attract big game off certain grouse habitats. Examples: burning, seeding, water development, etc.	CDOW, BLM, Private Landowners & users & land managers, Work Group, Industry, NRCS, HPP	Ongoing
		2d. Manage wild horse population levels and habitat to minimize or avoid resource conflicts on grouse habitats.	BLM, CDOW, Landowners & users & land managers	Ongoing

D. Predation

1) Issues Related to Predation

Although the Work Group recognizes that no one factor is likely the cause for the shrinking of the range or population decline of sage-grouse in Garfield and Rio Blanco counties, many Work Group members believe that predation is one of the most important issues to consider. Some Work Group members believe that predator numbers have increased dramatically. The predator control setting in Colorado changed in 1996 with voter passage of Amendment 14. The constitutional amendment states "It shall be unlawful to take wildlife with any leg hold trap, any instant kill body-gripping design trap, or by poison or snare in the state of Colorado." While the intent of the amendment was to stop lethal trapping, it also curtails the control of animals causing damage. The amendment does contain an agricultural exemption allowing farmers and ranchers to lethally trap animals causing damage to their livestock and crops during one 30-day period per year. Also, governmental health departments are allowed to use lethal traps to protect public health and safety. Lethal traps remain legal to kill all types of rodents except beavers and muskrats. (You can still use mousetraps to kill mice in your house, shed or barn). Non-lethal traps can be used for scientific research, falconry, for relocation, or for medical treatment pursuant to regulations established by the Colorado wildlife commission. The text of amendment 14 is contained in Appendix B.

Some members of the Work Group note that sage-grouse are killed by predators and have always been killed by predators. These Work Group members believe that predation is not a limiting factor in sage-grouse populations provided that adequate cover is available. In addition, some Work Group members believe that predator control over broad geographic areas is impractical and will not be effective without habitat improvement. Predator control to increase production and recruitment in bird populations has been used in extreme cases such as endangered species, but has been effective and incorporated only on small, intensively managed areas.

Sage-grouse and other ground nesting birds have developed effective strategies for hiding from predators when they occupy habitat of sufficient quality. Schroeder and Baydack (2001) suggest that predation has the potential to affect the annual life cycle of sage-grouse in three primary ways 1) success of nests, 2) survival of juveniles, and 3) annual survival of breeding-age birds. However, little is known about the relative importance of predation on the viability of grouse populations.

Documented nest predators include ground squirrel, weasel, badger, elk, coyote, common raven, American crow, red fox, striped skunk, black-billed magpie and various species of snakes. Numerous species have also been documented killing and/or consuming adult sage-grouse and include Cooper's, ferruginous, red-tailed and Swainson's hawks, northern goshawks, coyote, red fox, bobcat, and golden eagle. Numerous predator species are also known to kill juvenile sage-grouse. Because of the small size of juvenile grouse, additional predators have been documented and include American kestrels, merlin, northern harrier, common raven, and weasel. Some Work Group members also feel that birds such as great horned owl, and loggerhead shrike, might kill sage-grouse in the area.

Some of the Work Group members are particularly concerned with the increased diversity of predators in local sagebrush communities. For example raccoons, striped skunk, and red fox are not believed to have inhabited sagebrush communities prior to intensive Euro-American settlement. However, humans have introduced additional food supplies (grain, garbage, carrion) and places for such predators to over-winter and rear their young (abandoned buildings, barns, haystacks). Raccoons and red fox were not considered common in western Colorado 50 years ago. In addition, raptors, eagles, and ravens now have more places to nest and perch in the form of planted trees and artificial structures built by humans. Connelly et al. (2000) suggest that as habitat has become more fragmented, the addition of nonnative predators (red fox, domestic dogs and cats) and the increased abundance of native predators (i.e. common ravens and crows) can result in decreased nest success. Red fox have been implicated in affecting nest success and the annual survival of breeding age birds. Researchers in Utah's Strawberry Valley area suggest that red fox are responsible for preying upon the sage-grouse population in that area (Flinders 1999). Red fox have been implicated in other areas, but rigorous field studies are needed to support or refute these hypotheses (Connelly et al. 2000).

Landowners are also concerned with increasing numbers of Wyoming ground squirrels. Ground squirrels have been documented as a sage-grouse nest predator, however, it is not known if ground squirrel nest predation significantly impacts sage-grouse populations. Connelly et al. (2000) suggested that several studies on nest success have found nest success to be greater than 40% and that nest predation does not appear to be a problem across the range of sage-grouse. In contrast, Gregg (1991) and Gregg et al. (1994) suggested that nest predation may be limiting grouse numbers in Oregon. Research in Moffat County has found nest success between 45-60% (Hausleitner 2003, A. D. Apa unpublished data).

Most of the Work Group believes that we need more information on specific sage-grouse predators in the local area. More information is needed on whether predators are having a negative impact on the viability of the sage-grouse population in western Garfield and Rio Blanco Counties. Research could help determine if specific predators are having a negative impact during specific periods of sage-grouse survival (e.g., nest success, juvenile survival, and adult survival).

Research is necessary before the Work Group recommends specific predator control. Any recommended control will be species and site specific. In addition, it is important to consider unanticipated effects of predator control. For example, controlling red fox and coyotes might have the unanticipated effect of increasing ground squirrel numbers, which in turn may increase sage-grouse nest predation. On the other hand, reducing ground squirrels, which are common prey for some of the predators that also prey on sage-grouse, could possibly increase other types of predation pressure on sage-grouse.

2) Conservation Actions Relating to Predation

Goal:	Objectives:	Actions:	Who:	When:
Evaluate predation of sage-grouse.	1. Move toward a better understanding of local predator/prey relationships relating to sage-grouse.	1a. Clearly define data quality objectives for monitoring & research.	Work Group	Beginning 2005
		1b. Develop plan, obtain funding for, and initiate research to monitor local predator populations and how they affect the sage-grouse population.	CDOW, Work Group, BLM, CSU Extension	As necessary
		1c. Evaluate the data (as available) & determine if continued monitoring is necessary.	CDOW, Work Group, BLM, CSU Extension, NRCS	Ongoing
		1d. If research documents that predation is having a significant negative effect on the local sage-grouse population, obtain funding and implement appropriate site and species-specific practices in accordance with CDOW and United States Department of Agriculture (USDA) p79redator management plans and policies.	CDOW, USDA, NRCS	Ongoing
	2. Maintain productive quality sage-grouse habitat to reduce predation opportunities.	2a. Use best management practices (identified in the Monsen manual) in habitat management to improve or maintain vegetation in sage-grouse habitats (see Conservation Actions for Habitat Change, and Conservation Actions for Grazing).	CDOW, Work Group, BLM, NRCS	Ongoing
	3. Reduce or	3a. Follow Conservation	Utility	Ongoing

Goal:	Objectives:	Actions:	Who:	When:
	modify factors that facilitate predation.	Actions for power lines in order to reposition new power lines and install raptor deterrents when applicable and feasible. 3b. Selectively remove trees, remove/modify raptor perches, and maintain quality sagebrush habitat, where raptor predation concerns on sage-grouse have been identified.	companies, CDOW, Work Group CDOW, BLM, Work Group, NRCS	 Ongoing

E. Energy Industry and Mineral Development

1) Issues Related to Energy Industry and Mineral Development

Development and transmission of energy and mineral resources in the geologic Piceance Basin (which includes the Parachute, Piceance, and Roan Creek watersheds) has been a possibility since at least 1920, when energy interests began acquiring lands, patents, and leases in this area. Varying efforts involving oil, oil shale, and natural gas have taken place over the years leaving relatively small footprints on the landscape, with impacts concentrated at several experimental oil shale plants and the Magnolia oil field.

Advances in drilling technology and rising natural gas demand and subsequent rising prices have led to a significant increase in natural gas drilling activity in the Parachute-Piceance-Roan area. Recently, Garfield County became the most active drilling area in Colorado. Simultaneously, oil-shale leasing has resumed, interest in oil-shale development has increased, and several companies have initiated pilot projects. The timing of this increased activity corresponds with increasing concern for the status of Greater Sage-Grouse range-wide, and locally for the population of grouse in western Garfield and Rio Blanco counties. Natural gas activity is currently the most common and constant type of human activity occurring across much of the conservation Plan area. Other mineral development (e.g. sodium minerals) is ongoing but has not been coincident or influential on sage-grouse in the Parachute-Piceance-Roan area.

Wildlife managers and local Work Group stakeholders are concerned that the amount and timing of energy and mineral development has the potential to impact Greater Sage-Grouse populations. Of particular concern is the rapidly expanding (see Table 8) nature of the natural gas activities, including exploration, increased traffic, increased number of roads, well pad spacing, associated pipelines, powerlines, compressor stations, etc. The primary dilemma faced by wildlife managers and energy operators is the close overlap in the types of terrain used by sage-grouse and the type of terrain required to access and locate energy production facilities from engineering, economic, and environmental standpoints. This common terrain is the relatively level, narrow ridge tops lying between steep, and often very deep, canyons. These ridge tops are generally where the largest patches of sagebrush are located within the area. Further complicating the situation is the fact that the suitable habitat (<20% slope) comprises a relatively small portion of the terrain in most of the area.

Table 8. Number of Drilling Permits Issued Statewide and by County, 2004-2007

Area	2004	2005	2006	2007	Pending
Garfield County	796	1509	1834	2663	405
Rio Blanco County	154	161	360	317	65
State total	2915	4373	5905	?	?

(Data current as of 2/4/2008, Colorado Oil and Gas Conservation Commission [COGCC] web site)

A key factor affecting the development of this conservation Plan is that approximately 65% of the land within the Plan area is privately owned. A large majority of that private land is owned by energy companies. While there are stipulations and regulations in place on public lands that are intended to protect key sage-grouse habitat components, similar restrictions are discretionary on private lands. Private lands encompass a majority of the wetter, higher elevation, high-quality grouse habitat. Public lands within the Plan area are generally lower and drier. The long-term persistence of Greater Sage-Grouse within the Parachute-Piceance-Roan area could be largely affected by the voluntary cooperation of private landowners. Energy and mineral development is happening and will continue to happen. It is essential to develop a plan that promotes the survival of the sage-grouse population in the area during the relatively more intense development phase of natural resource extraction.

To maintain a Greater Sage-Grouse population in the Parachute-Piceance-Roan area while developing the various energy and mineral resources, the local working group will endeavor to develop and integrate new and existing information on sage-grouse, continuously communicate and share information among all parties, develop plans and strategies for avoiding, reducing, minimizing, and mitigating impacts on grouse and grouse habitat, and to research and monitor the response of the grouse population as development continues.

The Work Group discussed whether or not to include the Colorado Conservation Plan Population Viability Analysis (PVA) report in our local Plan. The PVA was created by a consultant, hired by CDOW for the state-wide plan (Colorado Greater Sage-grouse Steering Committee, 2008). It is a tool to simulate real situations to help forecast what might happen with different risk scenarios. To our knowledge, none of the other local work groups included the PVA, in most cases because it was not available when those plans were written. It was suggested that "*we should reference it in our Plan, but we need to be clear that it is just a model, and we will not add the PVA in its entirety into our Plan. In the text of our Plan we need to include that the information presented in the PVA was the basis for much of this group's discussions and decisions. Decisions on population targets and strategies attempted to incorporate the findings of the PVA model.*" (PPR Work Group meeting summary, 4-27-07.) If in the future, this Plan is criticized, the Work Group felt we should be able to defend our decisions because of the awareness of the PVA, but we are not using it as a sole basis for our decisions. Over the next several years as more data is collected, this Work Group hopes that the PVA model will be refined with new data and cross-checked. Among the risks examined in the PVA are "Impacts of Oil and Natural Gas Development on Greater Sage-grouse Population Dynamics."

2) Conservation Actions Relating to Energy Industry and Mineral Development

Goal:	Objectives:	Actions:	Who:	When:
Maintain a viable population for Greater Sage-grouse while developing energy & mineral resources	1. Develop & consolidate maps that show important GSG habitats to guide energy industry and agencies	1.a. Develop a map that depicts SG seasonal habitat (i.e. occupied, etc.) based on current knowledge and ongoing updates. Assemble into a GIS program useable by agencies and industry.	CDOW, BLM, NRCS**,** Industry, Work Group, USFWS	Immediately and ongoing
		1.b. Design maps to fit the audience structure (leave the details out or in as needed for the focus of the presentation).	CDOW, BLM	Immediately and ongoing
		1.c. As means to evaluate extent and distribution of physical habitat modification and sources of behavioral disruption, develop real time map (GPS accuracy standards) of on-going activity, surface disturbance, and habitat reclamation status. Require accurate project delineation submitted as compatible shapefile to appropriate regulatory agencies in an ongoing collaborative fashion.	CDOW, BLM, NRCS**,** Industry, Work Group, USFWS, CDRMS	Immediately and ongoing
		1.d. Continue, integrate and accelerate current agency and industry efforts to identify, evaluate, and map grouse habitat in PPR --goal of approximately 90,000 acres by end of 2009 --obtain access on private holdings	CDOW, BLM, NRCS, Industry, Landowners	Immediately and ongoing
		1.e. Use and refine existing vegetation and other map data to develop a better understanding of piñon-juniper/mountain shrub and industrial encroachment on GrSG habitat	Industry, CDOW, BLM, Landowners	Ongoing
	2. *Improve communication* among	2.a. Incumbent on agencies to clearly define and educate industry reps on desired wildlife objectives.	Work Group, BLM, CDOW, NRCS**,**	Ongoing

Goal:	Objectives:	Actions:	Who:	When:
	agencies, industry, and affected publics involved with mining and energy development, to facilitate improved trust, working relationships, planning, and more effective management of GrSG and their habitats	Work with industry to develop matrix for 1) general guidance to understand sage-grouse habitat requirements seasonally and geographically; and 2) for site specific project analysis for well fields or mine sites.	Industry, COGCC, CDRMS	
		2.b. Incumbent on industry to clearly define and educate agency biologists on desired industry objectives for gas & mineral production; 1) develop matrix for general guidance to understand types and timing of activities necessary to produce and transport gas and/or other minerals; 2) site specific project analysis for well fields or mine sites. Including identifying and sharing benefits of new technology with wildlife officials.	Industry, Work Group, BLM, CDOW, COGCC	Ongoing
		2.c. Use local Work Group as a forum for coordination of resources for integration of ideas. • Continue the Work Group well after the Plan is done. Meeting frequency to be determine (refer to I.C. Process). • Promote and provide regular opportunities for public involvement to improve energy and mineral planning as it relates to management of GrSG and GrSG habitat.	Work Group, Industry, BLM, CDOW, counties, COGCC, CDRMS	Ongoing
		2.d. Recognizing private lease and surface rights, develop a voluntary communication process to assist the energy industry to work with LWG's in planning energy activity on non-federal surface-owned leases.	Work Group, Industry, Agencies, Landowners	Ongoing

Goal:	Objectives:	Actions:	Who:	When:
		2.e. Share energy development plans with agencies ASAP to facilitate improved planning, analysis, and management of GrSG within sagebrush habitats, recognizing confidentiality sensitivities.	Industry, Consultants, Agencies	Ongoing
		2.f. Encourage open communication between companies to entertain opportunities to reduce impacts and/or maximize benefits to GrSG	Counties, COGCC, CDOW, BLM, Work Group, Industry	Ongoing
		2.g. Encourage oil, gas, and mining companies to participate on local GrSG Work Groups.	BLM, CDOW, Industry, Landowners, Work Group, Counties, COGCC, CDRMS	Ongoing
		2.h. Promptly and frequently update information related to energy and mineral development and GrSG to foster a better understanding of impacts to the species.	Industry, BLM, CDOW, CDRMS, COGCC, Landowners, etc. (Everyone!)	Ongoing
		2.i. Communicate and improve the understanding, sharing, and acceptance of research and modeling efforts regarding GrSG and mining/energy development.	Industry, Work Group, CDOW, BLM, Landowners, NRCS, CDRMS	Ongoing
		2.j. Confer with all interested parties on current findings and new information for actions that benefit GSG to adapt accordingly.	BLM, LWG, Industry, Landowners, CDOW, COGCC BLM, CDOW, Industry, CDRMS, Landowners	Ongoing

Goal:	Objectives:	Actions:	Who:	When:
	3. Develop and implement appropriate *on- and off-site mitigation practices* within GrSG habitat	3.a. Evaluate the need for near-site and/or off-site mitigation possibilities to maintain sage-grouse populations during oil and gas development and production and energy and mineral development through mining.	CDOW, BLM, Industry, Landowners	End of 2007 and Ongoing
		3.b. Define what constitutes meaningful mitigation to meet site- and/or issue-specific GrSG population and/or habitat objectives, based on current, regularly updated information, site capacity and timeline restrictions. Monitor the response of sage-grouse population.	BLM, CDOW, Industry, Landowners, COGCC	End of 2007 and Ongoing
		3.c. Identify impediments inclusive of environmental regulation to implementing beneficial mitigation measures (e.g. storm water management).	BLM, CDOW, Industry, Landowners, COGCC, CDRMS	Ongoing
		3.d. Continue to invite/query/charge industry group with ideas that may reduce disruption of habitat. Wherever possible, incorporate site-specific COAs, SUAs, BMPs (on-site mitigation measures) on proposed operations in GrSG habitat, in accordance with decision matrix and mitigation practices (see Appendix C) consistent with lease rights, or as negotiated with operators, leasees, and landowners.	CDOW, CDOW Research, in cooperation with Industry, BLM, NRCS, CDRMS, etc.	Ongoing
		3.e. Determine whether sage-grouse will move to mitigation areas as mine and energy development sites develop in active habitat. Based on research and monitoring.	BLM, CDOW, Industry, Landowners	Ongoing
		3.f. Identify and conduct habitat enhancements on potential	BLM, CDOW, Work Group,	Ongoing

Goal:	Objectives:	Actions:	Who:	When:
		locations where there may be opportunities for off or on-site mitigation for GrSG. Identify suitable mitigation practices within those areas. Use mapping information.	Industry, Landowners	
		3.g. Consider site capability and the timeline necessary to restore areas to suitable GrSG habitat, when determining which mitigation practices should be implemented on a site-by-site basis. Use mapping information.	BLM, CDOW, Industry, COGCC, Landowners, CDRMS	Ongoing
		3.h. Conduct mitigation measures (e.g. off site habitat enhancement) prior to mine site development or expansion, or energy field development, where possible, to minimize sage-grouse population disruption.	BLM, CDOW, Industry, Landowners, Work Group	Ongoing
		3.i. Investigate, evaluate, and implement mitigation trust/banking opportunities within PPR (as the first priority) area where appropriate for GrSG habitat. Secondly consider opportunities outside of PPR area.	BLM, CDOW, Industry, Landowners, Work Group	Ongoing
		3.j. Augment populations or promote occupation in areas not influenced by development or where development is less likely.	BLM, CDOW, Industry, COGCC	Ongoing
		3.k. Refer to BMP's located in appendix for mitigation options for different phases: Planning Project Siting Construction/Drilling Completion Production & Operations Reclamation (interim & final) (check if there is a BMP that addresses water development for	Industry, CDOW, BLM, COGCC, CDRMS	Ongoing

Goal:	Objectives:	Actions:	Who:	When:
		SG).		
	4. Minimize the *impacts during gas field life cycle, mining, and energy development* in GrSG habitat, in order to sustain viable GrSG populations in Colorado.	4.a. Where substantial development may occur, prepare a plan that evaluates the impacts to sage-grouse from the entire project development, not just from individual site development.	BLM, Counties, CDOW, Industry	Ongoing
		4.b. Investigate opportunities and provide incentives to promote cluster development in key GrSG habitats. Cluster the development of roads, pipelines, electric lines, and other facilities, and use existing, combined corridors where possible.	BLM, Counties, CDOW, Industry, NRCS	Ongoing
		4.c. Investigate opportunities and provide incentives to promote GrSG conservation measures.	CDOW, BLM, Counties, Industry	Ongoing
		4.d. Where a 3 year consecutive downward trend in lek counts (as measured by the 3-year running average) is seen in areas with intense energy development, consider aggressively pursuing additional strategies to address population sustainability including: • options for increasing GrSG female survival • short duration of energy development and expedite reclamation • see "Population Augmentation" strategy section of Statewide Plan for GrSG.	Industry, BLM, Counties, COGCC	Ongoing
		4.e. Minimize disturbance/mortality during construction/development/production of oil & gas resources (see Appendix C/BMP's)	Industry, CDOW, BLM, COGCC	Ongoing
		4.f. Share the management results	All	Ongoing

Goal:	Objectives:	Actions:	Who:	When:
		and mitigation efforts that are occurring within different companies and agencies within PPR.		
	5. Research & monitoring.	5.a. Integrate and share the various research occurring in the PPR area on a regular and reoccurring basis.	All	Ongoing
		5.b. Develop and encourage opportunities to cooperate on research efforts in the PPR area. (Research could include broader topics e.g. threshold of noise tolerance, augmentation, relocation, cumulative impacts, etc.)	All	Ongoing
		5.c. Evaluate potential additional impacts from alternative energy development to minimize impacts to GrSG.	All	Ongoing

F. Recreation

1) Issues Related to Recreation

When recreational activities occur on a recurring basis in sage-grouse habitat during critical periods, such activities have the potential to disturb or alter sage-grouse habitat use. Critical periods include the breeding period, which includes strutting and nesting, and winter months when available habitat may be limited. In addition to direct disturbance, various recreational activities can also cause habitat degradation such as soil erosion and damage to plant communities.

Public recreation in the Parachute-Piceance-Roan area occurs primarily in the fall during the big game seasons and somewhat concurrently with small game hunting, primarily blue grouse. Most of this activity takes place on BLM and CDOW lands in the area, and seems to be at lower levels now than 10-50 years ago. Due to the high percentage of private land ownership (65% in occupied range, 46% within the Plan area), recreation is and likely will continue to be limited in scope in the area. However, the Work Group recognizes the potential for increases in recreational activities on public lands, including, but not limited to, hiking, mountain biking, horseback riding, OHV use, dispersed camping, cross-country skiing, snowshoeing, and snowmobiling. The Bureau of Land Management manages most public lands in the Piceance Creek drainage and these areas are, with some exceptions, open to motorized vehicles.

Another potential source of recreation disturbance to sage-grouse is viewing of the grouse themselves on leks in the spring. At this time, this is not known to be a problem, and seems unlikely to become an issue given the remoteness and difficulty in access associated with private land and poor road conditions. There are other areas in Colorado to view strutting sage-grouse that are more accessible and more likely to yield sightings of birds.

The issue of hunting in the area includes two aspects. The first is potential effects of hunting associated activities on sage-grouse. Currently, hunting of game animals in the area occurs in the fall. By fall, a sage-grouse's diet has switched primarily to sagebrush leaves, and as a result, the potential habitat for food and cover for the grouse is probably at its broadest compared with any other time of the year. Thus, although birds may be disturbed and flushed by hunters chasing other quarry, it is not a critical time for sage-grouse since their vulnerability to disturbance is relatively low during this time.

The second hunting-related issue is the potential impact of hunting sage-grouse. At that time, it was estimated that there were fewer than 100 males in the population, the number considered necessary to allow hunting. The hunting season for grouse in the Parachute-Piceance-Roan area has been closed since 1995. Due to better techniques and more consistent effort, recent (2005-2007) lek counts have averaged 195 males, well above the 100 male threshold necessary to permit a hunting season for the PPR population." The Work Group expressed little or no interest in asking for an opening of the season on sage-grouse at this time, given the potential threats from activities addressed elsewhere in this Plan.

2) Conservation Actions Relating to Recreation

Goal:	Objectives:	Actions:	Who:	When:
1. Maintain a viable population of GrSG while allowing appropriate levels of recreational use within GrSG habitat.	1. Minimize the impacts of recreation in GrSG habitat, in order to sustain viable GrSG populations and their habitat.	1.a. Develop signs and brochures that illustrate differences between GrSG and Dusky (Blue) Grouse and post in area due to overlap in habitat in area. 1.b. Monitor recreation use in area during spring and summer; if roads/trails or recreational uses conflict with sage-grouse habitat requirements, pursue management options such as seasonal use restrictions, closure, removal, re-alignments, buffers, etc.	CDOW, Landowners BLM, Landowners	Fall 2008 Ongoing

G. Water Project Development and Water Management

1) Issues Related to Water Project Development and Water Management

New water developments, or changes in existing water use, have the potential to change grouse habitat for better or for worse. An issue in some geographic areas is that plans for water reservoirs could cover important grouse habitats, potentially brood-rearing habitat and /or winter range. In some cases, significant amounts of acreage could be converted into reservoirs. Small reservoirs might be beneficial to GrSG, providing them a new water source, particularly at lower elevations (Water availability is generally not a problem above 8,000 ft). Also, changes in points of diversion of natural springs and rivers may also impact the GrSG (also more relevant in the lower areas), e.g., loss of hay meadows used as brood-rearing habitat.

2) Conservation Actions Relating to Water Project Development and Water Management

If plans for water developments and water management changes in the area begin to take shape, the Work Group should become actively involved in analyzing such plans as they arise, with an eye toward the potential effects on Greater Sage-Grouse. However, given the nature of water issues and that potential projects will arise from a variety of sources, it will be difficult to address this issue comprehensively. Therefore developing a specific set of strategies is difficult. Rather than doing so, points to keep in mind with regard to such potential are listed below:

- Encourage proponents to advise or come to Work Group with proposals
- Work informally with proponents and other interested parties within Work Group setting if possible and agreeable prior to regulatory process
- Work within established regulatory processes
- Analyze water development projects on a case-by-case basis for effects on GrSG
- Analyze changes in current water management on a case-by-case basis.

The Work Group will maintain contacts with the Colorado River Water Conservation District and the local Bluestone and Yellowjacket conservancies.

IV. MONITORING AND EVALUATION OF CONSERVATION PLANNING EFFORTS

This Plan contains over 100 conservation actions relating to 7 primary issues that the Work Group identified as factors that have the potential to affect sage-grouse populations or sage-grouse habitat in Parachute Piceance and Roan Creek drainages of Rio Blanco & Garfield Counties, Colorado.

Monitoring efforts will focus on evaluating methods of enhancing, and protecting breeding, brood-rearing, and wintering sage-grouse habitats as well as mitigation techniques for behavioral effects. Conservation actions and management efforts relating to sage-grouse and their habitats will be monitored and adaptive management applied. Adaptive management is characterized by management that monitors results of policies and/or management actions, and then integrates these results into future actions to adapt policy and management actions as necessary.

As this plan was being prepared, the U. S. Fish and Wildlife Service made an "unwarranted" listing finding for the Greater Sage-Grouse (December 2005). A court complaint was filed on July 14, 2006, by the Western Watersheds Project, alleging that the USFWS 12-month finding is incorrect, arbitrary, and unwarranted by the facts. In December, 2007, the court granted the motion by the plaintiff and the USFWS will be required to review its earlier decision to not list the species. In light of this court action, the Workgroup, going forward, should be mindful of the USFWS "Proposed Policy for Evaluating Conservation Efforts When Making Listing Decisions (PECE)." The PECE was not specifically addressed in the preparation of this plan. The policy identifies criteria USFWS will use in determining whether formal conservation efforts (such as this Plan) contribute to making the need to list a species are unnecessary. This policy is included as Appendix G.

The Work Group members recognize the need to continue to gather information and report on efforts to improve conditions for sage-grouse. Therefore, the working group will use a GIS database maintained and operated by CDOW to document habitat treatments designed to improve sage-grouse habitat in the area. The Work Group will also work with local counties to document land use changes in sage-grouse habitat. In addition, the Work Group will work with the Counties and local Land Conservation Organizations to document the number of acres of sage-grouse habitat protected through conservation easements, etc.

The primary population data that will be collected includes total number of active and inactive leks, average number of males per lek, and number of new leks located annually. The CDOW will provide an annual report of these population data to the Work Group and U.S. Fish and Wildlife Service (USFWS).

Annual meetings will be held to review and discuss the population data, to discuss and compile information on the habitat treatments completed, as well as to discuss any new information regarding sage-grouse and their habitats. Annual meetings with the Work Group will also serve as a forum to discuss and develop a yearly Annual Work Plan for the Parachute Piceance and Roan Creek drainages of Rio Blanco & Garfield Counties. The CDOW will provide the Annual

Work Plans as well as a yearly status report detailing management efforts relating to sage-grouse to the USFWS.

A. Conservation Actions Relating to Monitoring and Evaluation

Goal:	Objectives:	Actions:	Who:	When:
Continue to foster public/private partnerships to benefit sage-grouse, monitor and evaluate such actions, share information relating to sage-grouse, and provide pertinent information to the USFWS.	1. Continue to work within the sage-grouse Work Group context.	1a. Convene annual Work Group meetings.	CDOW	Beginning 2008
		1b. Develop yearly Annual Work Plan outlining planned efforts to benefit sage-grouse.	Work Group	Beginning 2008
	2. Use the concepts of Adaptive Management to maximize understanding and insure that efforts will benefit sage-grouse.	2a. Monitor the effects of treatments to benefit sage-grouse.	CDOW, BLM, Work Group	Ongoing
		2b. Integrate monitoring results to modify management actions as necessary.	CDOW, BLM, Work Group	Ongoing
	3. Document management actions completed to benefit sage-grouse.	3a. Communicate management actions and results to other members of the Work Group.	Work Group	Ongoing
		3b. Develop GIS database to document sagebrush habitat treatments in the area.	CDOW	Beginning 2008
		3c. Provide outreach to new and current landowners to increase awareness of the local Conservation Plan and best management practices.	CSU Extension, CDOW, NRCS, Work Group, Conservation Districts	Ongoing
	4. Document other impacts (positive and negative) to sage-grouse habitat as part of an overall habitat	4a. Work with Rio Blanco and Garfield Counties to be proactive in land-use planning (for the benefit of sage-grouse) and monitor land-use changes in the area.	CDOW, County Planners, Land Trusts	Ongoing

Goal:	Objectives:	Actions:	Who:	When:
	assessment. 5. Provide documentation of Work Group efforts to benefit sage-grouse and their habitat.	5a. Provide annual status report to the USFWS.	CDOW	Beginning 2008

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VI. APPENDICES

Appendix A: Available Funding Opportunities for GrSG Habitat Conservation

Table A-1. Specific funding opportunities identified for GrSG habitat conservation.

Colorado Division of Wildlife (CDOW)						
Grant / Program	**What land is eligible?**	**Length of Agreement**	**Easements**	**Cost Share**	**Applicant obligations**	**Contact Information**
Colorado Species Conservation Partnership Program (CSCP)	Any land where an easement or management plan are needed to benefit sage-grouse.	Variable	one-time, up-front payment	Variable	Develop a conservation plan and comply with the terms of the easement, or develop a plan and assist with the cost, establishment, and maintenance of conservation practices.	Ken Morgan (303)291-7404 http://wildlife.state.co.us/
Habitat Partnership Program (HPP)	All land is eligible where wildlife/human interactions occur.	Variable	N/A	Variable	Contact local District Wildlife Manager and develop proposal. Must be able to evaluate the success of project based on objectives.	Local District Wildlife Manager http://wildlife.state.co.us/
Cooperative Habitat Improvement Program (CHIP)	All private land for which the habitat improvement has been approved by the area habitat biologist	10 years	N/A	85%	Applicant must provide 15% of cost of habitat improvement and must ensure practice is maintained through the term of the contract.	CDOW (970)255-6185 http://wildlife.state.co.us/
Habitat Stamp Program	All land – primarily for deer/elk winter range and hunting and fishing opportunities	Variable	N/A	variable	N/A	Ken Morgan (303)291-7404 http://wildlife.state.co.us/

Table A-1 (con't). Specific funding opportunities identified for GrSG habitat conservation.

Natural Resources Conservation Service (NRCS)							
Grant / Program	**What land is eligible?**	**Length of Agreement**	**Rental Payments**	**Easements**	**Cost Share**	**Applicant obligations**	**Contact Information**
Conservation Security Program (CSP)	Private agriculture operation lands	5-10 years	Flat rates - based on Conservation work applied to land	N/A	50—65%	Record keeping of past and present conservation efforts	Local NRCS office www.nrcs.usda.gov
Conservation Reserve Program (CRP)	Highly erodible cropland. Marginal pastureland is also eligible.	10-15 years	Payment based on length of agreement and average rental rates for the county.	N/A	50%	Develop and follow a plan for the conversion of cropland to a less intensive use. Also, assist with the cost, establishment, and maintenance of conservation practices.	Local FSA or NRCS office. www.nrcs.usda.gov
Conservation Reserve Program Continuous Sign-up	Highly erodible cropland. Marginal pastureland is also eligible.	10-15 years	Payment based on length of agreement and average rental rates for the county	N/A	50% to 90%	Develop and follow a plan to implement riparian buffers, wildlife habitat buffers, wetland buffers, filter strips, grass waterways, shelterbelts, living snow fences, contour grass strips, salt tolerant vegetation, or shallow water areas for wildlife. Also, assist with the cost, establishment, and maintenance of conservation practices.	Local FSA or NRCS office www.nrcs.usda.gov
Environmental Quality Incentives Program (EQIP)	All private land in agricultural production is eligible; includes cropland, grassland, pastureland and non-industrial private forestland.	1-10 years	N/A	N/A	up to 75%	Develop and follow an EQIP plan that describes the conservation and environmental purposes to be achieved; assist with installation costs.	Local NRCS office www.nrcs.usda.gov
Farm and Ranchland Protection Program (FRPP)	Private land that contains prime farmland or other unique resources and is subject to a pending easement from an eligible entity.	Perpetual easement	N/A	one-time, up-front payment	N/A	Continue to use the land for agricultural purposes. Develop a conservation plan and comply with the terms of the easement.	Local NRCS office www.nrcs.usda.gov
Grassland Reserve Program (GRP)	Private land that includes grassland, forbs, or shrubs (including rangeland and pastureland); and land that historically was dominated by grasses, forbs, and shrubs and has significant value for plants and animals.	10-30 year agreement, or perpetual easement	annual payment based on length of agreement	one-time, up-front payment on perpetual	up to 100%	Develop and follow a plan for the restoration and maintenance of grasslands. If necessary, assist with the cost of restoration. Can maintain agricultural use with development of a conservation plan.	Local NRCS office www.nrcs.usda.gov

Table A-1 (con't). Specific funding opportunities identified for GrSG habitat conservation.

Natural Resources Conservation Service (NRCS)							
Grant / Program	**What land is eligible?**	**Length of Agreement**	**Rental Payments**	**Easements**	**Cost Share**	**Applicant obligations**	**Contact Information**
Wetlands Reserve Program (WRP)	Most private wetlands converted to agricultural use prior to 1985 are eligible. Wetland must be restorable and suitable for wildlife benefits.	10 years, 30 years, or perpetual easement	N/A	one-time, up-front payment	up to 100%	Develop and follow a plan for the restoration and maintenance of the wetland. If necessary, assist with the cost of restoration. Also, must give up agriculture production rights.	Local NRCS office www.nrcs.usda.gov
Wildlife Habitat Incentives Program (WHIP)	All private land is eligible, unless it is currently enrolled in CRP, WRP, or a similar program	5-15 years	N/A	N/A	up to 75%	Prepare and follow a wildlife habitat development plan; assist with installation costs.	Local NRCS office www.nrcs.usda.gov

Table A-1 (con't). Specific funding opportunities identified for GrSG habitat conservation.

U.S. Fish and Wildlife Service (USFWS)							
Grant / Program	**What land is eligible?**	**Length of Agreement**	**Rental Payments**	**Easements**	**Cost Share**	**Applicant obligations**	**Contact Information**
Landowner Incentive Program (LIP)	All private and tribal land	Variable	Yes	Short and long term	up to 75%	Personnel from state agency will need to submit application, USFWS will approve, and CDOW will administer grant in cooperation with the landowner.	Ken Morgan (303)291-7404 http://wildlife.state.co.us/
Intermountain West Joint Venture Partnership	Projects considered acceptable for funding include long-term protection, restoration, or enhancement of any bird habitat. Joint Venture emphasis is centered upon on-the ground conservation.	Up to 30 years	N/A	Yes	50%	N/A	David Klute – Colorado Representative (303)291-7320 www.iwjv.org
North American Wetland Conservation Act	State, private, Tribal, Federal?	Variable	No	Long-term	50%	Work with local USFWS office, but grant is administered through USFWS Migratory Bird Office	Local USFWS office or http://www.iwjv.org/

Table A-1 (con't). Specific funding opportunities identified for GrSG habitat conservation.

U.S. Fish and Wildlife Service (USFWS)							
Grant / Program	**What land is eligible?**	**Length of Agreement**	**Rental Payments**	**Easements**	**Cost Share**	**Applicant obligations**	**Contact Information**
North American Wetland Conservation Act, Small Grants	State, private, Tribal, Federal	Variable	No	Long-term	50%	Work with local USFWS office, but grant is administered through USFWS Migratory Bird Office (Up to $50K/grant)	Local USFWS office or http://www.iwjv.org/
Partners for Fish and Wildlife	All private land, wetland and riparian habitat has been a primary focus along with some treatment of sagebrush.	Variable, most projects delivered in 1-3 months	N/A	N/A	75-100%	Work with USFWS Biologist to develop project plan. Follow management actions for duration of wildlife extension agreement.	Bob Timberman (970) 723 4926 www.coloradopartners.fws.gov
Private Stewardship Grants Program	Private land	Variable	Yes	No	Variable	The contract and plan must provide quantifiable measures to evaluate the success of the project. The grant is administered through USFWS Ecological Services.	Local USFWS office http://grants.fws.gov/ (applications due 12/03 or 1/04)
Section 6 Conservation Grants	State, private, Tribal, Federal	Variable	N/A	N/A	up to 75%	Work with local USFWS office, but grant is administered through USFWS Ecological Services	Local USFWS office http://grants.fws.gov/
State Wildlife Grants	State, private, Tribal, Federal	Variable	Yes	Short term and long term	75% planning, 50% implementation	States, but not Tribes, must develop comprehensive wildlife management plans	Jim.Guthrie@co.state.us or local USFWS office http://grants.fws.gov/
Tribal Wildlife Grants	Tribal	Variable	N/A	N/A	100%	Up to $250,000 / tribe	Local USFWS office http://grants.fws.gov/

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Table A-1 (con't). Specific funding opportunities identified for GrSG habitat conservation.

Non-Governmental Organizations (NGOs)							
Agency / Organization	**Grant / Program**	**What land is eligible?**	**Length of Agreement**	**Easements**	**Cost Share**	**Applicant obligations**	**Contact Information**
Audubon Society	N/A	Stress bird habitat and ecosystem restoration	Variable	N/A	Variable	N/A	www.audubon.org
Pheasants Forever	N/A	Mostly private lands to acquire lands for public use.	Variable	N/A	Variable	N/A	www.pheasantsforever.org
Great Outdoors Colorado (GOCO)	Legacy Initiative/ Open Space/ Wildlife Grants	All private and public land where state agencies, non-profit conservation organizations, local governments, or private land owners are interested in conservation and land protection.	Variable	Possible	Variable, usually requires a minimum 25% match	Personnel from local governments, non-profit land conservation organizations, CDOW, and Colorado State Parks need to be submit proposal and manage contract.	www.goco.org (303)863-7522 info@goco.org
Mule Deer Foundation	N/A	All land that is critical to wildlife	Variable	Possible	Variable	Must go through USFS, BLM or one of their corporate partners	www.muledeer.org 1-888-375-3337
Quail Unlimited	N/A	All land that potentially provides habitat for quail and (sometimes) sage-grouse	Variable	Possible	Variable	Must go through USFS, BLM or one of their corporate partners	www.qu.org
Rocky Mountain Elk Foundation	N/A	All land that is critical to wildlife	Variable	Possible	Variable	Must go through USFS, BLM or one of their corporate partners	www.rmef.org
National Fish and Wildlife Foundation	N/A	Special grants for research on all land that potentially provides habitat for fish and wildlife.	Variable	Possible	Minimum 1:1	Non-federal partners, community-based organizations, tribes, educational institutions, and other non-profit organizations.	www.nfwf.org

Table A-1 (con't). Specific funding opportunities identified for GrSG habitat conservation.

Non-Governmental Organizations (NGOs)							
Agency / Organization	**Grant / Program**	**What land is eligible?**	**Length of Agreement**	**Easements**	**Cost Share**	**Applicant obligations**	**Contact Information**
National Forest Foundation	N/A	On or adjacent to National Forests or Grasslands	Variable	N/A	1:1 ratio with private	Non-federal partners, community-based organizations, tribes, educational institutions, and other non-profit organizations.	www.natlforests.org
North American Grouse Partnership	N/A	All land that provides habitat to sage or other grouse	Variable	N/A	Variable	Non-federal partners, community-based organizations, tribes, educational institutions, and other non-profit organizations.	www.grousepartners.org
The Nature Conservancy	N/A	All private and public land where agencies, non-profit conservation organizations, local governments, or private land owners are interested in conservation and land protection.	Variable	Possible	Variable	Federal and non-federal partners, community-based organizations, tribes, educational institutions, and other non-profit organizations.	www.nature.org
National Wildlife Turkey Federation	N/A	All private and public land where agencies, non-profit conservation organizations, local governments, or private land owners are interested in conservation and land protection.	Variable	Possible	Variable	Federal and non-federal partners, community-based organizations, tribes, educational institutions, and other non-profit organizations.	www.nwtf.org

Appendix B: Amendment 14 – Predator Control Changes

Amendment 14: Prohibited Methods of Taking Wildlife (1996)

Be it Enacted by the People of the State of Colorado:

Article XVIII of the Constitution of the State of Colorado is amended by the addition of a new Section 12, to read:

Section 12. Prohibited methods of taking wildlife.

(1) It shall be unlawful to take wildlife with any leghold trap, any instant kill body-gripping design trap, or by poison or snare in the state of Colorado.

(2) The provisions of subsection (1) of this section shall not prohibit:
(a) The taking of wildlife by use of the devices or methods described in subsection (1) of this section by federal, state, county, or municipal departments of health for the purpose of protecting human health or safety;
(b) The use of the devices or methods described in subsection (1) of this section for controlling:
(I) wild or domestic rodents, except for beaver or muskrat, as otherwise authorized by law; or
(II) wild or domestic birds as otherwise authorized by law;
(c) The use of non-lethal snares, traps specifically designed not to kill, or nets to take wildlife for scientific research projects, for falconry, for relocation, or for medical treatment pursuant to regulations established by the Colorado wildlife commission; or
(d) The use of traps, poisons or nets by the Colorado division of wildlife to take or manage fish or other non-mammalian aquatic wildlife.

(3) Notwithstanding the provisions of this section 12, the owner or lessee of private property primarily used for commercial livestock or crop production, or the employees of such owner or lessee, shall not be prohibited from using the devices or methods described in subsection (1) of this section on such private property so long as:
(a) such use does not exceed one thirty day period per year; and
(b) the owner or lessee can present on-site evidence to the division of wildlife that ongoing damage to livestock or crops has not been alleviated by the use of non-lethal or lethal control methods which are not prohibited.

(4) The provisions of this section 12 shall not apply to the taking of wildlife with firearms, fishing equipment, archery equipment, or other implements in hand as authorized by law.

Appendix C: Best Management Practices (BMP's)

BEST MANAGEMENT PRACTICES (BMP's)
Methods to Reduce Impacts to Greater Sage-grouse
Kim Kaal, CDOW & Parachute, Piceance Roan Creek Subcommittee developing the local Plan for Greater Sage-grouse Conservation, July 2007

Best management practices (BMP's) are recommendations to guide landowners, land users, and land managers to lessen the impact of oil and gas development activities on Greater Sage-grouse through mitigation, less disruptive drilling and production practices, and improved infrastructure development. They are a site-specific means to minimize negative effects on sage-grouse. These practices are intended to be used as components of, or in addition to, requirements of an APD or leasing agreement. They can be used alone as single actions or together in a comprehensive management program. The intent of this list is to provide action-oriented management practices based on the latest science and to encourage voluntary implementation of these practices.

This list was compiled to provide land managers, owners, and users, with tools that they can use; this document does not have regulatory authority to enforce their implementation. Only the leasing authority, when appropriate, can require any actions on the part of a leaseholder. It is, however, important to note, that the implementation of as many of these practices as feasible, will serve to minimize the impacts of oil & gas activity on sage-grouse and assist in the conservation of these birds. The BMP's listed here directly relate to many of the strategies created in the PPR plan. As such, it is important to use a comprehensive approach to the strategies and BMP's.

There are difficulties with providing a list of specific best management practices. Changing industry knowledge and practices, new scientific information, and the challenges of field verification and monitoring all present obstacles in the development and maintenance of such a list. The best known management practices must inherently evolve with the changing conditions in industry, wildlife management, and technology. These are not "one-size-fits-all" tasks that can be used for every situation, nor are they a cookbook to create a specific product. It must be understood, therefore, that close collaboration in the implementation of these guidelines is necessary between industry and wildlife personnel.

Siting and Construction

- Involve CDOW personnel early in the survey for wildlife issues prior to development. Plan around issues accordingly.
- In the project planning phases use Natural Diversity Information Source and any additional habitat/wildlife mapping available prior to development.
- Consult with CDOW on surface occupancy within 4 miles of any greater sage-grouse leks within suitable habitat.
- Within suitable sage-grouse habitat, avoid all surface disturbance within 0.6 mile of any Greater Sage-Grouse lek between March 15 and May 15, except when such activities would not disrupt breeding or nesting activities, as determined in consultation with CDOW (and BLM if on public land)..

- Within suitable sage-grouse habitat, avoid breeding/nesting season (March 15 – July 7) road construction, drilling, and well completion within 4 miles of any active or potentially active Greater Sage-Grouse leks except when such activities would not disrupt breeding or nesting activities, as determined in consultation with CDOW (and BLM if on public land).
- Within 4 miles of an active or potentially active sage-grouse lek, keep total surface disturbance within sage-grouse habitat to 1% or less. (After reclaimed lands re-grow sufficient native vegetation they would no longer be counted towards the calculated percentage.)
- Within suitable sage-grouse habitat, avoid breeding/nesting season (March 15 – July 7) travel on existing roads within view of potentially active sage-grouse leks to portions of the day between 9:00 am and 5:00 pm .
- Use state of the art technology to protect existing vegetation. Use of mats if possible for drilling operations to preserve topsoil and vegetative root stock.
- Wherever mats cannot be used, conserve soil horizons and segregate topsoil from subsoil. Manage topsoil to maintain soil microbe health and viability.
- Minimize habitat fragmentation by limiting surface disturbance by reducing the number of well pads per section.
- Control public access in suitable habitat (i.e. gate roads, etc.). Minimize the impact of newly developed or opened areas by consolidating facilities.
- Perform voluntary onsite (i.e. CDOW & BLM) on private lands to identify issues prior to ground disturbance.
- Consolidate pipeline corridors and economize gas transportation. Encourage cooperative gas carrying agreements.
- Place road and pipeline right-of-ways such that they avoid critical habitat and mitigate their effects wherever possible.
- Cluster wells on multiple well pads and place associated production to maximize interim reclamation of well pads.
- Consolidate oil and gas production facilities to reduce disturbance to wildlife and minimize long term impacts. Reduce the number of locations where water and oil would be hauled off by truck.
- Preplan and adequately size infrastructure and facilities to accommodate current and future gas production.

<u>Drilling Operations and Production</u>

- Simultaneously complete wells to facilitate faster drilling and development rates.
- Strive to centralize hydraulic fracturing operations to minimize surface impacts.
- During production phase restrict well site visitations in breeding season (Mar. 1 – May 15) within 0.6 miles of active and potentially active GrSG leks to portions of the day after 9:00 am and before 5:00 pm.
- Strive to economize visitation to wells by use of multi-function contractors.
- Use early and effective reclamation techniques, including interim reclamation, to speed return of disturbed areas to use by grouse. (May require multiple reclamation efforts and multiple soil amendments.)
- Reduce long-term footprint of facilities to the smallest practical space.

- Utilize reclamation seed mixes consisting of native bunchgrasses, forbs and appropriate subspecies of big sagebrush.
- Practice reclamation techniques that speed recovery of pre-existing vegetation. (e.g. brush-beating of sage brush for site clearance, retention of topsoil with native seed)
- Avoid aggressive, non-native grasses (e.g. intermediate wheatgrass, pubescent wheatgrass, crested wheatgrass, smooth brome, etc) in reclamation seed mixes.
- Make every effort to aggressively control noxious and invasive weed species based on weed management plan that strives to minimize the impact to non-target plant species.
- Recycle and reuse water on site where possible to reduce truck traffic. (i.e. closed loop).
- Educate employees and contractors on best management practices, environmental regulations, and raise awareness on sage-grouse needs.
- Encourage industry participation in CDOW's Operation Game Thief program and immediately report all potential poaching incidents. Educate industry and their contractors on the importance of poaching and wildlife harassment mitigation.
- Create development plans to phase development to maintain sage-grouse habitat.
- Install automated systems, including high tank alarms, emergency shut down and facilitate remote monitoring.
- Expeditiously skim and eliminate oil from produced water ponds and reserve pits, and exclude wildlife and sage-grouse with fencing and or netting.
- Protect wetlands, drainages, and riparian areas from erosion, sedimentation and spills. Map wetlands prior to development to identify and properly permit these sensitive areas. Restore to functional condition & reclaim areas of erosion.
- Consider wetland banking if feasible.
- Facilitate increased communication and cooperation between stakeholders, companies and agencies.

<u>Transportation</u>

- Manage travel and prohibit off road travel. Manage development of road networks through transportation planning, and reduce habitat fragmentation.
- Restrict and monitor vehicular speed to reduce wildlife collision potential, increase safety, and minimize dust generation.
- Encourage carpooling, transportation coordination or provide mass transport options for workers to work sites. Consider advantages of man camps.

<u>Environmental</u>

- Restore functional wetlands.
- Spread quick germinating site adapted native seed or sterile non-native for interim reclamation on cut and fill slopes of well pads and roads. Right-of-way are final reclamation not interim.
- Develop site specific reclamation plans and consult with CDOW on seed mixes, apply seed most effectively during the late fall and early winter. Assess reclamation success at least annually through photo documentation, vegetation plots, documentation of invasive weeds and erosion. Evaluate reclamation in different areas that represent different elevations, vegetative communities, slope aspects, water proximity.

- Cooperate with CDOW on wildlife management issues. Provide opportunities for hunter outreach, education and conservation on private lands. Consider hunting leases on private lands or land exchanges.
- Compile maps containing wildlife information including mule deer, elk, sheep, sage-grouse, raptor, wildlife usage etc.
- Track wildlife habitat improvements or changes on maps, photographs, and other documentation.
- Monitor and map wildlife presence or usage areas. Document using photographs, maps and annual reports as to deer and elk usage. Identify locations of native fish (Cutthroat trout) and consider stream habitat improvements. Compile information on maps to track changes and document occurrences.
- With the exception of exclusionary fencing install high tensile or post and rail fences and or remove all fencing that is a hazardous to SG.
- Install raptor perch deterrents on fences in sage-grouse habitat.
- Encourage retrofitting of existing powerlines and other overhead structures to deter raptor perching where utility corridors impact Greater Sage-grouse seasonal habitats.
- Construct grazing management plans and annually access grazing regiment to meet SG habitat requirements. (check grazing strategy for more detail needed)
- Engage in or fund CDOW and private research to develop methods for impact reduction or habitat improvement.
- Reduce noise effects using special mufflers, equipment housing, installation of sound barriers, earthen berms, etc. in particularly sensitive SG areas.
- Apply certified weed free mulch to reclaimed areas to preserve seed and maintain soil moisture.
- Allow no pets on site and report feral animals to County Animal Control Officers.
- Fence livestock out of newly reclaimed areas where appropriate or practical until reclamation becomes established. Once fences are no longer needed removing fencing material and dispose of properly.
- Consult with CDOW/BLM/USFS on wildlife habitat enhancement projects, reclamation planning, noxious weed control, riparian habitat restoration, grazing management, geographic area specific seed mixes.
- Consider putting lands under conservation easement.
- Maintain voluntary compliance on private lands with all state and federal environmental regulations.

<u>Adaptive Management & Monitoring</u>

- <u>The PPR LWG encourages creative solutions to allow for both energy development and the persistence sage-grouse in the Piceance Basin. Exceptions to timing limitations and limitations on surface disturbance acres may be granted in order to allow implementation of other strategies designed to minimize impacts to sage-grouse (e.g. temporally clustered development). Alternate strategies must be based on the best available science and agreed to by the Colorado Division of Wildlife.</u>
- <u>All strategies implemented to minimize impacts to sage-grouse during energy development must be continually evaluated for effectiveness. If the three-year running</u>

average high male lek count continually declines for three years, consider changing strategy.

REFERENCES:

- COGCC Rules and Regulations http://oil-gas.state.co.us/
- BLM and Forest Service "Gold Book" Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development http://www.blm.gov/bmp/goldbook.htm
- Low-Volume Roads Engineering Best Management Practices Field Guide http://ntl.bts.gov/lib/24000/24600/24650/Index_BMP_Field_Guide.htmBLM
- Western Governors Association Coal Bed Methane Best Management Practices Handbook (http://www.westgov.org/wga_reports.htm)
- EPA's National Menu of Stormwater Best Management Practices http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm
- EPA's Storm Water Pollution Prevention Plans for Construction Activities http://cfpub.epa.gov/npdes/stormwater/swppp.cfm
- Weed control guidance http://www.blm.gov/weeds/PullingTogether/PullingTogether.pdf.
- CDOW Strategic Plan http://wildlife.state.co.us/About/StrategicPlan/
- Colorado Weed Management Association http://www.cwma.org/
- CDOW fencing standards guidance
- COGCC wildlife policy
- CDOW main (303) 297-1192
- COGCC main (303) 894-210

Appendix D: Explanation of the 1976 Lek Counts and Numbers Used

Explanation of the 1976 Lek Counts and the Numbers Used
John Toolen, December 2007

The most extensive and complete lek count information for the Piceance Creek area prior to the turn of the century is contained in the report "Survey of sage grouse strutting ground complexes and seasonal use areas within the Piceance Basin Wildlife Habitat Area, Progress Report, 12/20/1977, Colorado Division of Wildlife," widely known within the CDOW as "the Krager Sikes Act report."

The report's lek count information, while more extensive and complete than most data prior to 2000, has its own set of gaps and peculiarities, and I wanted to document the various constraints and limitations of this information as well as explain how I dealt with these issues in coming up with the numbers reported for the year 1976 used and cited in the conservation Plan. I wanted to use this information as a historical reference point, if only for the purpose of being able to state whether or not we think that we are counting more or fewer grouse in the area today than we did in the past.

Peculiarities of 1975-1977 data:

- Actual number of birds counted was not reported; rather, the number of birds counted at each lek was reported as being within a "range." The ranges were set at 1-2, 3-5, 6-15, and 15+ (which more logically could be called 16+). This presents difficulties in comparing data from these years to other years when actual counts were reported. One can take the mid-point of each range and report it, but how do you deal with "15+"? The text in the report does state that all leks were small, "less than 25 birds."
- The report does specifically state that the counts were of males or all birds present, though it does report that cock attendance at 84 Mesa decreased from 5 in 1971 to 1 in 1974.
- Counts were not conducted at the 28 leks reported in each year; rather, 3 leks were counted in 1975, 20 in 1976, and 5 in 1977.
- There was no overlap of counts among years, with the possible exception of 84 Mesa, which was reported as "last sighting, 1974."
- It is not stated or noted definitively when the 84 Mesa lek was visited during the 3-year period, or whether or not it was visited in all of the 3 years.
- No lek other than 84 Mesa was reported as having "zero" birds during 1975-1977. We do not know if that means that other leks were visited and not recorded if birds were absent, or if no other leks were visited.
- Other data was available for other leks not counted by Krager's crew.

What I Did With the Data and Why

- I assumed the numbers reported were males, based on reference to 84 Mesa in text of report and statement quoted in next bullet point.
- I used 24 birds as the maximum number of males seen at a lek, based on the statement in the text that "the leks discovered were small (less than 25 strutting cocks)…" The highest whole number less than 25 is, of course, 24.
- I set up a spreadsheet with three columns for each year: minimum, middle and maximum. I put in numbers the following way: **Range 1-2**: 1, 2, 2. **Range 3-5**: 3, 4, 5. **Range 6-15**: 6, 11, and 15. **Range 15+ (16-24**): 16, 20, 24.
- I also included data from other count sources as available from eight other leks. Three of these leks overlapped in non-count years with 3 of the 28 leks in the Krager report. I included available data from other areas in order to make the closest comparison with current numbers which cover leks not included in the Krager report. These numbers are reported in the spreadsheet as the same number for each category of "minimum, middle, and maximum" (e.g., 4,4,4).

Results

- I disregarded the numbers from 1975 and 1977. Full counts were not done in those years by Krager's crew (3 leks in '75 and 5 in '77); unfortunately, leks counted in those years were not counted in 1976. One could conceivably lump those counts with the 1976 counts, but year-to-year variability can be high, and I decided no to do this.
- The minimum, middle, and maximum numbers reported for 1976 are 204, 284, and 350 males, respectively. What this means is that the only "real" number that can be stated as fact is 204. We know that there were at least 204 males on observed leks in the area because they were actually seen. The numbers for middle and maximum are more speculative. The high number of 350 could conceivably be higher; there is no way to know if all the birds present were actually seen. On the other hand, the way the data were presented, we can't really assume that the maximum numbers of birds in each range were seen, although it is "possible," if improbable, that 350 birds were seen and additional birds went undetected.

We can say for certain that 204 birds were seen on 28 different leks in the spring of 1976. This number is probably lower than the number of birds actually there, but because of the peculiarities of the number reports, we will never know for sure. So I decided to add, somewhat conservatively and arbitrarily, to add 30 males to the count by Krager. This number (234) is carried forward into the conservation Plan as the "official" number of males reported in 1976.

Appendix E: CDOW Lek Definitions and PPR Lek Location Map

Abstract

This dataset was created by the Colorado Division of Wildlife for the Colorado Greater Sage Grouse Conservation Plan (CCP). The dataset was created by merging individual population lek data received from various CDOW Wildlife Conservation and Terrestrial biologists.

The following defines the CCP Status field:

- Active lek: A display area that has been attended by >=2 male sage-grouse in >= 2 of the previous 5 years.

- Inactive lek: A display area that has not been utilized (no male sage-grouse) for display or breeding in the last 5 years.

- Historic lek: A display area that has not been utilized for display or breeding in the last 10 years.

- Potentially active lek: A lek for which there is insufficient information to accurately categorize into active, inactive, or historic. Additionally, leks with male sage-grouse displaying or breeding in the last 5 years but does not meet activity status (>=2 birds for >=2 years of the last 5 years) are considered "potentially active". This definition is similar to the "unknown" category used in the Colorado Conservation Plan (CCP) and CDOW Species Activity Maps. The name has been changed for this Plan to make a distinction between leks in this population, for which we are gathering information annually, versus leks in other areas (particularly the larger populations in Moffat and Jackson counties) where many lek sites are not always annually due to the number of leks and the time it would take to get to all of them each spring.

All data is the best available. Inconsistencies and errors may be present. Some leks where not mapped because of wrong or missing location information. This data shall not be redistributed without the consent of the Colorado Division of Wildlife.

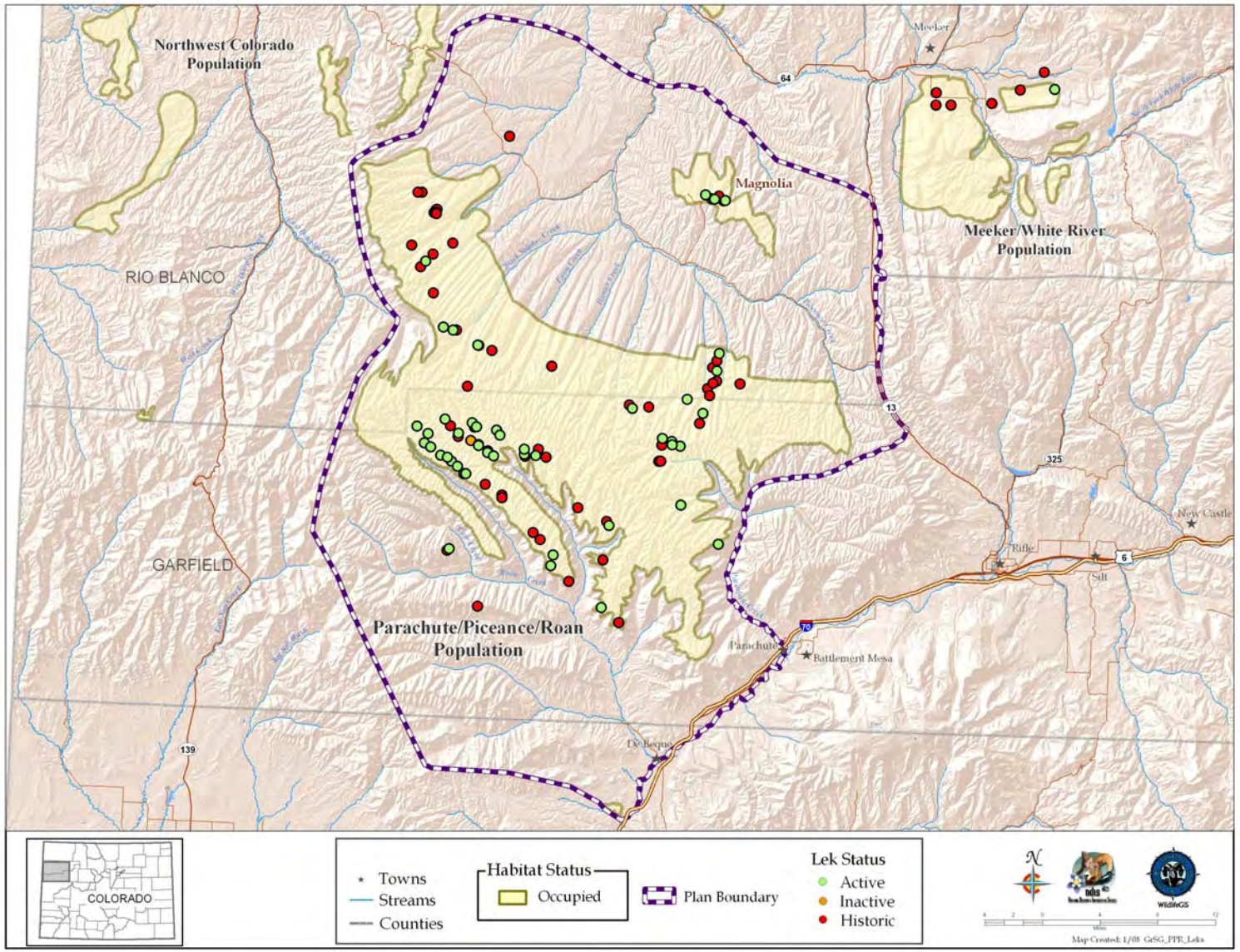

Figure F-1. PPR Lek Locations as of 2007

Appendix F: PPR Greater Sage-Grouse Habitat Mapping Summary

PPR Greater Sage-Grouse Habitat Mapping Summary

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Purpose and Need

In order to develop landscape-scale conservation strategies specific to the PPR, the BLM (White River Field Office) initiated a 3 year, landscape-level greater sage-grouse habitat inventory for the Piceance Basin in the summer of 2006. The PPR population is unique because the available habitat is naturally fragmented due to topography and because sagebrush parks are often interspersed with mountain shrubs. The habitat inventory is being conducted on both public and private land and will provide critical local information on the quantity and quality of available sage-grouse habitat in the PPR at a scale not possible from state or national mapping efforts. Specifically, the habitat inventory will provide: 1) a biologically-based estimate for the number of acres of sage-grouse habitat in the Piceance Basin, 2) the spatial arrangement of suitable habitat and unsuitable habitat, and 3) the quality of available habitat (i.e. herbaceous understory, encroachment from pinyon/juniper, etc).

The primary objective of the Piceance Basin sage-grouse habitat inventory is to create a relatively simple landscape-scale map of the different vegetation types found within potential sage-grouse habitat. Since the map is GIS-based, it can easily be shared, updated, and overlaid with other landscape features such as leks, roads, well pads, etc. We plan to use the habitat inventory map as a means to: 1) determine the suitability of specific areas as potential sage-grouse habitat, 2) prioritize areas in need of habitat restoration, and 3) evaluate land uses that may impact either suitable habitat or restoration efforts.

Computer Model of Potential Habitat

We began by developing a computer model of potential sage-grouse habitat within the overall range established by the CDOW for the PPR population. We identified potential sage-grouse habitat using a GIS (geographic information system) model based on slope and vegetation type. We used the Colorado Vegetation Classification Project (CVCP) data and included 19 vegetation classes that included grasses, forbs, sagebrush (*Artemisia tridentata),* rabbitbrush (*Chrysothamnus* spp.), and mountain shrubs. We did not include drainages and used a 75m buffer around drainages to remove them from the model. Slope was generated from a DEM (digital elevation model) and was originally limited to 15% or less. Not including the Magnolia area, the computer model estimated 38,613 acres of potential sage-grouse habitat (including both public lands and private property) for the PPR population.

While the computer model is soundly based on habitat requirements, we have always considered it a work in progress and we have been updating our estimate of potential habitat as we gain more local information. In some areas, the model overestimates habitat by including habitat types that are not suitable sage-grouse habitat such as aspen, oak/serviceberry, and pinyon/juniper. In other areas, the model underestimates habitat by not including the basins at the

tops of drainages. In response to the observation of sage-grouse using areas outside of the modeled habitat, we ran the model again using a 20% slope cut-off instead of the original 15% slope cut-off. Using the 20% slope model, we estimated 55,170 acres of potential sage-grouse habitat (Figure F-1).

Habitat Inventory Map

The next step was to ground-truth the vegetation types within the computer model. We went to areas identified by the computer model as potential habitat and classified them into general habitat categories based on the vegetation type present at the site: oak/serviceberry (OS), aspen (AS), pinyon/juniper (PJ), grass (GR), rabbitbrush (RB), mountain shrub (MT), and sagebrush (SG). We designated mountain shrub sites as those sites where ≥25% of the shrub cover (excluding rabbitbrush) at the site was composed of bitterbrush, serviceberry, and/or snowberry. At representative sites, we used 30m line transects to measure vegetation. Shrub cover was estimated using the line intercept method, forb and grass cover was estimated using the Daubenmire method, and visual obstruction was estimated using a Robel pole.

Approximately 9,885 acres and 29, 205 acres were mapped during the 2006 and 2007 field seasons, respectively (Figure F-2). In addition to the 204 vegetation transects, there are an additional 177 photo points. Herbaceous understory and shrub composition information was collected at representative rabbitbrush sites (n=3), mountain shrub sites (n=111), and sagebrush sites (n=90). There was no significant difference in herbaceous cover between mountain shrub and sagebrush sites. The most obvious difference between the two types of sites is simply the composition of shrubs at the site. Research from the Colorado Division of Wildlife on habitat use by radio-collared PPR birds will help resolve whether or not mountain shrub is important sage-grouse habitat. Since we record shrub cover by species, we will be able to go back and look at this data again as research progresses and will be able to identify sites that are an equal mixture of several shrub species (e.g. bitterbrush, snowberry, serviceberry, rabbitbrush, sagebrush, serviceberry) or sites that are dominated by only a few species (e.g. sagebrush and serviceberry).

One of the primary products of the sage-grouse habitat inventory is the habitat type map. The map is GIS-based and can be overlaid with other shapefiles to see the spatial arrangement of habitat types in relation to other landscape features such as leks, roads, etc. Since it covers such a large area, it is difficult to show habitat types for the entire inventoried area on a small map. Figure G-3 shows a portion of the habitat inventory map for an area west of the Sprague Gulch Road and Divide Road junction. While the map shows mountain shrub sites and sagebrush sites as discrete units, it is important to remember that in reality there is a gradient between them. In some areas, the habitat inventory closely follows the modeled habitat but in other areas we have mapped acreage outside of the model. The map shows the spatial arrangement of the habitat types but it does not show areas in need of habitat restoration. We found it difficult to map encroachment and habitat quality and instead use the site photos and transect data to convey that information.

A Work in Progress

It can not be overemphasized that our estimate of potential habitat is only an initial estimate and that it is subject to revision as we gain more local knowledge. We are trying to use our habitat inventory together with the computer models to estimate potential habitat. It is critical that we also consider how well those methods match the areas that the birds are actually using. We plan to work closely with CDOW to determine how well our model of potential habitat and

the habitat inventory map matches their location data from radio-collared birds and to make adjustments as necessary.

While this data is preliminary and incomplete, it is already proving valuable. We are using this information to improve our estimate of the acreage of sage-grouse habitat. We have also used this information to identify several potential areas for habitat restoration work based on dense shrub cover, low understory cover, tall serviceberry shrubs, or the encroachment of pinyon/juniper. Our goal over the 2008 summer field seasons is to complete the PPR habitat inventory for all sage-grouse habitat within the White River Resource Area. To do so, it is critical that we continue our existing partnerships with private landowners and establish new partnerships.

Partners

As mentioned above, the habitat inventory is being conducted on both public and private land. We are grateful to the following landowners for allowing us permission to use their land to access public land and/or to conduct the habitat inventory on their land: Jim Brennan, ConocoPhillips, J. Lynn Dougan, EnCana, ExxonMobil, Torrence Hughes, Dan Johnson, Pat Johnson, Tim Mantle, Jerry Oldland, Orion Energy Partners, Shell, and Tim Uphoff.

We would also like to thank EnCana for providing $34,000 to help fund this project in 2006 and 2007. In 2007, CDOW provided one technician and also provided housing for another technician at the Little Hills bunkhouse.

We hope to continue these partnerships in the future and to develop new partnerships with other landowners in the Piceance Basin.

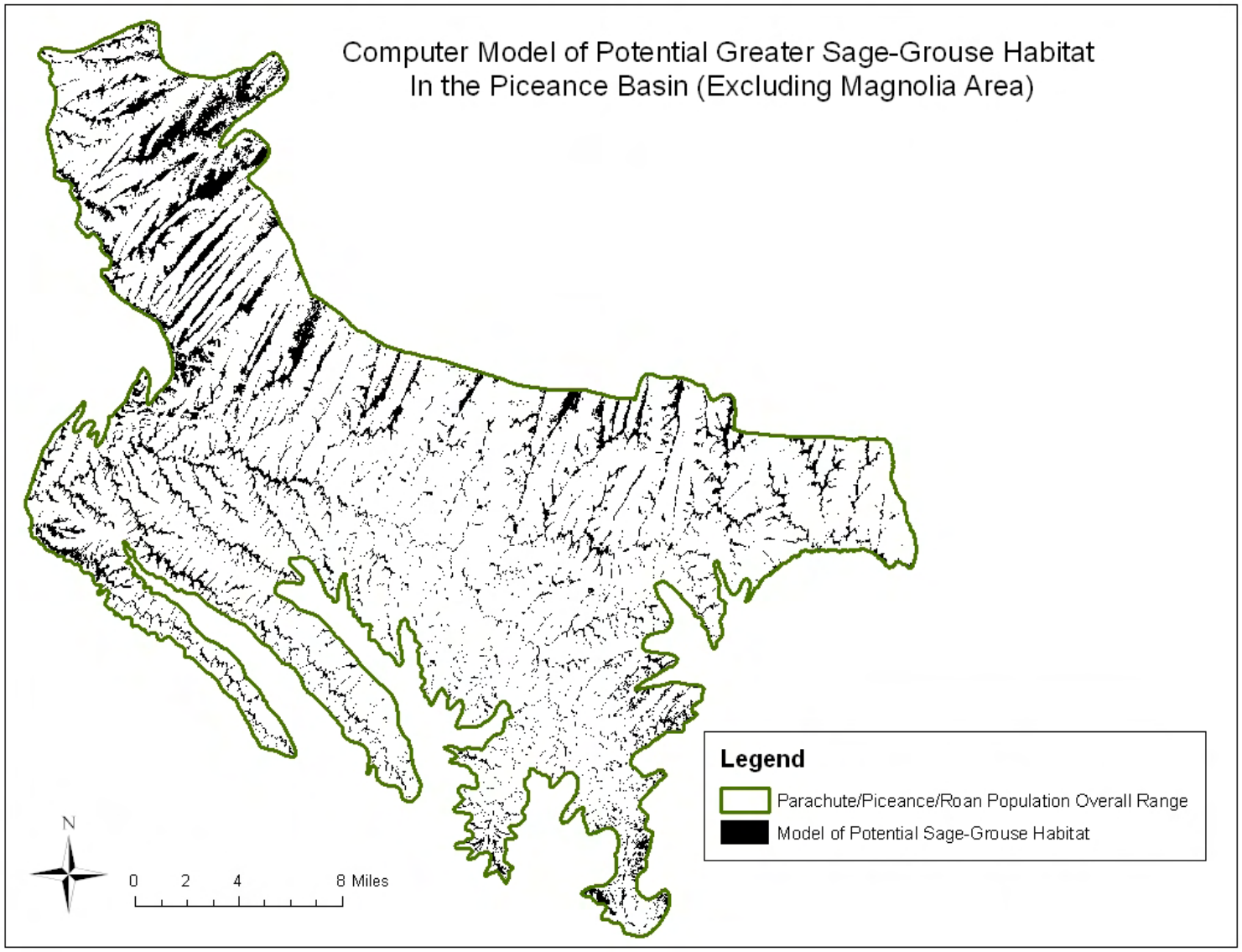

Figure F-1. Computer Model of Potential Greater Sage-Grouse Habitat in the Piceance Basin (Excluding the Magnolia Area)

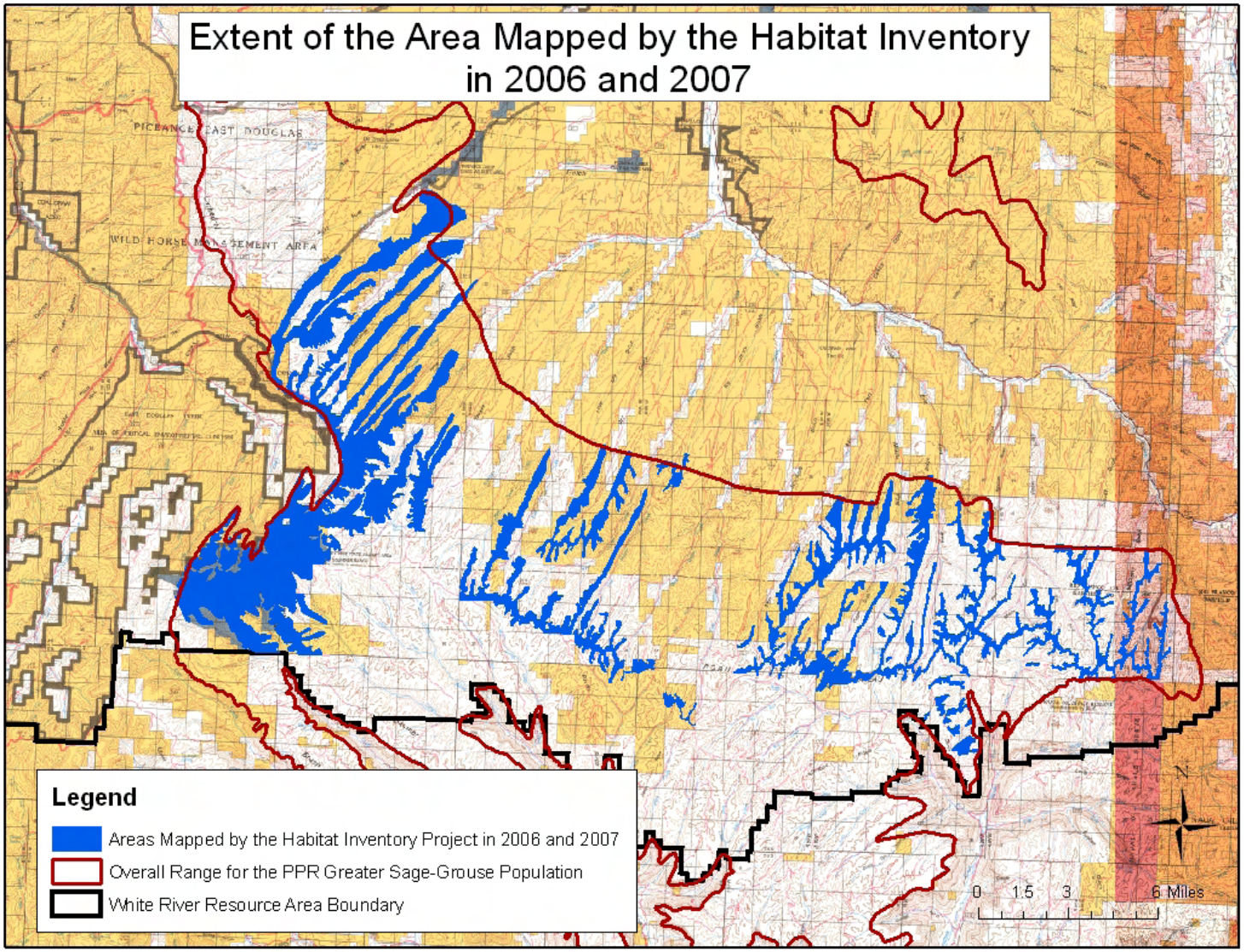

Figure F-2. Areas mapped for sage-grouse habitat inventory during the 2006 and 2007 field seasons.

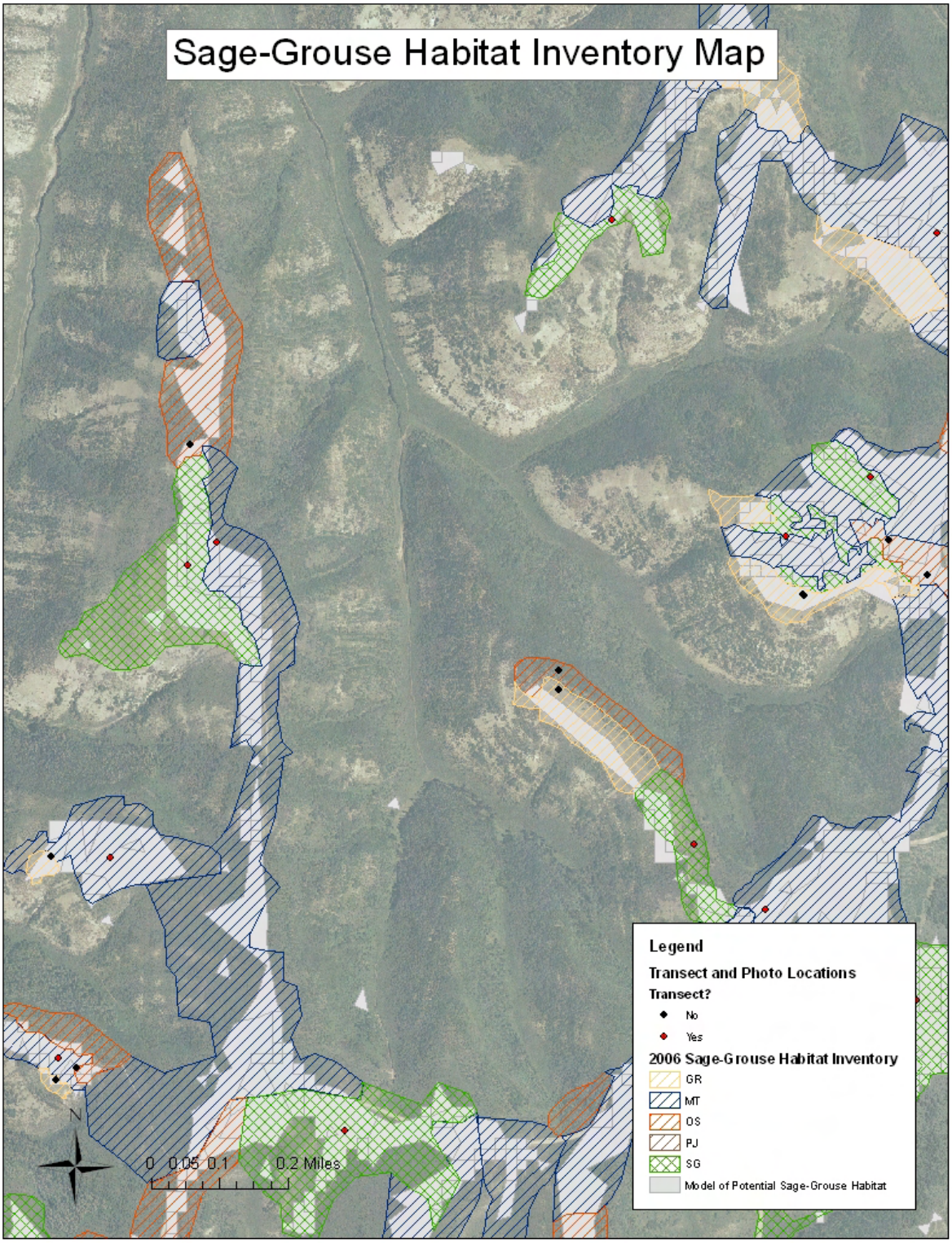

Figure F-3. An example of the sage-grouse habitat inventory map for an area west of the Sprague Gulch Road and Divide Road junction. (GR=grass, MT=mountain shrub, OS=oak/serviceberry, PJ =pinyon/juniper, SG=sagebrush)

Appendix G: USFWS "Proposed Policy for Evaluating Conservation Efforts When Making Listing Decisions

U.S. Fish & Wildlife Service / National Oceanic & Atmospheric Administration

Proposed Policy for of Conservation Efforts When Making Listing Decisions

On June 13, 2000, the Fish and Wildlife Service and the National Marine Fisheries Service (Services), published a draft policy for the evaluation of conservation efforts when making listing decisions under the Endangered Species (Act). While the Act requires us to consider all conservation efforts being made to protect a species, the policy identifies criteria we will use in determining whether formalized conservation efforts contribute to making listing a species as threatened or endangered unnecessary. The policy applies to conservation efforts identified in conservation agreements, conservation plans, management plans or similar documents developed by Federal agencies, State and local governments, Tribal governments, foreign governments, businesses, organizations, and individuals.

What is the purpose of this policy?
We have proposed this policy in order to ensure consistent and adequate evaluation of formalized conservation efforts (conservation efforts identified in conservation agreements, conservation plans, management plans, and similar documents) when making listing decisions. We have also proposed this policy to facilitate the development of conservation efforts that sufficiently improve a species' status so as to make listing the species as threatened or endangered unnecessary.

Does the policy specify the level of conservation, or types of conservation, needed to make listing unnecessary?
No, the policy does not provide guidance for determining the level of conservation or the types of conservation efforts needed to make listing unnecessary. Also, the policy does not provide guidance for determining when parties should enter into agreements or when a conservation effort should be included in an agreement or plan. *The policy provides guidance only for evaluating the certainty of implementation and effectiveness of formalized conservation efforts.*

What authority does the Service have to implement this policy?
Section 4(a)(1) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1533(a)(1)) states that we must determine whether a species is threatened or endangered because of any of the following five factors:

(A) the present or threatened destruction, modification, or curtailment of its habitat or range;

(B) overutilization for commercial, recreational, scientific, or educational purposes;

(C) disease or predation;

(D) the inadequacy of existing regulatory mechanisms; and

(E) other natural or manmade factors affecting its continued existence.

Although this language focuses on impacts negatively affecting a species, section 4(b)(1)(A) requires us also to "tak[e] into account those efforts, if any, being made by any State or foreign nation, or any political subdivision of a State or foreign nation, to protect such species, whether by predator control, protection of habitat and food supply, or other conservation practices, within any area under its jurisdiction, or on the high seas." Read together, sections 4(a)(1) and 4(b)(1)(A) and our regulations at 50 C.F.R. section 424.11(f) require us to consider any State, local, or foreign laws, regulations, ordinances, programs, or other specific conservation measures that either positively or negatively affect a species' status. The manner in which the section 4(a)(1) factors are framed supports this conclusion. Factor (D) for example— "the inadequacy of existing regulatory mechanisms"—indicates that we might find existing regulatory mechanisms adequate to justify a determination not to list a species.

In addition, we construe the analysis required under section 4(a)(1), in conjunction with the directive in section 4(b)(1)(A), to authorize and require us to consider whether the actions of any other entity, in addition to actions of State or foreign government, create, exacerbate, reduce, or remove threats to the species. Factor (E) in particular—any "manmade factors affecting [the species'] continued existence"—requires us to consider the pertinent laws, regulations, programs, and other specific actions of any entity that either positively or negatively affect the species. Thus, the analysis outlined in section 4 requires us to consider any conservation efforts by State or local governments, foreign governments, Tribal governments, Federal agencies, businesses, organizations, or individuals that positively affect the species' status.

What are the criteria that a conservation effort must meet in order for the Service to determine that it might contribute to making listing unnecessary?
Conservation agreements, conservation plans, management plans, and similar documents generally identify numerous conservation efforts (i.e., actions, activities, or programs) to benefit the species. In determining whether a formalized conservation effort contributes to making listing a species as threatened or endangered unnecessary or contributes to forming a basis for listing as threatened rather than endangered, we must evaluate whether the conservation effort affects the status of the species.

Two factors are key in that evaluation: (1) For those efforts yet to be implemented, the certainty that the conservation effort will be *implemented* and (2) the certainty that the conservation effort will be *effective*. In order for us to determine that a formalized conservation effort contributes to making listing a species unnecessary or contributes to forming a basis for listing a species as threatened rather than endangered, the conservation effort must meet the following criteria:

A. The certainty that the conservation effort will be implemented:

- The conservation effort; the party(ies) to the agreement or plan that will implement the effort; and the staffing, funding level, funding source, and other resources necessary to implement the effort are identified.
- The authority of the party(ies) to the agreement or plan to implement the conservation effort, and the legal procedural requirements necessary to implement the effort, are described.

- Authorizations (e.g., permits, landowner permission) necessary to implement the conservation effort are identified, and a high level of certainty that the party(ies) to the agreement or plan that will implement the effort will obtain these authorizations is provided.
- The level of voluntary participation (e.g., by private landowners) necessary to implement the conservation effort is identified, and a high level of certainty that the party(ies) to the agreement or plan that will implement the conservation effort will obtain that level of voluntary participation is provided (e.g., an explanation of why incentives to be provided are expected to result in the necessary level of voluntary participation).
- All regulatory mechanisms (e.g., laws, regulations, ordinanaces) necessary to implement the conservation effort are in place.
- A high level of certainty that the party(ies) to the agreement or plan that will implement the conservation effort will obtain the necessary funding is provided.
- An implementation schedule (including completion dates) for the conservation effort is provided.
- The conservation agreement or plan that includes the conservation effort is approved by all parties to the agreement or plan.

B. The certainty that the conservation effort will be effective:

- The nature and extent of threats being addressed by the conservation effort are described.
- Explicit objectives for the conservation effort and dates for achieving them are stated.
- The steps necessary to implement the conservation effort are identified.
- Quantifiable, scientifically valid parameters that will demonstrate achievement of objectives, and standards for these parameters by which progress will be measured, are identified.
- Provisions for monitoring and reporting progress in implementation (based on compliance with the implementation schedule) and effectiveness (based on evaluation of quantifiable parameters) of the conservation effort are provided.
- Principles of adaptive management are incorporated.

Based on input received during the public comment period, these criteria may be revised in the final policy.

Whom should I contact about this policy?
To obtain further information on the proposed policy, contact our Headquarters Office at the address below. More information and office addresses can also be found by visiting the Fish & Wildlife Service website: (http://www.fws.gov).

U.S. Fish and Wildlife Service
Endangered Species Program
4401 N. Fairfax Drive, Room 420
Arlington, VA 22203
703/358 2105

National Marine Fisheries Service
Office of Protected Resources
Room 13658
1315 East West Highway
Silver Spring, MD 20910
301/713 1401

September 2001

Appendix H: List of PPR Workgroup Members

First Name	Last Name	Affiliation
Fran	Amendola	Norwest Corporation
Vic	Beckler	
Drew	Bennett	Mesa Land Trust
Paul	Betzer	ConocoPhillips Co.
Geoff	Blakeslee	The Nature Conservancy
Clait	Braun	Grouse Inc.
Bill & Nancy	Brennan	Landowner
John	Bridges	Western Area Power Administration
Indra	Briedis	
Nicole	Brynes	Encana
Rep. Bernie	Buescher	Colorado House of Reps.
Chris	Canfield	COGCC
Dave	Cesark	Williams Production RMT
Chris	Clark	Plains Exploration and Production Co.
Creed	Clayton	USFWS
Ray	Clifton	Colorado Rural Electric Assoc.
Bob	Coleman	Marathon
Fred	Cummings	NRCS
Dennis	Davidson	NRCS
Eileen	Dey	Conoco-Phillips
Steve	Don	Grand Valley Rural Power Lines Inc.
Scot	Donato	Bill Barrett Corp
Stephanie	Duckett	Colorado Division of Wildlife
Bill	Ekstrom	CSU Cooperative Ext.
Darby	Finley	Colorado Division of Wildlife
Maurice	Foye	HRL Compliance
Chris	Freeman	Berry Petroleum
Kathy	Friesen	EnCana
John	Gardner	Rifle Citizen-Telegram
Paul T.	Gayer	Kinder Morgan
Terry	Gosney	EnCana
John	Gray	Westwater Engineering
Carrie	Gudorf	Cordillean
Joe	Gumber	Westwater Engineering
Adell	Heneghan	Marathon Oil Company
Geoff	Hier	CO Rural Elect. Assoc.
Ed	Hollowed	BLM
Joel	Hurmance	EDM Consultants
Terry	Ireland	USFWS
Tyson	Johnston	PDC - Petro Development Corp.
Kim	Kaal	CO Div. of Wildlife

Andy	Keep	NRCS
Tom	Knowles	CDOW
Elissa	Knox	CO Div. of Wildlife
Pete	Kolbenschlag	Colorado Environmental Coalition
Nicole	Korbe	Tri-State Generation & Transmission Assoc.
Frank	Krugh	Marathon Oil
Mike	Lopez	Land Manager
Justin	Lovato	Conoco Phillips
Jeff	Madison	Rio Blanco County
Noe	Marymor	CDOW / NRCS
Dan	Mathews	CO Div. Reclamation Mining & Safety
Pat	McCarty	CSU Cooperative Ext.
Larry	McCown	Garfield County Commissioner
Dave	McDonald	Landowner
Mike	McKibbin	Grand Junction Daily Sentinel
Mike	McKibbin	Rifle Citzen Telegram
Brandon	Miller	CDOW
Cathy	Neelan	North American Mediation Associates
Forrest	Nelson	Rio Blanco County Commissioner
David	Neslin	Colorado Oil & Gas Commission
Joe	Neuhof	Colorado Environmental Coalition
Lori	Nielsen	EDM Consultants
Big Eddie	Nielson	NRCS
Sean	Norris	Chevron
Jerry & Stephanie	Oldland	Landowner
John	O'Rourke	Earth Tech.
Lee	Parker	Chevron Shale Oil Co.
Brad	Petch	Colorado Division of Wildlife
Al	Pfister	W. Colorado Field Office, USFWS
Evan	Phillips	CDOW
Heidi	Plank	Bureau of Land Management
Kent	Rider	Williams
Larry	Robinson	Landowner
Albert	Romero	Colorado Division of Wildlife
Pam	Roth	Williams Energy
Heather	Sauls	BLM
John	Savage	Landowner
Terri	Schulz	The Nature Conservancy
Clee	Sealing	North American Grouse Partnership
Steve	Shuey	CDRMS
Steve	Smith	The Wilderness Society
Brett	Smithers	Bureau of Land Management
Ron	Spencer	White River Electric Assn.
Ken	Strom	Audubon Colorado
Mike	Swaro	CDOW
Jim	Thate	Colorado Rural Electric Assoc.

Dan	Thompson	NRCS
Bob	Timberman	USFWS
John	Toolen	Colorado Division of Wildlife
Tim & Chris	Uphoff	Landowner
Boone	Vaughn	Landowner
Deanna	Walker	Conoco-Phillips
Kent	Walter	Bureau of Land Management
Chuck	Whiteman	Shell Oil

VII. SIGNATURES OF PARTICIPANTS

The following pages include signatures and/or letters of support from the following:

Federal Agencies
State Agencies
County or Municipal Governments
Private Sector and Individual Signature (includes companies, organizations, etc.)
Letters of Support

CONSERVATION AGREEMENT

The U.S. Fish and Wildlife Service-Western Colorado Ecological Services Field Office hereby states it intent to assist with and participate in the implementation of the Parachute-Piceance-Roan Conservation Plan (Plan) as prepared by the Working Group. By signing this Conservation Agreement (Agreement) the Service shows support for the purpose, guiding principals, and conservation actions as stated in the Plan. Authority for the Service to enter into this Agreement and participate in implementation of the Plan comes from the Endangered Species Act of 1973, as amended; the Fish and Wildlife Act of 1956, and the Fish and Wildlife Coordination Act, as amended. Signing of this Agreement does not constitute a review under the Policy for Evaluating Conservation Efforts When Making Listing Decisions (PECE), nor an evaluation of the real or absolute extinction risk for the greater sage-grouse. The Service's endorsement of the Plan is not an indication that it will determine, under PECE, that the Plan should be considered when the Services makes a listing determination for the greater sage-grouse, nor does the existence of the Plan necessarily result in the Service determining that listing is not warranted. Specific commitments are as follows:

1. To pursue funding opportunities through available grants or funding sources for implementation of the Plan.

2. To attempt to provide a representative to Working Group meetings.

3. To use our authorities to review Federal projects and recommend measures to avoid or minimize impacts to the greater sage-grouse and its habitat.

4. To provide technical assistance for proposed projects as needed and requested.

5. To provide recommendations to address issues of concern during future Plan revisions, including but not limited to inclusion of habitat disturbance guidelines for project related impacts.

Performance of all activities described above is contingent on adequate funds and staff being made available and allocated to the Fish and Wildlife Service (Service). All projects or management actions implemented in accordance with the Plan will be subject to all laws, regulations, policies and procedures in effect at the time the action is implemented. This agreement is neither a fiscal nor a funds obligating document. This Agreement shall not prohibit the Service from engaging in management actions regarding greater sage-grouse conservation beyond those described in this Agreement and in the Plan. However, such management actions should be coordinated with the Working Group.

This Agreement is effective as of the date of signing and shall remain in effect until the Service chooses to amend or terminate the agreement. If the habitat disturbance guideline issue is not resolved within six months, the Service's support of this plan may be terminated.

Allan R. Pfister

Allan R. Pfister, Western Colorado Field Supervisor
U.S. Fish and Wildlife Service-Ecological Services

4/29/08
Date

Conservation Agreement

The U.S. Bureau of Land Management (White River Field Office) hereby states its intent and commitment to assist with and participate in the implementation of the Parachute-Piceance-Roan (PPR) Greater Sage-grouse Conservation Plan. This plan was prepared by a work group of affected stakeholders and is designed to conserve and enhance populations and habitats of Greater Sage-grouse (GRSG), a BLM sensitive species. This plan is in no way meant to be construed as a Resource Management Plan Decision. All projects or management actions implemented through these guidelines will be subject to site specific environmental analysis required under the National Environmental Policy Act. Specific commitments made hereby are as follows:

1. All proposed projects or actions funded, implemented or authorized by the BLM will be analyzed with respect to impacts on Greater Sage-grouse and their habitats in accordance with the guidelines set forth in this plan.

2. To implement the guidelines, conservation actions, and intent set forth in this plan within the constraints of existing laws, policies, regulations and management plans, and while considering the needs or implications to other species and multiple uses.

3. To work with private landowners, companies, organizations and other state or federal agencies to implement necessary conservation actions to maintain or enhance Greater Sage-grouse habitat as outlined in this plan.

4. To exercise authorities for maintenance, conservation and management of Greater Sage-grouse populations and suitable habitat pursuant to provisions in the BLM Sensitive Species Policy Manual and the Federal Land Policy and Management Act (FLPMA).

Performance of all activities described above is contingent on adequate staff and funding being allocated to the signatory agency. This agreement shall not prohibit the signatory agency from engaging in management actions regarding Greater Sage-grouse conservation beyond those described in the agreement and in the Conservation Plan. Such management actions should be coordinated with the PPR Work Group.

This agreement shall become effective on the date of signature by the participating agency and shall remain in effect until the signatory party chooses to terminate the agreement, or the agreement is terminated by consent of the PPR Work Group. The agreement may be terminated by providing 90 days written notice to the PPR Work Group.

Kent F. Walter — April 29, 2008

Kent Walter, White River Field Office Manager
Bureau of Land Management, USDI

Date

Conservation Agreement

The U.S. Bureau of Land Management (Grand Junction Field Office) hereby states its intent and commitment to assist with and participate in the implementation of the Parachute-Piceance-Roan (PPR) Greater Sage-grouse Conservation Plan. This plan was prepared by a work group of affected stakeholders and is designed to conserve and enhance populations and habitats of Greater Sage-grouse (GRSG), a BLM sensitive species. This plan is in no way meant to be construed as a Resource Management Plan Decision. All projects or management actions implemented through these guidelines will be subject to site specific environmental analysis required under the National Environmental Policy Act. Specific commitments made hereby are as follows:

1. All proposed projects or actions funded, implemented or authorized by the BLM will be analyzed with respect to impacts on Greater Sage grouse and their habitats in accordance with the guidelines set forth in this plan.

2. To implement the guidelines, conservation actions, and intent set forth in this plan within the constraints of existing laws, policies, regulations and management plans, and while considering the needs or implications to other species and multiple uses.

3. To work with private landowners, companies, organizations and other state or federal agencies to implement necessary conservation actions to maintain or enhance Greater Sage grouse habitat as outlined in this plan.

4. To exercise authorities for maintenance, conservation and management of Greater Sage-grouse populations and suitable habitat pursuant to provisions in the BLM Sensitive Species Policy Manual and the Federal Land Policy and Management Act (FLPMA).

Performance of all activities described above is contingent on adequate staff and funding being allocated to the signatory agency. This agreement shall not prohibit the signatory agency from engaging in management actions regarding Greater Sage-grouse conservation beyond those described in the agreement and in the Conservation Plan. Such management actions should be coordinated with the PPR Work Group.

This agreement shall become effective on the date of signature by the participating agency and shall remain in effect until the signatory party chooses to terminate the agreement, or the agreement is terminated by consent of the PPR Work Group. The agreement may be terminated by providing 90 days written notice to the PPR Work Group.

Catherine Robertson, Grand Junction Field Office Manager
Bureau of Land Management, USDI

May 27, 2008
Date

Monday, June 09, 2008.max

Conservation Agreement

The U.S. Bureau of Land Management (White River Field Office) hereby states its intent and commitment to assist with and participate in the implementation of the Parachute-Piceance-Roan (PPR) Greater Sage-grouse Conservation Plan. This plan was prepared by a work group of affected stakeholders and is designed to conserve and enhance populations and habitats of Greater Sage-grouse (GRSG), a BLM sensitive species. This plan is in no way meant to be construed as a Resource Management Plan Decision. All projects or management actions implemented through these guidelines will be subject to site specific environmental analysis required under the National Environmental Policy Act. Specific commitments made hereby are as follows:

1. All proposed projects or actions funded, implemented or authorized by the BLM will be analyzed with respect to impacts on Greater Sage-grouse and their habitats in accordance with the guidelines set forth in this plan.

2. To implement the guidelines, conservation actions, and intent set forth in this plan within the constraints of existing laws, policies, regulations and management plans, and while considering the needs or implications to other species and multiple uses.

3. To work with private landowners, companies, organizations and other state or federal agencies to implement necessary conservation actions to maintain or enhance Greater Sage-grouse habitat as outlined in this plan.

4. To exercise authorities for maintenance, conservation and management of Greater Sage-grouse populations and suitable habitat pursuant to provisions in the BLM Sensitive Species Policy Manual and the Federal Land Policy and Management Act (FLPMA).

Performance of all activities described above is contingent on adequate staff and funding being allocated to the signatory agency. This agreement shall not prohibit the signatory agency from engaging in management actions regarding Greater Sage-grouse conservation beyond those described in the agreement and in the Conservation Plan. Such management actions should be coordinated with the PPR Work Group.

This agreement shall become effective on the date of signature by the participating agency and shall remain in effect until the signatory party chooses to terminate the agreement, or the agreement is terminated by consent of the PPR Work Group. The agreement may be terminated by providing 90 days written notice to the PPR Work Group.

Jamie E. Connell — 6-10-2008

Jamie Connell, Glenwood Springs Field Office
Bureau of Land Management, USDI

Date

CONSERVATION AGREEMENT

The USDA / Natural Resources Conservation Service hereby states its intent to assist with and participate in the implementation of the Parachute, Piceance & Roan Creek Greater Sage-grouse Conservation Plan, as prepared by the Parachute, Piceance & Roan Creek Greater Sage-grouse Work Group.

Performance of all activities described in the Plan pertaining to the NRCS is contingent on adequate funds and staff being made available and allocated to the agency. This agreement shall become effective on the date of signature by the participating parties, and shall remain in effect until the parties choose to terminate the agreement, or the agreement is terminated by consent with the Parachute, Piceance & Roan Creek Greater Sage-grouse Work Group.

Dennis Davidson
District Conservationist, USDA-NRCS
Garfield County

4/29/08
Date

Andy Keep
District Conservationist, USDA-NRCS
Rio Blanco County

4/29/08
Date

Jim Currier
District Conservationist, USDA-NRCS
Mesa County

4/29/08
Date

Conservation Agreement

The **Colorado Division of Wildlife** hereby states its intent and commitment to assist with and participate in the implementation of the ***Parachute-Piceance-Roan Greater Sage-Grouse Conservation Plan*** as prepared by the Parachute-Piceance-Roan (PPR) Greater Sage-Grouse Working Group. Specific commitments made hereby are as follows:

1. To provide one staff person to coordinate the implementation of this plan and represent the Division on the Parachute-Piceance-Roan Working Group, which consists of representatives from state and federal agencies, local government, conservation organizations, landowners, private industry, and interested members of the local community.

2. To assume lead responsibility for the inventory and monitoring of Greater Sage-Grouse in the Parachute-Piceance-Roan area, and to annually compile and report inventory and monitoring information.

3. To assume lead responsibility for the reintroduction of Greater Sage-Grouse into formerly occupied habitats in Colorado.

4. To implement and enforce specific State statutes and Wildlife Commission Regulations (Colorado Revised Statutes, Title 33, Articles 3 and 6, and Colorado Wildlife Commission Regulations Chapter 3) that control the taking and possession of Greater Sage-Grouse in Colorado.

5. To make recommendations to, and cooperate with, other state and federal agencies, local governments, private landowners, and land developers to avoid, minimize, or mitigate negative impacts of development and other land uses on Greater Sage-Grouse populations and their habitats in the Parachute-Piceance-Roan area.

6. To make recommendations to, provide some funding for, and cooperate with other state and federal agencies, local governments, private landowners, and conservation organizations to conserve and enhance Greater Sage-Grouse habitats in the Parachute-Piceance-Roan area.

7. To continue to support and conduct research on the population dynamics and habitat relationships of Greater Sage-Grouse in Colorado.

Performance of the commitments described above is contingent on adequate funding being made available and allocated to the signatory agency. This agreement shall not prohibit the signatory agency from engaging in management actions regarding Greater Sage-Grouse beyond those described in this agreement and in the Conservation Plan. This agreement shall become effective on the date of signing by the participating party and shall remain in effect until the signatory party chooses to terminate the agreement. The agreement may be terminated by providing 90 days written notice to the Parachute-Piceance-Roan Working Group.

Thomas E. Remington

Thomas E. Remington
Director, Colorado Division of Wildlife

5/16/08

Date

BOARD OF COMMISSIONERS
RIO BLANCO COUNTY
P.O. BOX 1
MEEKER, CO 81641

RIO BLANCO COUNTY SIGNATURE PAGE

Rio Blanco County has participated in the development of the Parachute-Piceance-Roan Greater Sage Grouse Conservation Plan and concurs with the findings. The Rio Blanco County Board of County Commissioners support the mission of the Plan to conserve and enhance Greater Sage-grouse population and habitats in Rio Blanco and Garfield Counties in ways that are compatible with existing and future land uses thereby insuring the opportunity for people to enjoy this wildlife resource in perpetuity. Any actions undertaken by the County are strictly voluntary. Signing this plan shows the County's support, but shall in no way bind the County to any particular action.

COUNTY OF RIO BLANCO,
STATE OF COLORADO, By
and Through Its BOARD OF
COUNTY COMMISSIONERS

ATTEST:

Nancy R. Amick
Clerk & Recorder
Rio Blanco County

Forrest F. Nelson, Chairman

Joe F. Collins, Commissioner

Kenneth C. Parsons, Commissioner

Forrest F. Nelson, Chairman ***Joe F. Collins*** ***Kenneth C. Parsons***
County Administration (970) 878-9430 *Fax (970) 878-5442* *bocc@co.rio-blanco.co.us*
Rio Blanco County Administration Building, 317 E. Market Street, Meeker, CO 81641

VII. SIGNATURES OF PARTICIPANTS

Private Sector and Individual Signature Page

"Signatories to this Plan have participated and concur with the Plan development. They support the mission of the Plan to conserve and enhance the Greater Sage-Grouse populations and habitats in Garfield, Mesa, and Rio Blanco Counties in ways that are compatible with existing and future land uses, thereby insuring the opportunity for people to enjoy this wildlife resource in perpetuity. Any actions undertaken by the signatories are strictly voluntary. Signing this Plan shall in no way be construed to reduce or deprive the signatories of any rights, privileges they enjoy. Any party to this agreement can terminate with a written notice to the Workgroup via the Colorado Division of Wildlife offices in Grand Junction or Meeker, CO. If the species is listed under the Endangered Species Act it is the signatories' option to withdraw from this agreement at anytime."

Name	Affiliation
[illegible]	CO-DNR-DRMS
Chris Canfield	Colo. Oil + Gas Conservation Commission
[illegible]	
Steve Smith	THE WILDERNESS SOCIETY
[illegible]	White River Electric Assn Inc.
[illegible]	CO DOW
[illegible]	
[illegible]	CO DOW
[illegible]	West Water Engineering Co.
[illegible]	Colorado DRMS.

Private Sector and Individual Signature Page

Signatories to this plan have participated and concur with the plan development. They support the mission of the Plan to conserve and enhance the Greater Sage-Grouse population and habitats in Parachute, Piceance and Roan Creek ***areas of*** Colorado in ways that are compatible with existing and future land uses, thereby insuring the opportunity for people to enjoy this wildlife resource in perpetuity. Any actions undertaken by the signatories are strictly voluntary. Signing this plan shall in no way be construed to reduce or deprive the signatories of any rights or privileges they enjoy. Any party to this agreement can terminate with a written notice to the Workgroup via the Colorado Division of Wildlife Office in Grand Junction CO. If the species is listed, it is the signatories' option to withdraw from this agreement at anytime.

Name	Affiliation
[illegible]	Williams Production RMT
[illegible]	HRL COMPLIANCE SOLUTIONS INC.
	ConocoPhillips Company
Eileen Dey	ConocoPhillips Company
Joe Gumber	WESTWATER ENGINEERING
Bill Brenner	Rancher
Chris Ujdhoff	Rancher
	Rancher
Chris Clerk	Plains Exploration & Production
Sean Morris	Chevron U.S.A. Inc. CO
Nicole M. Byrnes	Working Group Member

Colorado Rural Electric Association
5400 North Washington Street
Denver, Colorado 80216
(303) 455-2700
FAX: (303) 455-2807

To: Greater Sage-grouse Steering Committee
CC: Cathy Neelan, North American Mediation Associates, LLC
John Toolen Bureau of Land Management
Lori Nielsen EDM International, Inc.
Brad Petch Colorado Division of Wildlife

Re: Comments regarding the review of listing status decisions prior to the April 29th signing of the local Parachute, Piceance and Roan Creek (PPR) Conservation Plan

The Colorado electric utilities do work in close cooperation with the Bureau of Land Management (BLM) and Colorado Division of Wildlife (CDOW) when planning and permitting is conducted to locate new utility corridors outside documented Greater Sage-grouse leks. We would like to continue working with the BLM and CDOW to preserve all potentially sensitive species including sage-grouse. We appreciate that over the past years the BLM and CDOW have allowed the electric utilities to comment on conservation actions.

In regard to the Parachute, Piceance and Roan Creek (PPR) Working Plan and the Greater Sage-grouse Statewide Conservation Plan as they relate to Electrical Structures, Rights-of-Way, and Power Lines, the Colorado Rural Electric Association would like to take this opportunity to comment on the PPR Plan, particularly as it relates to the Statewide GrSG Plan. The electric cooperatives have a valid concern that the "recommended 4-mile buffer zone", can be calculated as an 8-mile diameter potential exclusion area for suitable habitat as described in Appendix B of the GRSG Conservation Plan and can be easily misinterpreted as a recommended practice by permit applicants and land management agencies.

We are currently reviewing the Statewide Plan independently, as it pertains to power lines and electric utilities. Overall, we believe that the correlation and cross referencing of the PPR Plan with the Statewide Plan should be more consistent. A recent insertion into the Greater Sage-grouse PPR plan appendices refers to a Best Management Practice proposing that CDOW be consulted prior to surface occupancy within 4 miles of a lek.

Although we understand that 1) the PPR Plan is strictly voluntary, 2) the 4-mile radial distance buffer targets specific areas in the Piceance Basin, 3) the 4-mile buffer is not a "No Surface Occupancy" (NSO) area, and 4) the Statewide plan mentioned "it [the 4-mile buffer] is an area of consideration where the disturbance guidelines should be applied when, and if, possible" we are still concerned over the associated language. The language regarding the buffer zone refers to a request for consultation with the CDOW, which is an unknown. However, our major concern is that the land management agencies, such as the BLM may incorporate a 4-mile buffer into their permitting policy for power line right-of-way, particularly in the Piceance Basin based on how the PPR Plan is worded. If this became policy for permitting right-of-way, we feel this measure would be excessive and is beyond what was previously agreed upon by the PPR working group. Both documents should have clearer outlines of what is proposed.

The electric cooperatives have a valid concern that the "recommended 4-mile buffer zone", can be calculated as an 8-mile diameter potential exclusion area for suitable habitat as described in Appendix B of the GRSG Conservation Plan and can be easily misinterpreted as a recommended practice by permit applicants and land management agencies.

Colorado Rural Electric Association
5400 North Washington Street
Denver, Colorado 80216
(303) 455-2700
FAX: (303) 455-2807

When power lines are within the area of a Greater Sage-grouse lek we agree that electrical structures can be retrofitted with modern perching deterrents to dissuade birds of prey from using the electrical structure as an unfair advantage. However; this should also be evaluated on a case-by-case basis.

The concept of burying the high-voltage power lines should be evaluated on a project specific basis. An electrical pole has a very small footprint, and the equipment used to place the pole and string the overhead conductor do very little damage to the environment as compared to burying lines and the associated linear disturbance. A trench to bury the same power line will disturb an area at least 10 feet wide and for the entire length of the right-of-way. Trenching eliminates the existing and desired vegetation, while disturbed soil encourages unwanted vegetation, requires continual maintenance in seeding and weed prevention, and of course a buried power line is much more expensive to install than overhead lines.

As stated on Pages 83–84 of the Final PPR Plan, paragraph 3a verbiage such as, "Actions for power lines in order to reposition new power lines and install raptor deterrents when applicable and feasible" and the term "Conservation Actions" allow too much room for interpretation and could easily be construed to propose a variety of actions. It is our concern that plans containing "Conservation Actions" and "Best Management Practices" can more easily transcend into rules and laws than if the plans would plainly state that the CDOW and the BLM will work with all affected parties when sage-grouse leks are a viable concern.

To reiterate previous communications, the electric cooperatives are not-for-profit and we have to pass all increases in construction and operation costs on to the consumers.

CREA, with all intents and purposes will try to comply with the PPR Plan. However; CREA does not have the authority to sign and bind on the content of this plan on behalf of the cooperative members that may directly or indirectly be affected by the plan.

Thank you for the opportunity to comment.
If you have any questions or concerns please feel free to contact the Colorado Rural Electric Association.

Ray Clifton
Executive Director
Colorado Rural Electric Association
rclifton@coloradorea.org
303-455-2700 ext. 104

Jim Thate
Director of Safety Training and Loss Control
Colorado Rural Electric Association
jthate@coloradorea.org
303-455-2700 ext. 109

EnCana Oil & Gas (USA) Inc.

370 17th Street
Suite 1700
Denver, CO 80202

tel: (303) 623-2300
fax: (303) 623-2400
www.encana.com

EnCana Oil &Gas (USA) Inc. Signature Page

EnCana Oil & Gas (USA) Inc. participated in the development of the Parachute-Piceance-Roan Greater Sage Grouse Conservation Plan. We support the mission of the local working group to conserve and enhance this Greater Sage Grouse population and associated habitats through cooperative multi-party efforts, adaptive management, and private land stewardship, in ways that are compatible with our existing and future activities in the geologic Piceance Basin. EnCana may assist with and participate in the implementation of the Plan. Any actions undertaken by EnCana are strictly voluntary. This signature letter shall in no way be construed to reduce or deprive EnCana of rights or privileges. Signing this Plan shows EnCana's support but does not commit us to any particular action.

Byron R. Gale

Byron R. Gale, North Piceance Team Lead

July 24, 2008
Date