9. Habitat Monitoring					
ISSUE 9.1	Information on the location and condition of current seasonal habitats for GrSG in Colorado may not be adequate to effectively manage, maintain, and/or improve those habitats.				
OBJECTIVE 9.1.1	On a statewide basis, identify and delineate current GrSG habitat and track future changes in habitat.				
Reference Number	**Conservation Strategy**	**Responsible Parties**	**Timeline**	**Implementation**	**Effectiveness**
9.1.1.1	Develop inventory technique(s) (in conjunction with similar efforts for GuSG) for searching "vacant/unknown" habitat areas for sage-grouse use. Techniques should: (1) determine grouse presence and/or use; and (2) assist in delineating and distinguishing between "suitable vacant" areas and "suitable unknown" areas (using GIS mapping).	CPW	2008	**CPW: General -** CPW updates range maps for GrSG once every 4 years. Occupied range for GrSG was updated statewide in 2012 in conjunction with development of Priority Habitat maps. Vacant/unknown habitat polygons were also updated during this process, with some areas becoming occupied range and others being removed as unsuitable. **PPR** - Pellet transects were used to search for presence of GrSG on the Sunnyside area North and West of the Battlements. This area was vacant/unknown at the time but has now been changed to occupied (at least during extreme winters). CPW Researcher B. Walker has also used pellet transects to look at detection probability and occupancy. **NP and MP-** Inventory of vacant and unknown habitats is not an issue for NP or MP. The entirety of North Park and vast majority of Middle Park is GrSG habitat.	
9.1.1.2	In conjunction with efforts for GuSG, develop technique(s) to use in searching for new or previously unknown GrSG leks.	CPW	2008	**CPW Research:** CPW (Brett Walker) has been deploying solar GPS satellite transmitters on GRSG in the Hiawatha field (2010-2012) and in the PPR (2012) as part of a project evaluating lek-based monitoring and management strategies (Walker 2012a, Walker 2012b). Tracking morning locations of GPS males during the breeding season allows identification, confirmation, and counting of new GRSG leks. In addition, dual-frame sampling from helicopter has been conducted in four population zones in Colorado (North Park in 2009, Great Divide in 2010, and PPR in 2012). Dual-frame sampling includes surveying for GRSG leks within a spatially balanced random sample of 1 x 1 km cells (Walker 2012d). CPW Research: (1) Walker, B. L. 2012a. Using GPS Satellite Transmitters to Estimate Survival, Detectability on Leks, Lek Attendance, Inter-lek Movements, and Breeding-Season Habitat Use of Male Greater Sage-Grouse in Northwestern Colorado. Colorado Parks and Wildlife annual progress report. (2) Walker, B. L. 2012b. Evaluating Lek-Based Monitoring and Management Strategies for Greater Sage-Grouse in the Parachute-Piceance-Roan Population in Northwestern Colorado. Colorado Parks and Wildlife annual progress report. (3) Walker, B. L. 2012d. Evaluation of Alternative Population Monitoring Strategies for Greater Sage-Grouse in the Parachute-Piceance-Roan Population of Northwestern Colorado. Colorado Parks and Wildlife annual progress report. **CPW:** CPW staff note new leks found during lek counts each spring and lek data is updated annually. Ad hoc searches for new lek sites occur annual as time and conditions permit. Researcher B. Walker is currently using helicopter flights and dual-frame sampling techniques to discover new lek locations in PPR. Dual frame sampling has already been applied to NP and portions of NWCO.	**CPW Research:** Tracking males with GPS transmitters resulted in the discovery and confirmation of 5 new leks in the Hiawatha area in spring 2011 and 2012 (Walker 2012a). Dual-frame sampling from helicopter resulted in the discovery of 7 new GRSG leks in the PPR in spring 2012 (Walker 2012d).

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9.1.1.3	Survey and search vacant/unknown habitat for GrSG use and leks.	CPW	2009 and ongoing	**CPW Research:** See 9.1.1.2 above. **CPW:** NWCO - There is only a small amount of mapped "vacant/unknown" habitat in the NW Colorado GRSG population area and it has not been searched. Survey work and searches have been conducted in mapped occupied range to fill in gaps in known lek distribution, resulting in the location of several new leks over the past 4 years. Dual Frame Sampling has been conducted in north-central and northwest portions of NWCO. MWR - Some areas with no known leks have been searched. No additional leks (beyond the one currently active lek) were found, but additional areas are yet to be searched. MP - Portions of the vacant/unknown habitat will be searched for leks in Spring 2013. Landowners were contacted in fall 2012. PPR - Dual Frame Sampling techniques currently being conducted in occupied range may be extrapolated to vacant/unknown areas if it proves to work well in occupied range. NP - CPW conducted Dual Frame sampling in NP to locate new leks, but did not locate any additional leks. CPW continually searches for new leks from the ground when conducting lek counts. NESR - In 2010, CPW conducted helicopter flights in historic habitat to search for new leks. CPW has not organized a robust survey of the suitable vacant/unknown habitat in NESR. CPW does follow-up on anecdotal sightings in vacant or unknown habitat.	
9.1.1.4	Update the CDOW habitat map using new GrSG habitat categories: “Suitable Occupied”, “Suitable Unknown”, “Suitable Vacant”, and “Potentially Suitable Habitat” *. Within the “Potentially Suitable Habitat” category, consider the relative restoration priority of each habitat area.	CPW	2008	**CPW:** These mapping definitions have been applied to CPW GrSG habitat mapping. CPW has produced several landscape scale habitat maps utilizing a variety of mapping and modeling techniques, as well as the 2012 priority habitat map. CPW GrSG maps were up-dated in 2012 to more accurately reflect areas currently occupied. In addition, these maps are revisited every 4 years and updates are made where needed. CPW has a working sense of the relative restoration priority of habitat areas. This will be more systematically defined as the Sagebrush Steppe Habitat Coordinator completes landscape habitat planning in GrSG habitat.	**CPW:** CPW GrSG maps now include these mapping definitions.
9.1.1.5	Review and update statewide GrSG habitat-related mapping efforts.	BLM, CPW	Every 10 years, or as necessary	**CPW:** CPW conducted a comprehensive review of GrSG overall range and seasonal habitat maps in 2012. CPW revised and updated the overall range map to accurately reflect vegetation conditions and recent telemetry results. Rangewide seasonal habitat maps for breeding, summer, and winter seasons were developed and used to formulate Priority Habitat polygons. In addition, fine scale seasonal habitat models are being developed in areas of high energy development potential (PPR and the Hiawatha portion of NWCO).	**CPW:** CPW conducted a comprehensive review of GrSG overall range and seasonal habitat maps in 2012.

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9.1.1.6	In conjunction with GuSG efforts, delineate sagebrush communities by species and/or groups of species using GIS modeling techniques.	CPW	2009	**CPW:** Sagebrush communities have been delineated from other shrub communities in some areas using GIS (Basinwide Vegetation Project) but not always to species. Further refinement of sagebrush species mapping has been explored with CPW/USGS. A "Sage Map" proposal was submitted for a portion of the GuSG range. The proposal was not funded due to limitations in current ability to utilize modeling or remote means to quantify sagebrush community composition at a scale that is useful to management. Current remote efforts are limited to total shrub cover, average shrub height, and bare ground measurements relating to land health indicators and not sagebrush community type. The Wyoming Basin Ecoregional Assessment produced several quality models to quantify sagebrush habitat quality relating to patch size, fragmentation, distance to human disturbance, etc. CPW is assessing the applicability of these models to Colorado.	
9.1.1.7	Develop and implement a process and standardized template for acquiring information on habitat projects, activities, and changes. Keep information requests with landowners focused and to a minimum.	CPW	2008	**CPW: General -** At present, CPW maintains a list of GrSG habitat treatments conducted that contains limited information regarding project type, location, etc. The CPW Habitat Coordinators are working on a standardized template/methodology for collecting habitat project data. CPW is evaluating the USGS LTDL program. **MP** - The MP LWG meets twice a year to review projects completed during the prior field season and to propose new GrSG projects. All projects (habitat, education, easements, etc) are recorded in a spreadsheet that contains project title, description, lead party, partners, cost, acres impacted, conception date and completion date. This information has been recorded by the LWG and incorporated in CPW reports forwarded to the FWS annually since 2004. **NP** - Kremmling BLM has been recording a GIS database of habitat improvement projects in NP.	
9.1.1.8	Create a central GIS database to track all sagebrush modification treatments and natural disturbances across GrSG range. This task will include database maintenance and updates.	CPW, BLM	2009	**BLM:** This has not been done for GRSG. All habitat treatment and fire data on public lands are available through individual program databases. **CPW:** See 9.1.1.7. CPW is assessing the USGS LTDL program. This database has not been created for GrSG but a similar one was created for GuSG and can now be used as a template.	
9.1.1.9	Define GrSG seasonal habitats and map them into the GIS database. Incorporate GIS modeling techniques such as slope and aspect, observational data, and habitat assessment data into the seasonal habitat definitions.	CPW	2008	**CPW Research:** See 3.2.3.1 above. **CPW:** General - These mapping efforts occur both at the local population level and rangewide level. Local biologists and district officer update seasonal habitats at least every 4 years during the CPW SAM updates. In September 2012, CPW's Research Section (M. Rice) completed seasonal habitat mapping for GrSG statewide. NP - CPW implemented a radio-telemetry project in North Park to refine the seasonal habitat models for NP. Data are currently being processed. PPR and portions of NWCO - Fine-scale seasonal habitat maps are being developed for the PPR at present (CPW Researcher B. Walker). These fine-scale seasonal habitat models incorporate vegetation types, landscape variables, and telemetry locations.	
9.1.1.10	Evaluate the amount and spatial arrangement of GrSG habitat in Colorado.	CPW	2015	**CPW Research:** See 3.2.3.1. Seasonal habitat maps for the PPR and Hiawatha could be used to estimate the amount of GRSG habitat in these areas, but this has not been done.	**CPW:** More current and higher resolution vegetation maps will be necessary to accomplish this at a meaningful scale and level of detail.

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9.1.1.11	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.	CCP SC	2008	**CPW:** In 2012, CPW initiated development of a habitat enhancement tracking system that will systematically track project parameters, costs, and spatial data. This will provide a place to collect monitoring data on these projects. CPW has hired a habitat coordinator for sagebrush systems who has been tasked with development and implementation of this system in concert with CPW GIS specialists and field biologists.	
9.1.1.12	Develop and apply landscape-level GrSG habitat monitoring guidelines.	CPW	2010	**CPW Research:** See 3.2.3.1 above. Seasonal habitat mapping analyses have allowed us to generate landscape-scale habitat guidelines for GRSG in the PPR (Walker et al. 2010a). These guidelines show the mean, variation, and range of values for different landscape features that can be considered suitable habitat for GRSG. **CPW:** Several habitat monitoring guidelines have been developed and are being utilized at individual population zones for habitat monitoring. BLM's Habitat Assessment Framework (HAF) is an attempt at this at large scales, but is more an "assessment guideline" than a true monitoring effort. CPW and BLM staff attended joint training on the HAF process in 2012. Monitoring guidelines from the GuSG and GrSG plans are being implemented on several projects. CPW's Sagebrush Steppe Habitat Coordinator is developing monitoring standards that can be implemented more holistically and that will allow comparison with data collected with BLM and NRCS methodologies.	
OBJECTIVE 9.1.2	On a local basis, identify and delineate current GrSG habitat and track future changes in habitat.				
Reference Number	**Conservation Strategy**	**Responsible Parties**	**Timeline**	**Implementation**	**Effectiveness**
9.1.2.1	Use the standard sage-grouse habitat assessment protocol that was developed through the GuSG Rangewide Conservation Plan to assess GrSG habitat conditions (CCP Appendix C, “Habitat Monitoring Protocol”), and compare results to the GrSG habitat structural guidelines (see CCP Appendix A, “GrSG Habitat Structural Guidelines”). This protocol identifies which habitat variables should be measured (e.g., grass height) and which techniques should be used to measure them.	BLM, CPW, LWGs, NRCS, SLB, USFS, USFWS	Ongoing	**CPW: General -** CPW research data from NWCO and NESR has been used to develop Colorado-specific habitat structural guidelines for GrSG and to create habitat models for seasonal habitat mapping. **NWCO -** GrSG habitat measurements have been taken at a large number of use and non-use sites during CPW research projects in several areas of the NWCO population. **NP** - CPW conducted habitat measurements at over 300 GrSG use and non-use sites in NP as part of the NP telemetry study. The habitat measurement protocol was developed in consultation with CPW Avian Research. The protocol used standard methods so that data would be comparable to the GrSG Habitat Structural Guidelines, as well as data collected in other areas in Colorado. **NESR -** CPW completed vegetation measurements in NESR between 2004 - 2007. CPW used a vegetation protocol developed by CPW Avian Research that was similar to other GrSG and GuSG research studies. The protocol included the standard measurements described in the GrSG Habitat Structural Guidelines. **MP -** Data collected in other Colorado populations has been used when needed in MP. These data and resulting habitat structural guidelines have been shared with other entities.	

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9.1.2.2	Develop and implement habitat assessment training for LWGs, private landowners, and other land managers.	CPW	2008	**CPW: General -** Multiple efforts have been employed and additional efforts are ongoing. "Monitoring of Greater Sage-grouse Habitats and Populations", "Colorado Range Monitoring Guide", and many other products have been developed and distributed to the public at large throughout the state. CPW biologists attended a joint training session with BLM biologists on assessing GrSG habitat with the BLM Habitat Assessment Framework in 2012. **NWCO and MWR -**This has not been done in these populations by CPW, but other organizations have intermittently organized grazing management workshops for private landowners and land managers in northwest Colorado. **MP** - The Middle Park LWG hosted a grazing and habitat assessment workshop (Range School) for private and public land managers in November 2008. The workshop had approximately 30 participants. **PPR** - Habitat assessment field trips have been undertaken in the PPR. Attendance consisted mostly of agency personnel. **NESR** - This type of training has not occurred in NESR.	
9.1.2.3	Obtain funding sources to support habitat monitoring implementation on a statewide basis for local GrSG populations. **[See Research Strategy 21.1.1.1]**	BLM, CDA, CPW, Industry, LWGs, NGOs, NRCS, Other Research Institutions, Private Landowners, SLB, Universities, USFS, USFWS, USGS, WAFWA	Begin by 2010	**See** 21.1.1.1 **CPW**: NP - CPW obtained funding for a NP telemetry study and conducted habitat measurements at over 300 GrSG use and non-use sites in NP.	

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9.1.2.4	Evaluate the impact of vegetation condition (see "GrSG Structural Habitat Guidelines", CCP Appendix A) on GrSG populations.	CPW	2015	**CPW:** Efforts to accomplish this strategy are ongoing. The population dynamics of GrSG populations and timeframes required for sagebrush communities to responded to management action, make quantifying population responses of GrSG to vegetation condition challenging. CPW will be conducting a research project on Columbian Sharp-tailed Grouse in Routt County to attempt to quantify how modifying habitat conditions and availability will impact populations of this grouse. Results of this project should inform efforts to evaluate vegetation effects on GrSG as well. **NWCO -** Extensive habitat and use data has been collected in several areas within NWCO that will ultimately inform this process. However, no specific cause and effect research assessing the impact of vegetation condition has been conducted to date. **MP** - CPW and BLM Kremmling Field Office are selecting sites to evaluate during the summer of 2013 within GrSG occupied range in Middle Park. **PPR -** Research by B. Walker and T. Apa has looked at the unique vegetation conditions found in the PPR in relation to distribution and success of GrSG in PPR. A current project by CPW Researcher B. Walker is attempting to define the effect of pinyon-juniper removal on reoccupation of sites by GrSG. **NP** - CPW conducted extensive vegetation measurements at over 300 GrSG use and non-use sites in NP. The vegetation data will be used to refine the NP seasonal habitat modeling products. The vegetation data are also being analyzed to compare with the GrSG Structural Habitat Guidelines. **NESR** - CPW conducted vegetation measurements at sage-grouse use sites and random sites in NESR. These data were incorporated into the GrSG Structural Habitat Guidelines.	