V. CONSERVATION STRATEGY

The purpose of the RCP is to identify measures and strategies to achieve the goal of protecting, enhancing, and conserving GUSG and their habitats. This section presents the RCP's conservation strategy. We provide: (1) an overview of the rangewide perspective on population objectives; (2) strategies that address specific issues on a rangewide basis; and (3) recommended local conservation targets and strategies for each population. It is expected that the local conservation plans will be updated to address the local strategies presented here. The RSC views the strategies presented in "Local Conservation Targets and Strategies" (pg. 255) as the minimum efforts; in some cases, local groups may choose to undertake efforts beyond those described in the RCP.

The rangewide strategies are linked to each other and the local strategies in a number of ways. Many of the rangewide strategies, or components of them, are referred to within individual local conservation strategies, when relevant for the individual population (e.g., "Grazing", "Habitat Enhancement", and "Habitat Protection from Permanent Loss"). Others are primarily rangewide in nature (e.g., "Habitat Linkages"), to be addressed by agencies across the range of GUSG. Two of the rangewide strategies, "Information and Education" and "Research", will benefit all populations when they are implemented, but they are not specifically mentioned in any local strategy. Other rangewide strategies are to be used primarily in response to unplanned events, such as "Disease and Parasites", or "Weather/Drought", and should be referenced if such an event occurs in any individual population.

The rangewide and local strategies rely on and/or refer to some important components of the plan that are appendices:

Appendix B clarifies the entities listed under "Responsible Parties" in the conservation strategies (it also identifies acronyms in the plan);

Appendix C identifies funding opportunities for GUSG conservation;

Appendix F provides background on the spatially explicit model of housing growth in within GUSG range, and provides some guidance to local managers in identifying land most at risk of development;

Appendix H ("GUSG Structural Habitat Guidelines") identifies specific vegetation structure components necessary for GUSG seasonal habitats;

Appendix I ("GUSG Disturbance Guidelines") provides recommended buffers around GUSG seasonal habitats that should be observed in regard to habitat disturbance, as well as timing restrictions on activities that could disturb GUSG;

Appendix J (GUSG Habitat Use Data) illustrates the data used in development of Appendix I;

Appendix K Monsen (2005) has presented a manual addressing the restoration of sagebrush communities. We offer a summary and table of contents of this manual and recommend using Monsen (2005) for all GUSG habitat enhancement and restoration efforts (copies of Monsen 2005 are available on CD from CDOW; contact Pam Schnurr at Pam.Schnurr@state.co.us);

Appendix L provides suggested management practices for oil and gas development in GUSG habitat.

A. Overview of Rangewide Population Objectives

This plan is intended to help protect and improve sufficient habitat and implement other measures across the range of GUSG to ensure that the species has minimal (<1%) modeled risk of extinction over a 50-year time frame. Populations will be managed to retain 90% or more of genetic diversity over this same time frame. As outlined in the PVA, the Gunnison Basin GUSG population is the only population large enough to have a very high probability of surviving random demographic stochastic events over this time frame. It is also the only population large enough in and of itself to maintain a reasonably large degree of genetic variation over time. The Gunnison Basin therefore is the cornerstone for conservation of this species.

Preservation of smaller populations is also important. Smaller populations will be managed so that collectively they represent a sizable pool of both individual sage-grouse (> 1,000) and genetic diversity (80%). We will manage and protect habitats for population extinction probabilities of less than 5-10% (without artificial augmentation) over a 50-year time frame for Crawford, San Miguel Basin, and Dove Creek - Monticello, Utah. If population levels drop below 50-75% of the target we will augment numbers so that actual extinction risks will be minimal (see "Population Augmentation" rangewide strategy, Objective 1, Strategy 3, pg. 241). Limits on available habitat in other populations (Cerro Summit – Cimarron - Sims Mesa, Piñon Mesa, Poncha Pass) suggest local extinctions may occur without intervention. These habitats should be managed and protected to make the risk of extinction as low as possible, given existing and potential habitat constraints. Periodic demographic rescue may be necessary, and infusions of genetic material to counter loss of genetic diversity will be necessary.

B. Rangewide Conservation Strategies

Conservation strategies to be addressed on a rangewide basis are listed here. See "Threats and Analysis" (pg. 103) for background on specific threats and issues. Many of these strategies are to be implemented in response to certain scenarios or conditions, or are to be conducted annually/continually. In a few cases there is a specific singular target completion date, and in those instances the completion date is listed below the responsible group(s). In the next section, local strategies (recommended actions for local work groups and stakeholders) are listed. In many cases, the local strategies refer to protocols or guidelines developed here in the rangewide strategies section. Rangewide strategies are listed in alphabetical order.

While all rangewide and local conservation issues ultimately need to be addressed at some level, clearly some issues are of higher priority and will impact the conservation of GUSG more than others. Following is a discussion of the relative priority of rangewide conservation issues, since one of the main intents of the rangewide plan is to identify and prioritize these issues. Priorities may differ at local population levels. Implementation of some rangewide strategies will apply to all populations and work groups; others will be implemented by state or federal agencies. This prioritization is intended as guidance to local work groups and agencies as local conservation plans, and other agency plans and decision are revised, developed, and implemented.

The top 5 priority rangewide strategies, in order of priority, follow:

(1) Protection of occupied habitats from permanent loss is clearly the highest priority conservation strategy. If permanent habitat loss from development (primarily) or conversion is not addressed, successful implementation of all the other conservation strategies is not likely to be successful in conserving GUSG. Not all populations have equal conservation value, or are at equal risk of development; prioritization of habitat protection efforts is covered in "Prioritization of Habitat Protection Efforts" (pg.160). An equally important strategy is preventing significant degradation, whatever the cause, of existing habitat that is seasonally important to grouse. Research to evaluate the impacts of positive habitat improvements, and help mitigate impacts of various forms of development must occur.

(2) The second highest priority rangewide conservation strategy is to stabilize existing populations demographically and genetically through augmentation, and establish new populations in historically occupied habitats which are evaluated and deemed suitable. Reintroductions should be pursued cautiously. While they potentially can be a rapid means to increase numbers of GUSG, if habitat is not of a sufficient size and quality to maintain the birds, the reintroduction process may simply act as a drain on existing populations and may polarize local work groups. Augmentation techniques should be evaluated and improved.

(3) A slower, but perhaps surer, conservation strategy is habitat improvement within currently occupied and adjacent potential habitats. Relative gains from habitat improvements will vary across populations. PVA modeling suggested populations were strongly influenced by chick mortality, so employment of grazing systems or habitat improvement projects designed to increase forb and grass understories in sagebrush areas used for brood rearing should increase population growth rates and size. Greatest benefits will be in areas with demonstrable deficiencies in existing understories.

(4) Management of all wildlife proceeds in the face of considerable uncertainty, and it should be clear from this plan that the impacts of many management and other actions on GUSG are poorly understood. This uncertainty demands an adaptive management approach, which requires monitoring of how the "system", both sage-grouse and their habitats, is responding. Monitoring must not only be conducted to see how we are doing relative to the conservation goals set in this plan and others, but it must be done in a manner that increases our understanding of how sage-grouse respond. This is a high conservation priority. Implicit in this strategy is research to better estimate sage-grouse population size and means to effectively assess and evaluate quality.

(5) Finally, the 5th priority of the rangewide strategies is to protect from permanent loss historically used habitats that are not currently occupied by grouse. These are areas we've mapped as suitable, but unoccupied, or as "potentially suitable" habitat. These areas may, with proper restoration, serve as areas of expansion or as linkages connecting populations. These are obviously desirable outcomes, but they are in no way assured, and attempting to secure them in the short-term takes scarce resources away from the protection of currently

occupied habitats, considered far more critical to the future of GUSG. This strategy should be employed if and when resources permit.

Disease and Parasites

WNV currently poses the most serious potential disease threat to GUSG populations. Outbreaks of other diseases are possible, but they have typically been localized and may pose a threat to only the smallest GUSG populations. Efforts should be devoted to disease detection and management response in the event of infected GUSG. In addition, more needs to be known about the risk of disease transmission from other gallinaceous birds to GUSG.

Objective 1: Minimize occurrence and impact of diseases that threaten GUSG populations.	
Available Strategies	**Responsible Group**
1. Monitor GUSG and other species for presence of WNV in GUSG counties.	CDOW, UDWR, County and State Health Departments
2. In localized areas where the West Nile virus has been detected, control mosquitoes through applications of appropriate EPA regulated larvicides and/or adulticides in order to protect GUSG in the area.	CDOW, UDWR, County Governments
3. Investigate GUSG susceptibility to and inheritance of immunity to WNV (see "Research" strategy [pg. 247], Objective 6).	National Wildlife Research Center, CDOW, UDWR
4. If GUSG are infected with disease (other than WNV) that threatens a population: investigate, isolate, and control source of disease, and if possible, treat GUSG.	CDOW, UDWR
5. Investigate the possible need to conduct standard disease screening on all game birds before they are imported into or moved within GUSG range in Colorado.	CDOW Completion Date: 2005

Fire and Fuels Management

Appropriate management of fire in GUSG sagebrush habitat is crucial to maintaining and restoring the health of sagebrush communities. Fire planning, fire suppression, fire rehabilitation, the use of prescribed fire, and fuels treatments in and around GUSG habitat must be well planned and executed, using an interdisciplinary approach. As is always the case, human safety supercedes all recommendations with regard to wildfire response in GUSG habitat.

Fire management plans should consider potential fire effects in GUSG habitat so that an appropriate response to wildfires can be coordinated among the often numerous entities that may be involved in initial response. Fire suppression objectives should be clearly articulated in the local fire management plan so they can be effectively communicated to appropriate fire fighting officials and teams. If "Wildland Fire Use" (using lightning-ignited fires to manage resources or derive some benefit) is an option, the objectives and constraints need to be clearly expressed in the fire management plan to enhance the decision making process and to provide direction for managing the "Wildland Fire Use" fire.

Fire suppression activities to manage GUSG habitat need to be sensitive to objectives and constraints. Examples include, but are not limited to: 1) large back-fire operations to control wildfires may not be desirable and should be avoided if possible since the burnout itself may consume significant GUSG habitat; and 2) using dozers and engines in or near seasonal habitats should be avoided, if possible. Rehabilitation and restoration measures following a wildfire may be essential to ensure that a healthy sagebrush community reestablishes following wildfire. Monsen (2005) recommends some general restoration practices, including reseeding burned habitat in the same year of a burn, in late fall or early spring. Proper seedbed preparation is also important, as are weed control measures, and the use of native species seed mix is encouraged (Monsen 2005). Site specific rehabilitation should be based on local conditions (e.g., potential for natural regeneration, risk of invasive species, and erosion potential).

Prescribed fire, if applied at an appropriate scale, can be a viable tool to manage GUSG sagebrush habitat and to protect it from catastrophic wildfires. Prescribed burning can also be used as a fuels reduction tool adjacent to GUSG habitat to reduce the likelihood of wildfire spreading from adjacent fuel types (e.g., piñon-juniper, oakbrush, or ponderosa pine). Prescribed burning in spring and fall can effectively create a mosaic of small open patches in which forbs and grasses thrive and fuels are reduced (see "Habitat Enhancement" rangewide strategy, pg. 214, and "GUSG Structural Habitat Guidelines", Appendix H). Currently, successful prescribed burning in GUSG habitat uses snow fields, wet areas, and various topographic aspects to limit the size of patches. Fire plans need to consider the need for small patch sizes.

Mechanical treatments can be used as a fuel reduction tool in much the same manner as prescribed burns, to reduce the potential for catastrophic fires in GUSG habitat, wildland/urban interface, or human infrastructure areas. Mechanical fuels treatments, when developed and implemented using an interdisciplinary approach, can be very effective in meeting both the fuel/fire objectives as well as some habitat objectives (see "Habitat Enhancement" rangewide strategy, pg. 214). Reseeding following mechanical treatment and prescribed burning may be necessary to reduce the potential for invasive weeds and to maintain a desired shrub, grass and forb species mix.

In most GUSG populations, due to the already highly fragmented habitat, any planned habitat treatment (e.g., prescribed fire or fuels treatment) should be conducted at a small scale (Connelly et. al 2000; also see "GUSG Disturbance Guidelines", Appendix I). However, the size of treatment should be established after examining existing conditions (e.g., sagebrush species present, topography, previous fire history, type and distribution of seasonal habitat), cumulative areas of sagebrush modification, and potential of the proposed site.

Objective 1: Manage wildfire, prescribed burns and fuel treatments to minimize detrimental effects on GUSG populations and to improve GUSG habitat.	
Available Strategies	**Responsible Group**
1. Plan fire suppression response to potential wildfires in important GUSG habitat. Share fire response and GUSG seasonal habitat information with county, fire district, and federal fire fighting officials to plan and implement appropriate response to wildfires in these areas.	BLM, CDOW, NPS, NRCS, UDWR, and USFS
2. Manage habitat mosaics and fuels in GUSG areas to minimize the possibility of damaging wildfires. Use prescribed burning and mechanical fuels treatments at an appropriate scale to reduce the potential for catastrophic wildfires in and adjacent to GUSG habitat and to improve the quality and quantity of GUSG habitat (see "Habitat Enhancement" rangewide strategy, pg. 214).	BLM, CDOW, NPS, NRCS, UDWR, and USFS
3. Use prescribed burning at a small scale, when appropriate, to improve the quality and quantity of GUSG habitat (Connelly et al 2000; see also "GUSG Structural Habitat Guidelines", Appendix H, and Monsen 2005).	BLM, CDOW, NPS, NRCS, UDWR, and USFS
4. For burns in Wyoming sagebrush that are larger than 5 acres in occupied or potential GUSG habitat, encourage reseeding (see "Habitat Enhancement" rangewide strategy, pg. 214).	BLM, CDOW, NPS, NRCS, UDWR, and USFS
5. Evaluate response of habitat (see "Habitat Monitoring", pg. 220) to all burns and mechanical fuel reduction treatments.	BLM, CDOW, NPS, NRCS, UDWR, and USFS

Genetics

The low level of genetic diversity found in GUSG, particularly when compared to GRSG, is of conservation concern. While there is nothing that can be done to increase genetic diversity within the species, steps may be taken to attempt to maximize the probability of maintaining the current levels of variation. This could involve translocations of individuals among populations, to decrease the probability of losing alleles due to random genetic drift, which is a strong force in small populations. The Dove Creek - Monticello and Piñon Mesa populations were found to have particularly low allelic diversity and the highest levels of monomorphism (Oyler-McCance et al. in press). This fact, coupled with their small population sizes, suggest that these 2 populations are most at risk of negative genetic impacts and may be the best candidates for translocations from the largest, most genetically diverse population in Gunnison Basin. Many biologists advocate moving at least 1 individual per local population per generation to prevent population insularization caused by habitat loss and fragmentation (Franklin 1980, Frankel and Soulé 1981, and Allendorf 1983). This may be a good rule of thumb for GUSG.

Translocations should likely focus on females rather than males, since not all males breed, given the lek breeding system (see "Population Augmentation" rangewide strategy, pg. 241). The possibility of translocating fertilized eggs or chicks should be investigated as an alternative to translocating live females. Sufficient numbers of females (or eggs or chicks) should be translocated to assure that at least 1 translocated individual breeds in the following breeding season and successfully passes its genes to the next generation. The success of translocations should be monitored by following translocated individuals and monitoring their reproductive success. In addition, the genetic makeup of the population could be assessed through a genetic survey in subsequent years. Because baseline (pre-translocation) data are available (Oyler-McCance et al. in press), it is possible to track changes and monitor the genetic diversity of a population.

Further, signs of inbreeding (characteristics of fitness as they relate to genetic diversity) must be more closely examined. Comparisons of reproductive success (e.g., hatchability, chick survival) across the range should be carried out. Research on reproductive features (e.g., sperm function, egg normality), parasite load, and disease resistance (e.g., major histocompatibility complex variation) should be conducted, to make comparisons both within the GUSG and between the GRSG and GUSG.

Oyler-McCance et al. (in press) found that the San Miguel population may act as a conduit to gene flow among the small satellite populations. Surprisingly, they found a link between San Miguel and Cerro Summit – Cimarron - Sims Mesa, suggesting gene flow between these areas. The Cerro Summit – Cimarron - Sims Mesa population has not been well studied and deserves further attention. Additionally, habitat restoration and protection in areas between San Miguel and Gunnison should be a priority for conservation of the species in an attempt to facilitate natural movement among these populations.

While genetic concerns may be only one of several priorities for GUSG conservation and management, along with other issues (e.g., habitat loss and quality), they warrant consideration. Conservation activities should include monitoring and maintaining genetic diversity, preventing future habitat loss and fragmentation, enhancing existing sagebrush communities, and restoring sagebrush communities that have been converted.

Objective 1: Maintain > 90% of the genetic diversity present within GUSG over the next 50 years.	
Available Strategies	**Responsible Group**
1. Maintain a relatively large (~3,000) long-term average population within the Gunnison Basin.	BLM, CDOW, NPS, USFS, USFWS

Objective 2: Maintain 80% or more of the genetic diversity present within GUSG in areas outside the Gunnison Basin by 2015, so that genetic diversity can be (largely) restored in the case of loss within the Gunnison Basin.	
Available Strategies	**Responsible Group**
1. Increase genetic diversity within smaller populations through augmentation with eggs, chicks, or adults until collectively they represent 80% or more of the diversity within the Gunnison Basin.	CDOW, UDWR
2. Conduct research to evaluate use, maintenance, and possible enhancement of habitat corridors among populations that facilitate dispersal of individuals between populations and enhance genetic diversity.	BLM, CDOW, NPS, UDWR, USFS, USFWS

Objective 3: Maintain genetic diversity present within individual populations of GUSG so that each contains 70% of overall genetic diversity.	
Available Strategies	**Responsible Group**
1. Increase genetic diversity within smaller populations through augmentation with eggs, chicks, or adults.	CDOW, UDWR Completion Date: 2015

Objective 4: Develop and maintain a repository of genetic diversity in captivity.	
Available Strategies	**Responsible Group**
1. Develop captive breeding and rearing techniques to facilitate meeting objective 1 and 2 above, and to facilitate maintenance of a captive flock as a living genetic diversity bank if necessary.	CDOW
2. Archive samples encompassing the entire range of genetic diversity present within GUSG.	CDOW, Denver University, UDWR

Objective 5: Monitor genetic diversity within the Gunnison Basin and smaller populations.	
Available Strategies	**Responsible Group**
1. Continue to obtain blood and other tissue samples as birds are captured for other purposes and submit for genetic testing.	CDOW, Denver University, NPS, UDWR, USFWS
2. Continue to develop and refine, if it proves feasible, techniques to obtain DNA from fecal droppings so that genetic testing can be accomplished without capturing birds.	CDOW, Denver University

Objective 5: Monitor genetic diversity within the Gunnison Basin and smaller populations.	
Available Strategies	**Responsible Group**
3. Develop and implement a genetic diversity monitoring plan and schedule.	BLM, CDOW, Denver University UDWR, NPS, USFS
	Completion Date: 2007

Grazing

Healthy sage-grouse populations and ungulate grazing are not incompatible, if managed properly. Grazing is an important component of western rural economies. Continuation of sustainable ranching operations may prevent permanent conversion of sagebrush, such as through development and subdividing for housing. Site-specific research about the effects of livestock grazing on sage-grouse is lacking. Given all of this, we developed general recommendations for grazing to maintain sage-grouse habitats with diverse grass, forbs, and shrubs. If long-term monitoring indicates a downward trend in the vegetation and sage-grouse habitat, then adjustments should be made to livestock grazing management and wild ungulate population objectives.

Ultimately, site potential and environmental conditions will dictate vegetation composition, height, and density across landscapes. Grazing management practices may maintain or improve rangeland health and should be used to achieve and sustain desired vegetation conditions throughout GUSG range. Rangeland vegetation should be given the opportunity to either grow before grazing, or re-grow after grazing. This can be accomplished by controlling the distribution of grazers, duration of use, and the time of year livestock graze a particular location.

Although monitoring of grazing effects on GUSG habitat is a rangewide objective, implementation and scheduling of monitoring must be done by land managers at the local level.

Objective 1: Manage grazing to improve GUSG habitat and minimize conflicts between grazers and grouse, while providing for sustainable agriculture.	
Available Strategies	**Responsible Group**
1. Use grazing management guidelines (pg. 212) that list practices to benefit GUSG and GUSG habitat in order to meet GUSG structural habitat guidelines (Appendix H).	BLM, CDOW, Private Landowners, NPS, NRCS, USFS, UDWR
2. Incorporate specific sage-grouse habitat objectives into Land Health Assessments under Standards 3 & 4 (maintenance of healthy plant, animal & special status species) on BLM administered lands.	BLM
3. Reevaluate and implement plans for managing specific populations of big game (Data Analysis Unit plans in Colorado; elk and deer herd unit management plans in Utah), particularly for maintaining elk populations at management objectives.	BLM, CDOW, Private Landowners, USFS, UDWR
4. Develop wild ungulate winter habitat objectives to meet seasonal GUSG requirements.	BLM, CDOW, Private Landowners, UDWR, USFS
5. Develop strategies to draw ungulates away from treatment areas to allow proper recovery.	BLM, CDOW, Private Landowners, USFS, UDWR

Objective 1: Manage grazing to improve GUSG habitat and minimize conflicts between grazers and grouse, while providing for sustainable agriculture.	
Available Strategies	**Responsible Group**
6. Use and develop incentive programs to encourage private landowners to rest pastures, if needed, to benefit sage-grouse habitat (e.g., grass banks, resting allotments).	BLM, CDOW, NRCS, SCD, USFS, UDWR

Objective 2: Monitor grazing management effects on GUSG and GUSG habitat.	
Available Strategies	**Responsible Group**
1. At the end of the growing season (or as necessary throughout the year), monitor GUSG habitat and total utilization (e.g., cattle, sheep, wild ungulates, insects), and/or vegetation structure available during the important grouse use period, and adjust grazing management plans as necessary to achieve desired vegetation structure for GUSG (See "Habitat Monitoring" rangewide strategy, pg. 220, and Appendix H).	BLM, CDOW, NRCS, Private Landowners, UDWR, USFS
2. If monitoring evaluation indicates vegetation structure is not meeting structural habitat guidelines (Appendix H) for seasonal habitats (within the potential of a site) over 2 consecutive years, identify the problem and implement needed actions (see the guidelines below) to resolve problem.	BLM, CDOW, NRCS, Private Landowners, UDWR, USFS
3. Evaluate impact of grazing on GUSG and develop grazing BMP's for sage-grouse management (see "Research" rangewide strategy, pg. 247, Objectives 2 and 8).	BLM, CDOW, NRCS, UDWR, USFS

The grazing management guidelines presented here represent a partial list of grazing management practices that may be compatible with achieving GUSG habitat objectives. Local grazing prescriptions should specify timing, intensity, duration, and frequency of grazing, that together provide a recovery period for plant health and maintenance, and fit the specific circumstances (both biotic and abiotic factors) unique to that area, including other resource or operational considerations. This site specificity also maximizes potential flexibility or opportunities for each situation including incorporating private, state, and/or federal lands to reach habitat objectives.

Grazing Management Guidelines for GUSG:

1. With GUSG seasonal habitat use in mind, control the distribution of livestock, duration of use, and the time of year that livestock graze a particular location by using grazing systems such as rest-rotation, deferred rotation, or high intensity/short duration. Allow for growth or re-growth in each pasture during each growing season to provide quality vegetation and vegetation height requirements during periods of sage-grouse seasonal use (refer to "GUSG Structural Habitat Guidelines", Appendix H).

2. Use alternative pastures to avoid using sage-grouse seasonal use areas during or immediately before important use periods, if possible.

3. Where possible, do not graze the same pasture at the same time of year for consecutive years. If not possible, develop smaller grazing units within large pastures using salting, supplements, water, herding, or fencing to facilitate improved grazing practices.

4. Avoid over-utilization around riparian areas, water sources, bottoms and draws, and along benches, by diverting more utilization to slopes and ridge tops.

5. If needed, limit livestock use from pastures or allotments or change management plans when abnormal environmental events occur (e.g., drought, heavy snow fall, flooding) and stress vegetation.

6. As necessary, periodically graze lek sites moderately to heavily, to maintain site openness that GUSG require. Note: temporary fencing, herding, or increased stocking rate could be used, but needs to be limited to specific lek site, so as to not overgraze surrounding area.

7. Avoid placing salt, minerals or supplements near leks.

8. The timing and location of livestock turnout and trailing should not contribute to livestock concentrations in lek areas during the breeding season (late March through May).

9. Develop, when needed, alternative water sources to distribute livestock and improve water availability for wildlife and GUSG.

10. If monitoring data indicate forb vigor is not at proper condition or is declining, defer spring grazing periodically to increase forb vigor and occurrence. Lightly or moderately graze deferred areas following nesting or in the fall. Monitor to determine actual growth of grass during spring and summer deferment.

11. For late-successional sagebrush stands that don't meet habitat objectives for GUSG seasonal habitats, use mechanical, chemical, or grazing treatments that will rejuvenate new sagebrush growth and improve sagebrush quality and age diversity, as well as understory.

12. Treat sagebrush (e.g., mechanical, grazing, or chemical treatments) and manage grazing in historic riparian areas to increase riparian zone and raise the water table to reestablish riparian grasses and shrubs for brood-rearing habitat.

13. To improve vegetation composition and forage, plant forb seed in rangelands that lack forbs and have enough moisture and the soil characteristics to establish and support forbs.

14. Defer grazing in treatment areas for 2 full growing seasons after treatment, unless needed for seedbed preparation or desired understory and overstory are established.

Habitat Enhancement

Numerous observational studies have correlated the decline of sage-grouse populations with sagebrush treatment (Klebenow 1969, Wallestad and Pyrah 1974, Wakkinen 1990, Connelly et al. 1991, Gregg et al. 1994) or removal projects, but there is little research quantifying the positive impacts of habitat "improvements." Although it is widely accepted by wildlife management professionals that improving the quality of habitat can increase survival, recruitment, or other demographic parameters, hence leading to population increases, there has been little experimental research on sage-grouse that demonstrates this concept.

Evaluating Effects of Habitat Quality on GUSG

Recently, new techniques have been developed that may allow a more direct evaluation of habitat quality on sage-grouse chick survival, chick growth, and nest success. Huwer (2004) exposed human-imprinted GRSG chicks to habitats with low, medium, and high forb abundance levels to test the widely-held belief that high forb levels are important to chick growth and survival. She found chick growth rates were positively related with forb abundance level, but no similar association was documented with survival. Artificial nest studies (DeLong et al. 1995, Watters et al. 2002) coupled with telemetry studies (Gregg et al. 1994, Aldridge and Bingham 2002) have found increased nest success when nests were located in areas with higher levels of grass and forbs in the understory.

An alternative landscape level approach is to evaluate the relationship between population size and habitat quality; i.e., compare the average population density in areas with generally "good" habitat to population density in "poorer" quality habitat. This process could help explain some of the variability not explained by the mathematical relationship between amount of habitat and average population size (see "Analysis: GUSG Population Size in Relation to the Amount of Available Habitat", pg. 186). For example, if an analysis shows a linear relationship between the amount of habitat and abundance of a species, individual data points will usually lie somewhat above or below the line.

Although subjective and qualitative, the relationship between the quality of habitat within a given population and population size may be discernable. GRSG populations with relatively good habitat (intact sagebrush stands with age-class diversity and high quality understories) such as North Park and portions of northwestern Colorado, have recent lek counts above the number predicted by the habitat regression model (Fig. 38, pg. 195). In contrast, GUSG areas with relatively poor quality (and highly fragmented) sagebrush habitats such as Dry Creek and Monticello are below the predicted number (Fig. 38, pg. 195).

Habitat Improvement Approach

Public land management agencies will continue to improve the quality of sagebrush communities on public land through grazing management, fencing, re-seeding, fuels management, and other treatment projects. In addition, the CDOW and UDWR manage properties within the range of GUSG to improve habitat quality. CDOW and UDWR also build habitat improvement strategies into management plans on easements that are acquired. The NRCS provides technical advice on sage-grouse habitat improvement projects (giving

them high priority), and continues to avoid funding sagebrush removal projects that could prove detrimental to sage-grouse.

To assist with habitat improvement on private land, the RCP identifies funding sources and programmatic guidelines for local work groups to use as cost-share opportunities to implement habitat improvement strategies (Appendix C). Potential habitat improvement options available to the work groups are identified in the "Local Conservation Targets and Strategies" section for each population (beginning pg. 255). In addition, the ecological relationships and taxonomy of sagebrush and associated communities are available (Monsen 2005, Winward 2004), as well as treatment techniques that can be applied to improve or maintain healthy sagebrush communities. We offer several recommendations and observations regarding habitat improvements:

(1) Habitat improvement should be directed at specific and quantifiable ecological problem(s) (Monsen 2005, Winward 2004). Projects should have specific and quantifiable goals. Some past and current projects have the goal of enhancing the herbaceous (grass and forb) understory in areas that already have sufficient structural characteristics given the ecological status of the community. Expensive sagebrush manipulation projects that provide short-term herbaceous results should be viewed cautiously. Effort is best directed towards, for example, truly degraded sagebrush communities (e.g., breeding habitat that does not meet the "GUSG Structural Habitat Guidelines", Appendix H), improving riparian areas, reconstituting water tables by repairing down-cut banks, or piñon-juniper removal.

(2) The PVA analysis (pg. 168) illustrates that modeled GUSG population growth rates are most sensitive to nest success and chick survival. Therefore improvement, maintenance, or protection of productive breeding and summer habitat may show the greatest return for the effort and/or money.

(3) Treatments should be sufficient in aggregate (over time) to have a population level effect, but individual projects should be relatively small in scale if they involve the removal of sagebrush (Connelly et al. 2000).

(4) Have patience. Many of the local conservation plans have unrealistic expectations regarding how quickly projects could or should be accomplished, and how quickly vegetation and GUSG populations might respond. Habitat improvement projects are expensive, often require extensive review, and are long-term in nature. It is important to schedule treatments and management actions in a manner that maintains adequate suitable habitat while other areas are recovering.

(5) In all habitat planning efforts, consult and apply the concepts and techniques provided in Monsen (2005) and Winward (2004).

Specific Steps for Habitat Improvement

A strategy for increasing and protecting sage-grouse populations includes the restoration of vegetation conditions that improve seasonal habitat needs for sage-grouse. Three essential steps are suggested for designing habitat restoration projects for GUSG.

The first step is to identify the sage-grouse seasonal habitat component in the project area that is lacking or needs improvement (see "GUSG Structural Habitat Guidelines", Appendix H). For instance, good nesting habitat consists of live sagebrush with sufficient canopy cover and an adequate grass and forb understory (see "GUSG Structural Habitat Guidelines", Appendix H). If nest success is documented or suspected to be less than optimal, then conditions may exist where improvement of the shrub overstory or herbaceous understory in breeding habitat delineated for the population of interest may require intervention.

The second step is to gain an understanding of the site characteristics (site potential and community identification) of the area needing improvement. Of primary importance is identification of the individual species or subspecies of sagebrush that exists in the area. The RSC strongly recommends the use of Winward (2004) to identify the taxonomy and distribution of sagebrush in Colorado. It is essential that this step is completed prior to further planning as the sagebrush species or subspecies naturally adapted to the site of interest will determine the suite of possible management actions for a successful treatment. Attempting to change community types (e.g., black sagebrush to Wyoming big sagebrush) is inadvisable (Monsen 2005). Sagebrush species have evolved to differing ecological conditions. Knowledge of the vegetation, soils, and precipitation regimes of the treatment area need to be acquired (Monsen 2005). For instance, basin big sagebrush communities normally occupy deeper soils with slightly higher soil moisture than sites dominated by Wyoming big sagebrush. Occurrence of silver sagebrush, black sagebrush, and low sagebrush is related to specific soil conditions (Winward 1983).

The third step is to select the appropriate management and remedial treatment measures that could be successfully applied to the site to assist in meeting treatment goals. Monsen (2005) recently completed a detailed manual addressing the myriad of issues associated with sagebrush community restoration. We recommend that managers consult and apply Monsen (2005) to assist and guide the treatment planning phase of the project to design appropriate restoration options and application of techniques (e.g., timing of treatments, reestablishment of sagebrush, seeding practicality, seedbed preparation).

Objective 1: Conduct proper background planning for vegetation restoration/improvement projects that provide the structural habitat requirements in breeding, summer - fall, and winter sage-grouse habitats	
Available Strategies	**Responsible Group**
1. Identify sage-grouse habitat treatment objective in treatment area (see "GUSG Structural Habitat Guidelines", Appendix H).	BLM, CDOW, NPS, NRCS, UDWR, USFS
2. Identify ecological site characteristics and sagebrush species associated with project area.	BLM, CDOW, NPS, NRCS, UDWR, USFS
3. Utilize Monsen (2005), and select appropriate treatment options suitable for the site characteristics and treatment objectives.	BLM, CDOW, NPS, NRCS, UDWR, USFS
4. Work cooperatively with the Uncompahgre Plateau Project and other entities in the development and storage of native seed for restoration purposes.	BLM, CDOW, NPS, NRCS, UDWR, USFS

Objective 2: Conduct and monitor restoration techniques for improvement of the vegetation structure requirements necessary for productive breeding, summer - fall, and winter sage-grouse habitats.	
Available Strategies	**Responsible Group**
1. Conduct pre-restoration monitoring using a recognized technique appropriate to measure treatment objective	BLM, CDOW, NPS, NRCS, UDWR, USFS
2. Implement appropriate treatment/restoration action(s) (Monsen 2005)	BLM, CDOW, NPS, NRCS, UDWR, USFS
3. Monitor vegetation response to treatments in manner/timing appropriate to treatment type (see "Habitat Monitoring" strategy, pg. 220).	BLM, CDOW, NPS, NRCS, UDWR, USFS
4. Evaluate the impact of treatments on GUSG (see "Research" strategy, pg. 247, Objective 2).	CDOW, UDWR

Habitat Linkages Among Populations

We have identified extensive areas for potential linkages between currently isolated GUSG populations (see "Habitat Linkages Among GUSG Populations", pg. 163). These linkages may enhance the demographic and genetic viability of GUSG. These heterogeneous landscapes are composed of patches of landcover types frequently used by sage-grouse (e.g., sagebrush and sagebrush-grass mix) within a mosaic of contrasting land forms and land uses. Updated GIS analyses are needed to refine the distribution and evaluate the relative effectiveness of potential linkages. The effectiveness of a potential linkage will depend on the ability of GUSG to move among the isolated patches within a linkage. These movement patterns will likely depend on the composition (how much of the suitable landcover types are present in the landscape) and configuration (the size and shape) of the patches in the landscape. Seasonal movement and dispersal patterns of GUSG are not known well enough to be able to predict whether the birds will use linkages, or how landscape features may facilitate or impede dispersal movements. Understanding the effect of landscape features on dispersal patterns of GUSG is a critical step toward evaluating the effectiveness of the proposed population linkages (see Objective 1 below, and "Research" rangewide strategy, pg. 247, Objective 2, Strategy 1). Development of linkages between current GUSG populations is a relatively low conservation priority. Our first priority is to protect as much of currently occupied habitat as necessary, and then work towards establishing linkages as we gain more knowledge about land cover types and how they are used by GUSG.

Objective 1: Understand how sage-grouse move and disperse through fragmented and patchy habitats and how vegetation composition and landscape features facilitate or impede dispersal.	
Available Strategies	**Responsible Group**
1. Design and conduct research to measure GUSG movement patterns and dispersal across contiguous and fragmented habitats, and how landscape features, such as vegetation composition and landscape, facilitate or impede dispersal.	BLM, CDOW, NPS, USFS

Objective 2: Facilitate gene flow and dispersal of sage-grouse among populations and subpopulations across habitat linkages.	
Available Strategies	**Responsible Group**
1. Refine identification of potential linkages and prioritize possible habitat linkages between populations based on additional knowledge gained through research and updated GIS analyses.	BLM, CDOW, NPS, UDWR, USFS
2. Protect from permanent loss linkages that are demonstrated to allow for gene flow among populations (for protection strategies, see "Habitat Protection from Permanent Loss" rangewide strategy, pg. 223).	BLM, CDOW, NPS, USFS

Objective 2: Facilitate gene flow and dispersal of sage-grouse among populations and subpopulations across habitat linkages.	
Available Strategies	**Responsible Group**
3. Based on additional knowledge gained through research, identify areas on publicly owned land where habitat improvement efforts could restore functional linkages among populations.	BLM, CDOW, NPS, UDWR, USFS
4. Based on additional knowledge gained through research, identify areas on privately owned land where habitat improvement and protection efforts could restore functional linkages among populations.	CDOW, UDWR
5. Conduct habitat treatments to restore functional linkages among populations where feasible.	BLM, CDOW, NPS, UDWR, USFS

Habitat Monitoring

An adaptive management approach is recommended for all actions designed to benefit sage-grouse habitat. This means important sage-grouse habitat should be identified, habitat quality should be assessed, and changes in habitat should be monitored. This habitat monitoring will allow managers to evaluate management success, refine management programs, and identify additional habitat management needs (see "Habitat Enhancement" rangewide strategy, pg. 214). For GUSG, we will focus habitat monitoring at 2 scales: the rangewide (or landscape) scale, and the local (local population or conservation plan) scale.

Rangewide monitoring for GUSG will be based on the 2 rangewide mapping and habitat assessment efforts described in the Conservation Assessment of this plan (see "GUSG Habitat Mapping Efforts", pg. 54). Upon completion of the RCP, a more intensive CDOW mapping effort will be undertaken, primarily to further refine the current habitat categories. Habitat definitions will be adjusted and new definitions will be incorporated into future CDOW mapping efforts to improve landscape level habitat mapping efforts.

GUSG seasonal habitat should be mapped (see Objective 1, Strategy 8); until then, the following seasonal habitat definitions should be used:

> *Breeding Habitat:* Sagebrush communities delineated within 4 miles of an active strutting ground (lek) (see "GUSG Disturbance Guidelines", Appendix I, for discussion). Breeding habitat includes active strutting grounds (leks), nesting and early brood-rearing habitat (Connelly et al. 2000), usually in use from mid-March through late-June.
>
> *Summer – Fall Habitat:* vegetation communities including sagebrush, agricultural fields, and wet meadows (Connelly et al. 2000) that are within 4 miles of an active strutting ground (lek) (see "GUSG Disturbance Guidelines", Appendix I for discussion).
>
> *Winter Habitat:* sagebrush areas (Connelly et al. 2000) that have sufficient shrub height to be above winter snow cover (see "GUSG Disturbance Guidelines", Appendix I for discussion).

Local scale habitat monitoring quantifies vegetation structural characteristics and plant species diversity. Ideal habitat conditions vary among different GUSG seasonal habitats such as breeding, summer - fall, and winter (see "GUSG Structural Habitat Guidelines", Appendix H). Data from local habitat monitoring can serve to (1) assess current vegetation conditions; (2) compare current vegetation conditions with established habitat guidelines; and (3) evaluate the short-term and/or long-term vegetation response to environmental changes or human-induced treatments (project effectiveness monitoring).

Local habitat monitoring and assessment efforts must be consistent so that information can be shared, compiled, and compared across the range of GUSG. Therefore, *minimum* data standards will be developed in compliance with the accepted BLM/USFS monitoring protocol for use in occupied or potential sage-grouse habitat. It is understood that local offices, agencies, and work groups may collect additional data (within budget and personnel constraints), to achieve specific monitoring objectives.

Objective 1: On a rangewide basis: identify and delineate current GUSG habitat and track future changes in habitat.	
Available Strategies	**Responsible Group**
1. Develop inventory technique(s) for searching "vacant/unknown" habitat areas to determine grouse presence/use and to assist in distinguishing between and delineating (using GIS mapping) "suitable vacant" areas and "suitable unknown" areas.	CDOW Completion Date: 2005
2. Develop survey technique(s) to use in searching for new or unknown leks.	CDOW Completion Date: 2005
3. Update CDOW and UDWR habitat map using new habitat categories: "Suitable Occupied", "Suitable Unknown", "Suitable Vacant", and "Potentially Suitable Habitat" *. Within the "Potentially Suitable Habitat" category, consider relative restoration priority of each habitat area. Resolve mapping issues with all mapped categories at CO/UT state line.	BLM, CDOW, NPS, NRCS, UDWR, USFWS, USFS Completion Date: 2006
4. Review and update GUSG rangewide habitat-related mapping efforts.	BLM, CDOW, UDWR Completion Date: Every 10 years
5. Delineate sagebrush communities by species and/or groups of species using GIS modeling techniques.	BLM, CDOW, NPS, NRCS, UDWR, USFS
6. Create a central GIS database to track all sagebrush modification treatments and natural disturbances across GUSG range. This task will include database maintenance and updates.	BLM, CDOW, NPS, NRCS, UDWR, USFS, USFWS Completion Date: 2006
7. Define GUSG seasonal habitats for use in GIS mapping. Incorporate GIS modeling techniques such as slope and aspect, observational data, and habitat assessment data into the definitions.	CDOW, UDWR Completion Date: August, 2005
8. Map GUSG seasonal habitats in a GIS as defined in Strategy #7 above.	BLM, CDOW, NPS, NRCS, UDWR, USFS, USFWS Completion Date: June, 2006
9. Evaluate the impact of the amount and spatial arrangement of GUSG habitat on GUSG (see "Research" rangewide strategy, pg. 247, Objective 2.)	CDOW, UDWR
10. Develop a method of reporting and archiving data that facilitates evaluation of the effectiveness of management programs and how they meet the habitat objectives outlined in this plan.	BLM, CDOW, NPS, NRCS, UDWR, USFS, USFWS Completion Date: 2005

* *Suitable Occupied Habitat*: Areas known to be used by sage-grouse within the last 10 years from the date of mapping. "Use" is defined as (1) radiotelemetry locations; (2) confirmed observations of grouse or grouse sign by reliable sources; or (3) documented use reported in unpublished reports or publications.

  Suitable Unknown Habitat: Suitable and historic habitat adjacent to *Suitable Occupied Habitat,* where use by sage-grouse has not been documented but could occur. Habitat is similar to that within known occupied habitats.

  Suitable Vacant Habitat: Sagebrush habitat within the historic range of sage-grouse that is not mapped as the above 2 categories (*Suitable Occupied* or *Suitable Unknown*).

  Potentially Suitable Habitat: Habitat that is capable of producing sagebrush communities that could be occupied by sage-grouse, but would require a human- or non-human-induced perturbation. These areas have soils or other historic information (photos, maps, reports, etc.) indicating that sagebrush was the predominant cover type. These sites could include areas that have succeeded to non-sagebrush cover types (e.g., piñon-juniper).

Objective 2: On a local basis: identify and delineate current GUSG habitat and track future changes in habitat.	
Available Strategies	**Responsible Group**
1. To establish the minimum information to be collected in local habitat monitoring: write a standard protocol that identifies which habitat variables should be measured (e.g., grass height), and which techniques should be used to measure them.	RSC Completion Date: 2005
2. Assess habitat condition using standard protocol and compare results to "GUSG Structural Habitat Guidelines" (Appendix H). Report data in format developed in Objective 1, Strategy 10.	BLM, CDOW, Local Work Groups, NPS, NRCS, UDWR, USFS
3. Obtain funding sources to support monitoring implementation on a rangewide basis for local populations.	RSC
4. Evaluate the impact of vegetation condition on GUSG (see "Research" rangewide strategy, pg. 247, Objective 2).	CDOW, UDWR

Objective 3: Determine if the west side of the San Luis Valley should be considered historic GUSG habitat.	
Available Strategies	**Responsible Group**
1. Using historic photos, historic accounts, soils information, and other available information, determine whether the area mapped as 'Questionable' pre-settlement habitat (Fig. 3, #4, pg. 33) actually contained sagebrush at one time.	RSC Completion Date: 2005

Habitat Protection from Permanent Loss

Protecting GUSG habitat from permanent loss is key to conserving the species. Although conversion of sagebrush habitat to new agricultural fields could impact GUSG, the most serious threat of habitat loss is from subdivision development. Maintaining sustainable rural economies, where traditional land uses compatible with sage-grouse are profitable, can significantly reduce threats associated with subdivision development. This strategy is not intended to address permanent or temporary habitat loss due to factors other than housing development or agricultural conversion.

While protecting 100% of all habitats used by GUSG in each population might be desirable, attempting to do so in any one population will detract resources from protecting the most important habitats in other populations (since habitat protection is very expensive and funding is likely to be limited). From a conservation standpoint, some habitat loss can probably be absorbed by GUSG, or mitigated by habitat improvements or additions. For this reason we set an objective of protecting 90% of the seasonally important habitats (as mapped; see "Habitat Monitoring" rangewide strategy, pg. 220, Objective 1, Strategy 8 for strategy regarding mapping seasonal habitats) for each population.

Note that Table 22 (see pg. 160) should be used to assist in ranking habitat protection priorities among populations, given limited funding.

Objective 1: Maintain 90% of seasonally important habitats (combined public and private, as mapped) within each population, by protecting the necessary proportion of those private lands that are at risk of development from conversion to unsuitable housing densities (see "Spatially Explicit Analysis of Impacts of Additional Housing Units", pg. 154, and Appendix F). If seasonally important habitats are not mapped for a given population, the objective is to maintain 90% of those vegetation communities within occupied habitat that are likely used by GUSG (for discussion of these communities see "Model Development", pg. 186).	
Available Strategies	**Responsible Group**
1. Obtain conservation easements and implement management plans through the CSCP program.	CDOW
2. Complete conservation easements and management agreements for qualifying landowners as allowed by available funding.	CDOW, NGO's, UDWR
3. Develop and implement CCAA's with private landowners willing to maintain or enhance important habitat for GUSG.	CDOW, UDWR, USFWS Completion Date: 2006 or if/when GUSG are listed under the ESA.
4. Establish GIS datalayer of conservation easements that have sage-grouse considerations, using common attributes among populations and agencies.	RSC, CDOW, NGO's, UDWR
5. Incorporate sage-grouse considerations into existing easements as opportunities arise and innovative ideas become available.	CDOW, NGO's, NRCS, UDWR

Objective 1: Maintain 90% of seasonally important habitats (combined public and private, as mapped) within each population, by protecting the necessary proportion of those private lands that are at risk of development from conversion to unsuitable housing densities (see "Spatially Explicit Analysis of Impacts of Additional Housing Units", pg. 154, and Appendix F). If seasonally important habitats are not mapped for a given population, the objective is to maintain 90% of those vegetation communities within occupied habitat that are likely used by GUSG (for discussion of these communities see "Model Development", pg. 186).	
Available Strategies	**Responsible Group**
6. Obtain fee title to important habitats through purchase, land exchanges, or mineral rights acquisition.	BLM, CDOW, NRCS, USFS, UDWR
7. Enroll important habitats in conservation programs with incentive payments to landowners under the Farm Bill (e.g., CRP, EQIP, WRP, WHIP, Grassland Reserve).	CDOW, NGO's, NRCS, UDWR, USFWS
8. Work with county governments to discourage interference of urban development with objective 1. Provide information to county governments on status, location, and possible effects of different land uses on sage-grouse in their county. Provide examples of policy language used by other counties.	CDOW, NGO's, UDWR, USFWS
9. Develop better predictive models to identify areas at high risk of permanent habitat loss and of high value to GUSG in order to assist with prioritization of habitat protection efforts.	CDOW, UDWR, BLM, NRCS, USFWS, USFS
	Completion Date: 2009

Objective 2: Evaluate development potential and protection needs within vacant/unknown and potential habitats.	
Available Strategies	**Responsible Group**
1. Complete conservation easements and management agreements for qualifying landowners as allowed by available funding.	CDOW, NGO's, UDWR
2. Develop and implement CCAA's with private landowners willing to maintain or enhance important habitat for GUSG.	CDOW, UDWR, USFWS
	Completion Date: 2006 or if/when GUSG are listed under the ESA.
3. Incorporate sage-grouse considerations into existing easements as opportunity arises and innovative ideas become available.	CDOW, NGO's, NRCS, UDWR
4. Obtain fee title to important habitats through purchase, land exchanges, or mineral rights acquisition.	BLM, CDOW, NRCS, USFS, UDWR
5. Enroll important habitats in conservation programs with incentive payments to landowners under the Farm Bill (e.g., CRP, EQIP, WRP, WHIP, Grassland Reserve).	CDOW, NGO's, NRCS, UDWR, USFWS

Human Infrastructure: Powerlines, Other Utility Corridors, Wind Turbines, Communication Towers, Fences, and Roads

Potential negative impacts of structures in this category include loss and fragmentation of GUSG habitat, decline in habitat quality, and disturbance to GUSG. Research has not yet been conducted that clearly demonstrates these possible impacts (see "Research" rangewide strategy, pg. 247, for proposed research), but it is prudent to minimize the potential for impacts whenever possible. Each type of structure is addressed in a separate objective, but note that a single type of industry or activity might generate multiple structures and thus multiple objectives should be referenced for that activity (e.g., wind turbine development may include wind turbines, roads, and fences). Information here is drawn from the "GUSG Disturbance Guidelines" presented in Appendix I.

Objective 1: Minimize the potential for negative impact of POWERLINES and other UTILITY CORRIDORS on GUSG and their habitat.	
Available Strategies	**Responsible Group**
1. Identify and map existing powerlines and other utility corridors in GUSG range.	BLM, CDOW, NPS, STL, UDWR, USFS, Utility Companies
	Completion Date: 2006
2. For placement of new powerlines or other utility corridors, GUSG seasonal habitats should be mapped and avoided whenever possible. If seasonal habitats are not mapped, construction should be avoided within the buffers described in "GUSG Disturbance Guidelines" (Appendix I).	BLM, CDOW, Local Work Groups, NPS, UDWR, USFS
3. If utility corridors are constructed within mapped GUSG seasonal habitats encourage burial of the utility, or retrofit powerlines and other overhead structures to deter raptor perching.	BLM, CDOW, NPS, STL, UDWR, USFS, Utility Companies
4. To minimize GUSG collisions with powerlines or other overhead structures, encourage appropriately marking structures when they are near leks and other important seasonal GUSG habitat.	BLM, CDOW, NPS, STL, UDWR, USFS, Utility Companies
5. Activities associated with utility corridors should be conducted according to the "GUSG Disturbance Guidelines" (Appendix I). Routine maintenance and emergency repairs are not restricted by the timing guidelines.	BLM, CDOW, NPS, UDWR, USFS
6. If habitat disturbances occur that will require habitat restoration, the potential vegetation community needs to be identified (Winward 2004) and a diverse seed mixture of native shrubs, grasses, and forbs should be used (Monsen 2005).	BLM, CDOW, NPS, UDWR, USFS

Objective 1: Minimize the potential for negative impact of POWERLINES and other UTILITY CORRIDORS on GUSG and their habitat.	
Available Strategies	**Responsible Group**
7. Evaluate the impact of powerlines and other utility corridors on GUSG and GUSG habitat (see "Research" rangewide strategy, pg. 247, Objectives 2 and 7).	CDOW, UDWR, Utility Companies

Objective 2: Minimize the potential for negative impact of WIND TURBINES and COMMUNICATION TOWERS on GUSG and their habitat.	
Available Strategies	**Responsible Group**
1. Identify and map existing wind turbines and communication towers in GUSG range.	BLM, CDOW, NPS, STL, UDWR, USFS, Utility Companies Completion Date: 2007
2. For placement of new wind turbines or communication towers, GUSG seasonal habitats should be mapped and avoided whenever possible. If seasonal habitats are not mapped, construction should be avoided within the buffers described in 'GUSG Disturbance Guidelines" (Appendix I).	BLM, CDOW, NPS, STL, UDWR, USFS, Utility Companies
3. If wind turbines or communication towers are constructed closer to GUSG habitat than the minimum distance guidelines, retrofit all aspects of towers to deter raptor perching.	BLM, CDOW, NPS, STL, UDWR, USFS, Utility Companies
4. To minimize GUSG collisions with wind turbines, communication towers, and associated guy wires, encourage appropriately marking structures and/or altering tower features when near leks and other important seasonal GUSG habitat.	BLM, CDOW, NPS, STL, UDWR, USFS, Utility Companies
5. Activities associated with wind turbines, communication towers, and associated infrastructure should be conducted according the "GUSG Disturbance Guidelines" (Appendix I). Routine maintenance and emergency repairs are not restricted by the timing guidelines.	BLM, CDOW, NPS, STL, UDWR, USFS, Utility Companies
6. If habitat disturbances occur that will require habitat restoration, the potential vegetation community needs to be identified (Winward 2004) and a diverse seed mixture of native shrubs, grasses, and forbs should be used (Monsen 2005).	BLM, CDOW, NPS, STL, UDWR, USFS, Utility Companies
7. Evaluate the impact of wind turbines, communication towers, and associated infrastructure on GUSG and GUSG habitat (see "Research" rangewide strategy, pg. 247, Objectives 2 and 7).	CDOW, UDWR, Utility Companies

Objective 3: Minimize the potential for negative impact of FENCES on GUSG and their habitat.	
Available Strategies	**Responsible Group**
1. For placement of new fences, GUSG seasonal habitats should be mapped. New fences should not be placed within 0.6 mi of active leks.	BLM, CDOW, NPS, STL, UDWR, USFS
2. If fences are constructed closer than 0.6 mi to leks, or within other known GUSG seasonal habitats, then when possible, placement of fences should use topographic features to minimize possibility of GUSG collisions. Fences should be clearly marked for increased visibility and decreased probability of collision. Discourage the use of net-wire fencing if possible to allow easier movement of grouse under fences. Consider options to reduce possibility of raptors perching on fences. If fences are needed for seasonal livestock use, consider using let-down fences that can be put down during times of non-use.	BLM, CDOW, NPS, NRCS, STL, UDWR, USFS
3. Timing of activities should be modified according to the GUSG seasonal habitat in the area and the timing guidelines provided in Appendix I.	BLM, CDOW, NPS, NRCS, STL, UDWR, USFS
4. If habitat disturbances occur that will require habitat restoration, the potential vegetation community needs to be identified (Winward 2004) and a diverse seed mixture of native shrubs, grasses, and forbs should be used (Monsen 2005), if possible.	BLM, CDOW, NPS, NRCS, STL, UDWR, USFS
5. Evaluate the impact of fences on GUSG and GUSG habitat (see "Research" rangewide strategy, pg. 247, Objectives 2 and 7).	CDOW, UDWR

Objective 4: Minimize the potential for negative impact of ROADS on GUSG and their habitat.	
Available Strategies	**Responsible Group**
1. Identify and map roads in GUSG range.	BLM, CDOW, NPS, UDWR, USFS Completion Date: 2010
2. For placement of new roads, GUSG seasonal habitats should be mapped and avoided whenever possible. If seasonal habitats are not mapped, construction should be avoided within the buffers described in "GUSG Disturbance Guidelines" (Appendix I).	BLM, CDOW, County Governments, NPS, STL, UDWR, USFS
3. Timing of activities should be modified according to the GUSG seasonal habitat in the area and the timing guidelines provided in Appendix I.	BLM, CDOW, County Governments, NPS, STL, UDWR, USFS

Objective 4: Minimize the potential for negative impact of ROADS on GUSG and their habitat.	
Available Strategies	**Responsible Group**
4. If new roads are constructed within GUSG habitat, encourage appropriate governing authorities to restrict speed limits to 35 mph. Road should be constructed to avoid line-of-sight between strutting males and road/associated traffic.	BLM, CDOW, NPS, STL, UDWR, USFS
5. Consider GUSG habitat when determining allocation designations for user created routes. This should be done when developing activity or LUP level Travel Management Plans.	BLM, NPS, USFS
6. If habitat disturbances occur that will require habitat restoration, the potential vegetation community needs to be identified (Winward 2004) and a diverse seed mixture of native shrubs, grasses, and forbs should be used (Monsen 2005).	BLM, CDOW, County Governments, NPS, NRCS, STL, UDWR, USFS
7. Evaluate the impact of roads on GUSG and GUSG habitat (see "Research" rangewide strategy, pg. 247).	CDOW, UDWR

Hunting

If GUSG populations increase, there may be renewed interest in hunting the species. It is important to identify the steps necessary to address this possibility in a reasonable and biologically sound manner.

Objective 1: Institute recreational harvest of GUSG when and if populations can sustain it.	
Available Strategies	**Responsible Group**
1. Retain closed seasons while GUSG are classified as a candidate, threatened or endangered species.	CDOW, UDWR
2. Develop models to evaluate the impact of hunting removal of adult and juvenile male and female grouse under assumptions of additive vs. compensatory removal.	CDOW
3. Consider, with appropriate public input, opening hunting seasons when GUSG is no longer either a Candidate species for, or on, the list of threatened and endangered species. If the decision is made to allow hunting, develop season structures and other regulations to restrict harvest to 5-10% of the fall population, and to shift harvest away from adult females to the extent practical.	CDOW, UDWR

Information and Education

Informing and educating people about GUSG biology and status, threats to the species, and proposed conservation measures will provide people with an understanding of conservation concerns and perhaps introduce people to an otherwise unfamiliar but interesting avian species native to the western United States.

If planned and executed properly, actual learned objectives can be achieved through some of the current educational practices. Educational goals and objectives such as having participants know and demonstrate understanding of the monetary impact hunting and fishing have, as well as knowing and demonstrating understanding of how endangered species may act as indicator species, have all been successfully accomplished through educational practices. Educational programs have been successful through (1) focusing on school-aged students who will take newly acquired knowledge and communicate that understanding to their guardians at home; and (2) building a solid base of understanding for future generations by reaching youth.

The most successful educational activities in the past have usually been interactive. With manipulative games, interactive CD's, or hands on science, students have the best chance to relate to the concepts being taught. There are 2 basic ways of approaching these activities: (1) using a wide-range but "thin" approach; or (2) using a more specific targeted audience with in-depth coverage. Because GUSG populations are concentrated in specific parts of Colorado and Utah, we recommend targeting a specific audience for the most effective outcome. It is essential to keep landowners informed of the need for habitat protection and improvement, and to provide them information on effective techniques to achieve conservation goals.

Objective 1: **Keep landowners, public land managers, all potential stakeholders, and school children informed about the GUSG and its conservation.**	
Available Strategies	**Responsible Group**
1. Make the RCP and other relevant GUSG conservation information available to the public (e.g., on the RCP website)	CDOW, RSC
2. Continue participation in and dissemination of information to local GUSG work groups.	CDOW, UDWR
3. Establish and show demonstration areas to educate land managers about what good sage-grouse habitat is and how to create and maintain it.	BLM, CDOW, NPS, NRCS, UDWR, USFS
4. Establish and present an award(s) to recognize landowners that implement practices that benefit sage-grouse.	CDOW, NRCS, UDWR
5. Develop a GUSG student curriculum for students in selected school districts within the range of the GUSG.	CDOW, NGO's Completion Date: 2007

Lek Viewing

The protection of GUSG is dependent upon public interest in the species and support of conservation measures. Viewing courtship displays on leks may be of great interest to members of the public, which may translate into additional support for conservation. Nevertheless, lek viewing needs to be managed properly to avoid negative impacts to populations.

Objective 1: **Allow for public viewing of lek activity while minimizing harassment of GUSG at leks.**	
Available Strategies	**Responsible Group**
1. Design and enforce a lek viewing protocol that minimizes potential impacts to GUSG.	BLM, CDOW, Local Work Groups, NPS, UDWR, USFS
	Completion Date: By lekking season, 2006.
2. Treat lek locations as sensitive information.	BLM, CDOW, NPS, UDWR, USFS
3. Educate public about ethical viewing practices.	BLM, CDOW, Local Work Groups, NPS, UDWR, USFS
4. On public land, promote no more than 1 lek per population as a viewing site.	BLM, CDOW, Local Work Groups, UDWR, USFS
5. Monitor lek attendance patterns at viewing and control leks.	CDOW, UDWR
6. Evaluate the impact of lek viewing on GUSG (see "Research" rangewide strategy, pg. 247, Objective 7).	CDOW, UDWR

Noxious and Invasive Weeds

Although not a principal threat to GUSG populations, limited noxious weed invasions have occurred in some population areas. If not properly contained, these invasions can dramatically degrade the sagebrush habitat upon which GUSG depend. It is important that all work groups take actions now to monitor and minimize weed invasion while it is still manageable.

Objective 1: Minimize impact of noxious and invasive weeds on GUSG habitat.	
Available Strategies	**Responsible Group**
1. Identify and map undesirable noxious and invasive weed invasions that occur within GUSG habitat.	BLM, CDOW, County Governments, NPS, NRCS, SCD, STL, UDWR, USFS
2. Develop and implement control measures for noxious and invasive weeds.	BLM, CDOW, County Governments, NPS, NRCS, Private Landowners, SCD, STL, UDWR, USFS
3. Prevent new damaging invasions of noxious and invasive weeds in GUSG habitat.	BLM, CDOW, County Governments, NPS, NRCS, Private Landowners, SCD, STL, UDWR, USFS
4. Monitor effectiveness of treatments and/or spread of noxious and invasive weeds in GUSG habitat.	BLM, CDOW, County Governments, NPS, NRCS, Private Landowners, SCD, STL, UDWR, USFS
5. Integrate and coordinate weed management efforts with adjacent entities to increase effectiveness.	BLM, CDOW, County Governments, NPS, NRCS, SCD, STL, UDWR, USFS

Oil & Gas Development and Mining

Potential development in GUSG habitat from coal mining activities is minimal. Sand, gravel and other mineral mining activities may be associated with river channels within GUSG habitat. Appropriate suggested management practices (SMP's) for mineral development should be implemented during the planning and implementation phase of all mining sites to minimize impacts to the species (see energy and mineral SMP's in Appendix L). The following narrative provides additional information concerning oil and gas development procedures to aid the reader in the understanding and application of the recommended conservation strategies.

Federal energy resources are developed in Utah and Colorado through a leasing and permitting system. Rules and responsibilities are governed largely by the owner and/or regulator of the mineral estate. It is important to recognize that split estate situations often exist, where someone other than the surface owner owns the mineral estate for a particular parcel of land.

BLM manages the oil and gas resources on public lands as well as those federal minerals where the surface has been patented. BLM and USFS identify the lands open to leasing in their Land Use Plans (LUP's). The LUP's also identify any stipulations and/or conditions of approval needed to mitigate impacts.

Future development is managed on a site-by-site basis via permit with Conditions of Approval after site specific environmental analysis and a sufficient bond is posted. In those cases where the surface and mineral owners are different, both the BLM and state oil and gas commissions require the mineral owner to obtain a surface use agreement prior to permit approval. If the mineral owner is unable to obtain a surface use agreement, both the BLM and state oil and gas commissions have regulatory processes to address the surface use agreement issue. No NEPA analysis is required on private minerals/ non-federal land development processes. However, the owner and operator must abide by rules and regulations of the Colorado Oil and Gas Conservation Commission (COGCC) or the Utah Division of Oil, Gas, and Mining (UDOGM).

This section will be used primarily by those involved with and knowledgeable about the mining and energy industry in some way. Nevertheless, some basic background on the oil and gas development process is useful. The "typical" scenario leading to oil and gas development has several steps:

(1) Geophysical Exploration occurs (more detail follows). During this phase, the reservoir target is identified and a leasing nomination is submitted. Geophysical exploration may occur after the leasing stage as well.

(2) Leasing Stage. An LUP or associated amendment is developed using the NEPA process. Land that is available for oil and gas leasing is identified and stipulations are developed to mitigate impacts. Once a lease is granted, the oil and gas operator has a legal right to reasonable access to the lease for exploration and development, within the stipulation attributed to each parcel.

(3) Drilling Operations (more detail follows). An application for permit to drill (APD) is submitted, and if approved, an exploratory well is drilled. If the result is a "dry hole", the

well is plugged and reclamation occurs. Other APD's are submitted and approved and more exploratory wells are drilled until the company declines further exploration or a producing well is drilled. Once discovery is made, additional wells are drilled. These are development wells and fall under "Production Operations" below.

(4) Production Operations (more detail follows). A right-of-way for a pipeline is obtained and pipeline is installed. Production equipment is installed on the wellpad. The operator makes visits to the wellpad to make sure operations proceed properly and to adjust equipment. Operator submits sundry notices for other operations requiring approval, along with additional APD's. As wells become depleted, the operator obtains approval to plug the well and conduct reclamation.

Details of several of these stages follow, including clarification of which types of activities require various government leases and approvals.

Geophysical Exploration is a general term used for various indirect exploration methods which use geophysical instruments and methods to determine subsurface condition (i.e., the potential for oil and gas) by analysis of such properties as specific gravity, electrical conductivity, or magnetic susceptibility. A geophysical survey is the use of one or more geophysical techniques in geophysical exploration, such as earth currents, electrical, infra-red, heat flow, magnetic, radioactivity and seismic activity.

Most modern seismic exploration is based on the collection of data over a 2- or 3-dimensional grid. This requires thousands of geophones (instruments that detect Earth motions) placed on the ground and recording systems capable of recording ground motion from as many sites. The seismic wave is typically generated by either using a surface vibrator, i.e., a Vibroseis truck, or by an explosive source. Explosive sources are either placed in a drilled shot hole and exploded, or placed on the surface and exploded.

An oil and gas lease is not required to perform geophysical operations on federal lands. Federal approval to perform geophysical operations is required on surface lands administered by BLM or Forest Service.

Drilling Operations include all actions/phases associated with drilling an oil and gas well. They include access road construction, wellpad construction, drilling operations and completion operations. Drilling operations on federal oil and gas leases require an approved APD. Drilling operations consist of the use of a rotary drilling rig to drill a hole to the reservoir target and running open log holes. Completion operations include running cased hole logs, perforating the casing, installing the wellhead and facilities, and any stimulation of the reservoir, including hydraulic fracturing. If the well is dry and/or uneconomic, complete site reclamation is required.

An exploratory (wildcat) well is any well drilled beyond the known productive limits of any pool or field. A development well is any well drilled within the known productive limits of a pool or field for the purpose of obtaining oil and/or gas from the producing formation(s) in that field.

Production Operations include all actions/phases associated with production of oil and gas that occur after the drilling and completion of the well. They include pipeline construction, production equipment installation (separators, dehydrators, tanks), meter installation, compression installation, oil sales and hauling, water disposal and hauling, and interim wellpad reclamation activities. Production operations are approved via sundry

notices and/or right-of-ways. Sundry notices are required to change wellbore configuration, change metering and measurement, or for anything with new surface disturbance. Complete site reclamation occurs in the future after the well depletes and becomes uneconomic.

An oil and gas lease is required for all drilling and production activities. Inspections to assure compliance with regulations, stipulations and other orders are made by BLM and the COGCC or UDOGM.

Additional strategies that relate to Oil and Gas operations may be listed under the "Human Infrastructure" rangewide strategy (pg. 225).

Objective 1: Minimize mining and energy development impacts to GUSG habitat through planning. These strategies may differ in their application to the separate GUSG populations (as opposed to those in Objective 2).	
Available Strategies	**Responsible Group**
1. Identify federal lands open for Oil and Gas leasing during the land use planning process, while considering the impacts of mineral development on currently unleased GUSG habitat. Cumulative impacts of both leased and unleased GUSG habitat will be analyzed through projected development (reasonable foreseeable development- RFD) in the planning process.	BLM, USFS
2. Specific mitigation and exception criteria will be evaluated and implemented during the federal land use planning process and attach them to the lease as stipulations upon issuance.	BLM, USFS
3. Wherever possible, incorporate 'conditions of approval' (site specific mitigation measures) on proposed operations, consistent with lease rights. Mitigation outside of standard lease rights may be implemented if it is demonstrated that a combination of alternative mitigation measures does not reduce impacts to an acceptable level and those impacts constitute unnecessary and undue degradation of public lands and resources OR if mitigation is voluntarily implemented by the operator.	BLM, USFS
4. Encourage oil and gas companies to participate on local GUSG conservation work groups.	BLM, CDOW, UDWR, USFS
5. On private lands encourage CCAA development that incorporates SMP's for mineral development (see Appendix L).	CCAA Cooperators, CDOW, Private Landowners, UDWR, USFWS
6. Encourage counties, local work groups and private landowners to be involved in state oil and gas commission meetings, in order to comment on wellpad spacing densities and comprehensive planning within GUSG habitats.	BLM, CDOW, County Governments, Local Work Groups, NRCS, Private Landowners, UDWR, USFS

Objective 1: Minimize mining and energy development impacts to GUSG habitat through planning. These strategies may differ in their application to the separate GUSG populations (as opposed to those in Objective 2).	
Available Strategies	**Responsible Group**
7. If federal mining estate development is planned within potential breeding habitat (4-mile radius of an active lek): (a) delineate and field validate GUSG seasonal habitats, using methods identified in Connelly et al. 2003, until minimum data standards are established under "Habitat Monitoring" Objective 1, Strategies 7 and 8, Objective 2, Strategy 1.) Review of field data and habitat delineation should be coordinated with local CDOW or UDWR and/or BLM field biologists. (b) Complete a comprehensive development plan for the Geographic Area (except for exploratory wells), which includes measures to avoid or minimize loss of breeding habitat, such as clustering wellpads and associated infrastructure in non-sagebrush habitats.	BLM, CDOW, Oil and Gas Companies, UDWR, USFS
8. Apply "Suggested Management Practices (Appendix L) to minimize long term habitat loss and fragmentation in all sage-grouse seasonal habitats using best available science as guidelines (Connelly et al. 2000) and "GUSG Disturbance Guidelines" (Appendix I).	BLM, CDOW, COGCC, NPS, NRCS, Oil and Gas Companies, Private Landowners, UDOGM, UDWR, USFS
9. The following Lease Notice will be applied to new leases where necessary: "In order to protect crucial GUSG habitat, timing restrictions and controlled surface use may be applied beyond the 60 day and 200 meter standard lease rights. A wildlife and/or botanical inventory may be required prior to approval of operations. The inventory data will be used to apply conservation measures such as relocation of roads, pads, pipelines and other facility designs to reduce the impacts of surface disturbance on crucial GUSG habitat."	BLM, USFS

Objective 2: Minimize mining and energy development impacts to GUSG Habitat. These strategies apply to GUSG rangewide (as opposed to those in Objective 1).	
Available Strategies	**Responsible Group**
1. On federal lands or areas with federal mineral rights, apply a lease stipulation of NSO (no surface occupancy) within 0.6 (6/10ths) mile radius of active leks, for new leases.	BLM, USFS

Objective 2: Minimize mining and energy development impacts to GUSG Habitat. These strategies apply to GUSG rangewide (as opposed to those in Objective 1).	
Available Strategies	**Responsible Group**
2. Encourage and/or offer to have agency biologists attend notice of staking on-site visits on private lands, as well as state and federal mineral estates, to locate well pads and roads outside of important sage-grouse habitat whenever possible. a. Provide a digital layer of important sage-grouse habitat to Oil and Gas (O&G) Conservation Commission to identify opportunities for coordination. b. Encourage agency biologists to talk with O&G companies about willingness to participate in site visits. c. Educate oil and gas companies on GUSG habitat and the importance of protecting key sites.	BLM, CDOW, COGCC, NPS, NRCS, Private Landowners, UDOGM, UDWR, USFS
3. Develop evaluation and monitoring process for meeting reclamation objectives using standard criteria. a. Develop standard monitoring methods for evaluation. b. Identify and implement incremental habitat reclamation objectives.	BLM, CDOW, COGCC, UDOGM, USFS, UDWR
4. Recommend setting bonds sufficient to ensure appropriate GUSG habitat reclamation is met.	BLM, COGCC, County Governments, Local Work Groups, UDOGM, USFS
5. Develop a mitigation process (similar to USFWS mitigation policy). a. Use off-site mitigation, where appropriate to achieve sage-grouse habitat objectives. b. Investigate, evaluate and implement mitigation trusts/banking opportunities, where appropriate.	BLM, CDOW, UDWR, USFS, USFWS
6. Avoid or minimize impacts of sand and gravel operations on sage-grouse habitat. (see mineral and energy SMP's in Appendix L) a. Locate operations outside of lek buffer. b. Place sand and gravel pits in an area with the least amount of impact to brood-rearing habitat (1000 ft. outside of riparian areas where feasible).	BLM, CDOW, NPS, Private Landowners, USFS, UDWR
7. Investigate the impacts of mining and energy development on GUSG habitat (see "Research" rangewide strategy, pg. 247, Objective 2).	CDOW, UDWR

Objective 3: Minimize mining and energy development impacts to GUSG from human disturbance.	
Available Strategies	**Responsible Group**
1. Specific mitigation and exception criteria are evaluated and implemented during the land use planning process and are attached to the lease as stipulations upon issuance.	BLM, USFS
2. Wherever possible, incorporate 'conditions of approval' (site specific mitigation measures) on proposed operations, consistent with lease rights, to avoid important seasonal habitat use periods. Mitigation outside of standard lease rights may be implemented if it is demonstrated that a combination of alternative mitigation measures does not reduce impacts to an acceptable level and those impacts constitute unnecessary and undue degradation of public lands and resources OR if mitigation is voluntarily implemented by the operator.	BLM, COGCC, UDOGM, USFS
3. Encourage CCAA development on private lands which incorporates SMP's for mineral development (see Appendix L).	CDOW, UDWR, USFWS Completion Date: 2006
4. Encourage on private lands and incorporate on federal lands appropriate GUSG conservation measures on all geophysical exploration, to avoid important seasonal habitat use periods.	BLM, CDOW, COGCC, NPS, Private Landowners, STL, UDOGM, UDWR, USFS
5. Prohibit activities during the lekking season within a 0.6 mi. buffer around the lek, or if not possible, avoid the lek buffer from sunset to 2 hours after sunrise. Leks – March 20- May 15 (Exploration, Drilling, Production)	BLM, NPS, Private Landowners, STL, USFS
6. Avoid human activities and construction in mapped seasonal GUSG habitats during the time periods identified in Appendix I.	BLM, Oil and Gas Companies, USFS
7. Investigate impacts of mining and energy on GUSG (see "Research" rangewide strategy, pg. 247, Objective 7).	CDOW, UDWR

Pesticides

Conservation strategies for insecticide use should focus efforts (by NRCS) on (1) educating agricultural producers and cooperators about the potential impacts of insecticide spraying on sage-grouse; and (2) evaluation of specific insecticide types and timing of applications in an effort to minimize the impacts to sage-grouse. Insecticide application should be avoided during early brood-rearing (May-June) when use of insects by sage-grouse chicks is highest. In situations where insecticide application in sage-grouse habitat is unavoidable, alternative insecticides of lower toxicities should be recommended. The use of biological control to control crop-damaging insects and mosquitoes should be encouraged as an alternative to insecticide application whenever possible.

If herbicides are to be used for vegetation management, recommended guidance should be followed (see Objective 2) with care taken to minimize impacts to GUSG.

Objective 1: Avoid insecticide-related direct and indirect mortality to sage-grouse.	
Available Strategies	**Responsible Group**
1. Avoid spraying insecticides in sagebrush areas in May and June; avoid spraying in croplands/riparian areas in July and August.	BLM, CDOW, County Governments, NRCS, Private Landowners, UDWR, University Extension
2. Use alternative chemicals that have lower toxicity to sage-grouse.	BLM, CDOW, County Governments, NRCS, Private Landowners, UDWR, University Extension
3. Investigate the use of natural enemies to crop-damaging insects.	CDOW, NRCS, UDWR, University Extension
4. Develop an educational campaign to provide agricultural producers with information on the effects of insecticides on sage-grouse, possible alternative chemicals or control methods, and application timing that minimizes impacts to sage-grouse chicks.	CDOW, NRCS, UDWR, University Extension
5. Develop an incentive program to encourage agricultural producers to use less toxic methods of insect control.	CDOW, NRCS, UDWR, University Extension
6. Evaluate potential impacts to GUSG when insecticide use is proposed to reduce threats to resources on public lands, such as WNV spread.	BLM, CDOW, NPS, NRCS, UDWR, USFS

Objective 2: Apply herbicides in conjunction with existing guidance, while minimizing impacts to GUSG.	
Available Strategies	**Responsible Group**
1. Apply herbicides in conjunction with recommended guidance in Monsen (2005), where appropriate.	BLM, CDOW, County Governments, NPS, NRCS, Local Work Groups, Private Landowners, UDWR, USFS
2. Apply herbicides on BLM land consistent with BLM Vegetation Treatment EIS (1991).	BLM, CDOW, UDWR

Population Augmentation

Some of the smaller GUSG populations are likely to need augmentation to either avoid extinction or to boost genetic diversity (see "Genetics" rangewide strategy, pg. 208). In addition, it might be feasible to expand current populations and/or to establish new populations in historic habitat. Research into the possible avenues for doing this, including translocations and captive breeding, is necessary.

Objective 1: Reduce modeled extinction probabilities of small populations to less than 1% in 50 years through augmentation with wild-trapped or captive produced birds.	
Available Strategies	**Responsible Group**
1. Conduct, by 2010, research to evaluate success of translocating eggs or very young chicks to nests or brood hens (see "Research" rangewide strategy, pg. 247, Objective 3).	CDOW, UDWR, and Other Research Institutions
2. Conduct by 2010, research on captive breeding and rearing techniques (see "Research" rangewide strategy, pg. 247, Objective 3).	CDOW, UDWR, and Other Research Institutions
3. Evaluate procedures to augment populations that decline to 50% of target population size. If a population declines to 75% of target population size, then initiate augmentations with translocated or captive-reared eggs or chicks, following protocols to be developed based on current knowledge (to be modified by research results from strategy 1 above; see discussion in "Population Augmentation" pg. 180). Birds could be transplanted from the Gunnison Basin provided at least 450 males were counted on leks in the spring preceding the transplant.	CDOW, UDWR
4. Establish by 2010, if research in 1 and 2 above prove the efficacy, a captive breeding facility to serve as a reservoir of genetic diversity and to produce eggs and/or young to augment existing populations (as in 3) or genetic diversity until habitat and populations increase and stabilize.	CDOW

Objective 2: Establish sage-grouse populations in all historic, vacant, but suitable habitat through release of wild-trapped or captive produced birds.	
Available Strategies	**Responsible Group**
1. Evaluate potential for historic but currently unoccupied sagebrush habitats of 15,000 acres or larger to support GUSG by 2008.	CDOW, UDWR
2. Develop re-introduction protocols based on research discussed above by 2010.	CDOW, UDWR
3. Reintroduce translocated and/or captive-produced eggs and /or young into vacant historical habitat judged suitable.	CDOW, UDWR, USFWS

Population Monitoring and Targets

Current methods of estimating GUSG population size from lek counts make many unsupported assumptions. Research to address these assumptions and establish a more precise estimate is needed.

The population targets in this plan are based on current population estimates and potential habitat conditions (see "GUSG Population Targets Development", pg. 198). Habitat conditions and availability are expected to change over time, necessitating the need for reevaluation of population targets. In addition, population targets should be modified as knowledge of GUSG behavior and use of landscape features improves.

Objective 1: Assess GUSG population size and trends and provide for the long-term monitoring of GUSG.	
Available Strategies	**Responsible Group**
1. Using results of the "Research" strategy (pg. 247, Objective 1), develop statistically defensible methods to estimate population size and/or trends.	CDOW, UDWR
2. Maintain consistent current lek count protocols, but use research results to establish protocols for future population monitoring and record keeping, including mechanisms to insure consistent implementation and reporting.	CDOW, UDWR

Objective 2: Reevaluate population targets as habitat conditions change and knowledge increases with regards to GUSG behavior and population dynamics.	
Available Strategies	**Responsible Group**
1. Use adaptive management approach (pg. 302) to re-evaluate current population targets. Set population targets for any newly established populations.	CDOW, UDWR Completion Date: Starting in 2010 and every 5 years thereafter.

Predation

Because some GUSG populations are so small and are embedded in highly fragmented and developed landscapes, intensive predator control should be considered as a short-term management tool when predation causes significant population declines and where legally feasible. An integrated program that includes both intensive and extensive predator control methods may be the most effective but will likely be costly. Any predator control program must follow guidelines established by the CDOW and the UDWR, and include quantifiable objectives and long-term monitoring of both predator and GUSG populations in order to evaluate the effectiveness and validity of the program.

Objective 1: Protect GUSG from excessive predation when populations (3-year average) fall below 25 birds or to 25% of the long-term average goal.	
Available Strategies	**Responsible Group**
1. Identify relevant predator species within local GUSG populations that meet the trigger described above (see "Research" rangewide strategy, pg. 247, Objective 4).	BLM, CDOW, NPS, Other Research Institutions, UDWR, USFS, USFWS
2. Determine age-specific mortality and identify relative risks from avian and mammalian predation within local GUSG populations meeting the trigger described above (see "Research" rangewide strategy, pg. 247, Objective 4).	BLM, CDOW, NPS, Other Research Institutions, UDWR, USFS, USFWS
3. Evaluate whether predator control aimed at specific predator species is an effective management tool that increases production and recruitment of sage-grouse in the local populations meeting the trigger above (see "Research" rangewide strategy, pg. 247, Objective 4).	BLM, CDOW, NPS, Other Research Institutions, UDWR, USDA (APHIS), USFS, USFWS
4. Implement research to better understand the behavioral and spatial interactions of predators with prey and other predator species (see "Research" rangewide strategy, pg. 247, Objective 2, Strategy 2, and Objective 4)	BLM, CDOW, NPS, Other Research Institutions, UDWR, USDA (APHIS), USFS, USFWS
5. Evaluate the large-scale effects of landscape structure (composition and configuration of landcover types) and small-scale effects (vegetation structure and predator exclosures) on predator-prey interactions (see "Research" rangewide strategy, pg. 247, Objective 4).	BLM, CDOW, NPS, Other Research Institutions, UDWR, USDA (APHIS), USFS, USFWS
6. Evaluate land use practices that may increase predator populations (e.g., residential development and landfills that may provide artificial food sources for several species of avian and mammalian predators) (see "Research" rangewide strategy, pg. 247, Objective 4).	CDOW, County Governments, UDWR
7. Evaluate the effect of abandoned structures (e.g., farmsteads) that may serve as denning or nesting sites for predators (see "Research" rangewide strategy, pg. 247, Objective 4).	CDOW, UDWR

Objective 1: Protect GUSG from excessive predation when populations (3-year average) fall below 25 birds or to 25% of the long-term average goal.	
Available Strategies	**Responsible Group**
8. If research establishes predator control is likely to be effective, then develop and implement predator management strategies designed for specific GUSG population that is in accordance with CDOW, UDWR, and Federal regulations and policies.	BLM, CDOW, NPS, UDWR, USDA (APHIS), USFS, USFWS

Recreational Activity

Although it has been suggested there might be impacts to GUSG from recreational activities, research is needed to investigate this possibility. General guidelines for minimizing disturbance to GUSG will be useful in addressing any potential impacts.

Objective 1: If recreational activity is suspected in population declines, use experimentally designed studies to evaluate the cause and effect of recreational activity on the productivity and population viability of GUSG.	
Available Strategies	**Responsible Group**
1. Evaluate the effect of recreational activities on mating behavior (e.g., the number of males and females attending leks, time spent on leks by males and females, disturbance of courtship displays on leks by males, or the number of copulations (see "Research" rangewide strategy, pg. 247, Objective 7).	CDOW, Other Research Institutions, UDWR
2. Evaluate the effect of recreational activities on nesting and brood-rearing success (e.g., examine whether nest site selection, nest success and brood survival is greater in areas with little or no disturbance from human activities than areas with intensive recreational use (see "Research" rangewide strategy, pg. 247, Objective 7).	CDOW, Other Research Institutions, UDWR
3. Evaluate the effect of recreational activities on winter flocks (e.g., does snowmobiling decrease winter survival rates of sage-grouse (see "Research" rangewide strategy, pg. 247, Objective 7).	CDOW, Other Research Institutions, UDWR
4. Evaluate the effect of recreational activities on recruitment and long-term population dynamics of GUSG (see "Research" rangewide strategy, pg. 247, Objective 7).	CDOW, Other Research Institutions, UDWR

Objective 2: If it is demonstrated recreational activities are detrimental to the productivity and recruitment of GUSG, then implement strategies to minimize the affect of recreational activities.	
Available Strategies	**Responsible Group**
1. Minimize the effect of recreational activities on publicly-owned properties (where appropriate) by: a. Closing roads that are within 0.6 miles of a lek during the lekking season (March - May). b. Posting warning signs along roads within 2.0 miles of leks. Signs should indicate that the area is important for GUSG breeding and traffic (including hiking, biking, off-road vehicles) in the area is discouraged, March-May, especially at dawn and dusk (see "GUSG Disturbance Guidelines", Appendix I). c. Discouraging recreational activities in areas identified as GUSG winter habitat (during the winter). d. Permanently closing or relocating secondary roads and/or trails where appropriate, within areas identified as important seasonal GUSG habitat. e. If pets are determined to be a significant predator or disturbance factor of sage-grouse and sage-grouse nests (see "Research" rangewide strategy, pg. 247), then pets should be prohibited (or on a leash) in important breeding and nesting areas.	BLM, CDOW, NPS, UDWR, USFS
2. Minimize the effect of recreational activities on privately-owned properties by: a. Encouraging landowners to limit public access to leks and nesting areas on their property by posting warning signs. b. Assisting landowners in developing a responsible lek viewing program that controls access and limits disturbance to leks (see "Lek Viewing" rangewide strategy, pg. 231).	CDOW, Local Work Groups, Private Landowners, UDWR
3. Distribute informational material on the potential harmful effects of recreational activities on breeding, nesting, and winter areas based on results of research studies.	BLM, CDOW, Local Work Groups, NPS, UDWR, USFS

Research

There has been a great deal of speculation about the causes of the recent decline of GUSG populations. Unfortunately, there are few or no data derived from research studies to evaluate the various hypotheses for decline or the effectiveness of conservation actions to reverse it. This section is a summary of specific research needs that have been noted throughout the RCP. This list is meant only to illustrate where information is needed for GUSG. Among the many threats that face GUSG, some people have expressed concern that some research methods (e.g., trapping and radiotelemetry) may potentially harm grouse. While the RSC acknowledges those concerns, it should be noted that all research projects are peer-reviewed and evaluated by an Animal Care and Use Committee. Furthermore, we do not consider research to be a significant threat to a population or, ultimately, to the survival of GUSG. Information gained from scientific studies is indispensable for improving our understanding of the behavior and population dynamics of GUSG. This knowledge is critical to developing reasonable and defendable conservation and management actions and plans. An effective management program will require research studies that incorporate an adaptive management approach that uses acquired scientific information in the implementation of revised research and management plans.

Among the research objectives listed below, we consider the following objectives and their strategies to be the highest priority research needs:

- Objective 1: Develop and evaluate protocols for the inventory and monitoring of GUSG (Strategies 1, 2, 3, 4, 6, and 7).
- Objective 2: Evaluate the effect of habitat quality and quantity on the behavior (e.g., seasonal movement and dispersal) and population dynamics of GUSG (Strategies 1, 2, 3, 4, 5, and 6).
- Objective 3: Evaluate augmentation and captive rearing techniques on the population dynamics of GUSG (Strategies 1, 3, and 4).

Objective 1: Develop and evaluate protocols for the inventory and monitoring of GUSG populations and to evaluate factors that influence the population ecology of GUSG.	
Strategies	**Responsible Group**
1. Determine the validity of using lek counts to estimate population abundance by evaluating the impact of lek attendance (male and female), interlek movement, and sex ratio on population estimation. Evaluate the sources of observer bias and the effect of variability in lek counts on the long-term population dynamics of GUSG.	CDOW, UDWR and Other Research Institutions
2. Evaluate whether lek counts can be calibrated and measurements of accuracy and precision can be assessed using mark-resight or sightability models.	CDOW, UDWR and Other Research Institutions
3. Evaluate alternative methods for estimating population abundance (e.g., line transects or DNA fingerprinting using fecal samples).	CDOW, UDWR and Other Research Institutions

Objective 1: Develop and evaluate protocols for the inventory and monitoring of GUSG populations and to evaluate factors that influence the population ecology of GUSG.	
Strategies	**Responsible Group**
4. Determine the causes of mortality in different age and sex classes and the consequences for population dynamics.	CDOW, UDWR and Other Research Institutions
5. Examine the correlation (and time lag) between the variation in annual productivity and subsequent lek counts and its impact on the precision of population estimates.	CDOW, UDWR and Other Research Institutions
6. Refine the population viability assessment of GUSG based on more accurate and precise estimates of demographic parameters.	CDOW, UDWR and Other Research Institutions

Objective 2: Evaluate the effect of habitat quality and quantity on the behavior and population dynamics of GUSG.	
Strategies	**Responsible Group**
1. Evaluate the effect of the amount, configuration and composition of contrasting habitat types (including sage-grouse seasonal habitats) on sage-grouse behavior (e.g., movement and dispersal), species distribution, productivity, and population dynamics. Map and analyze landscape metrics (e.g., edge density, fragmentation, heterogeneity, fractal dimension), using the most reliable and current GIS data (see Objective 2, Strategy 7) and examine the spatial and temporal correlation with sage-grouse population dynamics. Evaluate the potential for dispersal of individuals into currently unoccupied suitable habitat.	CDOW, UDWR and Other Research Institutions
2. Evaluate the efficacy of remote sensing products and technologies in order to develop GIS databases of sufficient spatial resolution to evaluate the effect of changes in landcover types and land uses on the distribution and population dynamics of GUSG.	BLM, CDOW, UDWR, USFS, USGS, and Other Research Institutions
3. Develop a spatially-explicit population model that incorporates current estimates (with appropriate estimates of temporal and spatial variation) of demography (Objective 1, Strategy 6) and movement (Objective 2, Strategy 1) in order to evaluate the relative effects of changing land uses on GUSG populations.	CDOW, UDWR and Other Research Institutions
4. Evaluate the effect of vegetation structure (e.g., sagebrush canopy height and cover, forb and grass height, diversity, and abundance) on sage-grouse productivity (nest success and brood survival), adult survival and population dynamics.	CDOW, UDWR and Other Research Institutions

Objective 2: Evaluate the effect of habitat quality and quantity on the behavior and population dynamics of GUSG.	
Strategies	**Responsible Group**
5. Examine the temporal and spatial variation in environmental conditions that affect sagebrush habitat (e.g., defoliation or die-off of sagebrush as a result of drought) and their effects on sage-grouse productivity and demographics.	CDOW, UDWR and Other Research Institutions
6. Examine the effects of different habitat treatments on the behavior (e.g., movement patterns), productivity, and population dynamics of sage-grouse.	CDOW, UDWR and Other Research Institutions
7. Evaluate the effect of varying grazing management practices (domestic and wild ungulates) on the quality of sagebrush habitat (e.g., grass and forb abundance, diversity, and vegetation structure) and its relationship to sage-grouse productivity, demographics and population viability; use results to develop grazing BMP's for sage-grouse.	CDOW, UDWR and Other Research Institutions
8. Evaluate the potential impact of, and techniques for, converting CRP to sagebrush habitat on sage-grouse distribution and population viability.	CDOW, UDWR and Other Research Institutions
9. Evaluate the effect of powerlines, fences, roads, mining, energy development (including wind turbines), and other human infrastructure on habitat use, production, nest success, and mortality rates of the different age and sex classes of sage-grouse.	CDOW, UDWR, Utility Companies and Other Research Institutions

Objective 3: Evaluate augmentation and captive rearing techniques on the population dynamics of GUSG.	
Strategies	**Responsible Group**
1. Evaluate the effect of population augmentation on sage-grouse demographics and genetic diversity.	CDOW, UDWR and Other Research Institutions
2. Evaluate timing and procedure of translocating adults (male and female) between existing populations.	CDOW, UDWR and Other Research Institutions
3. Evaluate the effectiveness of translocating eggs or chicks to nests or brood hens.	CDOW, UDWR and Other Research Institutions
4. Evaluate the effectiveness of a captive-breeding program for population augmentation and translocations by: 1) evaluating the potential for maintaining a captive population, 2) evaluating the effect of hatching chicks in captivity on juvenile survival and recruitment, and population viability, and 3) evaluating the efficacy of translocating captive reared chicks to brood hens.	CDOW, UDWR and Other Research Institutions

Objective 3: Evaluate augmentation and captive rearing techniques on the population dynamics of GUSG.	
Strategies	**Responsible Group**
5. Evaluate timing and procedure of translocating (reintroducing) individuals of varying age and sex classes into currently unoccupied but suitable sagebrush habitat.	CDOW, UDWR and Other Research Institutions

Objective 4: Examine the effect of predation on GUSG behavior and population dynamics and monitor predator and prey populations.	
Strategies	**Responsible Group**
1. Identify relevant predator species within local GUSG populations that meet the trigger described in the "Predation" rangewide strategy (pg. 243).	CDOW, UDWR and Other Research Institutions
2. Determine age-specific mortality and identify relative risks from avian and mammalian predation within local GUSG populations meeting the trigger described in the "Predation" rangewide nstrategy (pg. 243).	CDOW, UDWR and Other Research Institutions
3. Evaluate whether predator control aimed at specific predator species is an effective management tool that increases production and recruitment of sage-grouse in the local populations meeting the trigger described in the "Predation" rangewide strategy (pg. 243).	CDOW, UDWR and Other Research Institutions
4. Implement research to better understand the behavioral and spatial interactions of predators with prey and other predator species.	CDOW, UDWR and Other Research Institutions
5. Evaluate the large-scale effects of landscape structure (composition and configuration of landcover types) and small-scale effects (vegetation structure and predator exclosures) on predator-prey interactions.	CDOW, UDWR and Other Research Institutions
6. Evaluate land use practices that may increase predator populations (e.g., residential development and landfills that may provide artificial food sources for several species of avian and mammalian predators).	CDOW, UDWR and Other Research Institutions
7. Evaluate the impact of perch sites for avian predators (e.g., fences and power lines).	CDOW, UDWR and Other Research Institutions
8. Evaluate the effect of abandoned structures (e.g., farmsteads) that may serve as denning or nesting sites for predators.	CDOW, UDWR and Other Research Institutions
9. Evaluate methods to deter predation on leks (e.g., nest protection structures, fencing).	CDOW, UDWR and Other Research Institutions

Objective 5: Examine the population genetics and evaluate conservation programs to maintain genetic diversity of GUSG.	
Strategies	**Responsible Group**
1. Evaluate the relative effectiveness of translocating females, chicks, or eggs, in maintaining genetic diversity in each sage-grouse population.	CDOW, UDWR and Other Research Institutions
2. Examine the variation in mating skew among males in each sage-grouse population and evaluate whether mating skew is a function of the number or size of leks.	CDOW, UDWR and Other Research Institutions
3. Determine the extent, cause and consequence of inbreeding depression in sage-grouse and its effect on productivity and population dynamics.	CDOW, UDWR and Other Research Institutions
4. Assess the potential for genetic drift in each sage-grouse population (i.e., measure the fluctuation in alleles or haplotypes over time) and evaluate the effect on the loss of genetic diversity.	CDOW, UDWR and Other Research Institutions

Objective 6: Evaluate the relative risk of WNV to GUSG.	
Strategies	**Responsible Group**
1. Determine the level of susceptibility and survival patterns of each age and sex class.	CDOW, UDWR and Other Research Institutions
2. Examine the spatial interaction of mosquito species that are the main vectors of the virus (e.g., *Culex tarsalis* and *C. pipiens*) with seasonal habitat use by GUSG (i.e., evaluate whether sage-grouse are more likely to be exposed to the virus in relatively wetter brood-rearing habitat than in lekking and nesting habitats).	CDOW, UDWR and Other Research Institutions
3. Examine whether sage-grouse can develop immunity to the virus and whether the immune response can be inherited.	CDOW, UDWR and Other Research Institutions
4. Examine the potential impact of the virus on the population dynamics and viability.	CDOW, UDWR and Other Research Institutions

Objective 7: Evaluate the impact of disturbances on the population dynamics of GUSG.	
Strategies	**Responsible Group**
1. Evaluate the effect of recreational activities (e.g., lek viewing, hiking, camping, off-road vehicles, etc.) on the mating behavior and life history patterns of sage-grouse.	CDOW, UDWR and Other Research Institutions

Objective 7: Evaluate the impact of disturbances on the population dynamics of GUSG.	
Strategies	**Responsible Group**
2. Evaluate the impact of agricultural and residential development (c) on the distribution and population dynamics of sage-grouse.	CDOW, UDWR and Other Research Institutions
3. Evaluate the impact of oil and gas development on the distribution and population dynamics of sage-grouse.	CDOW, UDWR and Other Research Institutions
4. Evaluate the impact of trapping and radio-marking or other research tools on the behavior, survival and productivity of sage-grouse.	CDOW, UDWR and Other Research Institutions

Objective 8: Investigate the interactions and interrelationships of species in sagebrush ecosystems.	
Strategies	**Responsible Group**
1. Evaluate the spatial and temporal interactions between different trophic levels (e.g., predators and prey) and between similar trophic levels (e.g., examine the impact of grazing by deer and elk on the quality of sagebrush habitats and its effect on sage-grouse behavior and productivity).	CDOW, UDWR and Other Research Institutions

Weather/Drought

Drought conditions and other extreme climatic conditions, such as abnormally high snowfall years or extremely cold years, appear cyclical and are nothing that sage-grouse have not experienced before. However, competing uses for water and land use provide additional challenges that need to be managed cooperatively and creatively. Therefore, climatic conditions should be monitored to determine how management practices can be used to maintain and improve habitat conditions.

In a report summarizing sagebrush defoliation in some GUSG areas, Wenger et al. (2003) state: "Several years of drought in western Colorado have stressed many plant communities. It has been suggested that the cumulative impacts from drought and insect or pathogen activity caused the defoliation and mortality (A. Winward, and S. Monsen, personal communication) of sagebrush in affected areas." Observations of such 'sagebrush die-off' events in recent years have been documented in Gunnison, Dry Creek Basin, near Monticello UT (106,000 acres), as well as in other GUSG habitat areas.

Objective 1: Investigate the effects of variable climatic conditions on GUSG.	
Strategies	**Responsible Group**
1. Monitor climatic conditions and research direct impact on sage-grouse survival, reproductive success, nest success, recruitment, movements, and habitat use.	CDOW, UDWR, Other Research Institutions
2. Monitor climatic conditions and evaluate effects on vegetation and insects that might affect sage-grouse cover and forage.	BLM, CDOW, UDWR, Other Research Institutions
3. Monitor sagebrush die-off events when and where they occur, using standard protocol and habitat attributes as outlined in the "Habitat Monitoring" strategy (pg. 220).	BLM, CDOW, Private Landowners, UDWR, USFS

Objective 2: Manage sage-grouse cover and forage in anticipation of drought conditions.	
Strategies	**Responsible Group**
1. Develop grass banks for livestock producers to graze during extreme conditions.	BLM, CDOW, NRCS, UDWR, USFS
2. Develop additional water sources for wildlife and livestock to minimize impact to existing riparian, wetland, and wet meadow areas.	BLM, CDOW, NRCS, UDWR, USFS
3. Manage invasive vegetation in riparian, wetland, and wet meadow areas to improve water table.	BLM, CDOW, NPS, NRCS, UDWR, USFS
4. In areas experiencing sagebrush defoliation due to drought or other natural factors, adjust grazing management, prescriptive fire, and/or vegetation management to minimize additive impacts.	BLM, CDOW, Private Landowners, NPS, NRCS, UDWR, USFS

Plan Implementation and Funding Allocation

An important part of any successful planning process is an implementation schedule with associated costs, and identification of current or potential funding. This plan endeavors to meet criteria identified by the USFWS for evaluation of conservation efforts when making listing decisions (PECE). The PECE criteria call for:

- 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.
- Explicit objectives for the conservation effort and dates for achieving them are stated.
- 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.

For each strategy or task, this plan has identified the responsible parties and the completion date where appropriate. Funding mechanisms are summarized in Appendix C. However, the estimated cost of the tasks has not yet been developed and a comprehensive implementation schedule must be developed.

Objective 1: Meet the PECE criteria with regards to implementation of the plan, identification of costs and funding sources, and mechanism to report progress.	
Strategies	**Responsible Group**
1. Develop a multi-year implementation plan that includes implementation schedule, costs, funding mechanisms, prioritization, and tasks leads.	RSC
	Completion Date: 2005
2. Develop provisions for monitoring and reporting progress in plan implementation.	RSC
	Completion Date: 2005
3. Report on plan effectiveness utilizing provisions developed in #2.	RSC
	Completion Date: Annually