Discussion Paper: Potential Range-wide Issues of Relevance to Greater Sage-grouse Conservation Efforts

INTRODUCTION

The following information is being presented to the Greater Sage-grouse Range-wide Issues Forum to serve as a starting point for discussions for development of range-wide conservation strategies for the greater sage-grouse and sagebrush habitats. This paper describes a preliminary suite of range-wide issues related to the conservation of greater sage-grouse. Additional range-wide sage-grouse and sagebrush habitat conservation issues (defined below), may be identified during the strategy development process. This paper is not intended to be utilized more broadly, including being published in any fashion whatsoever.

The focal audience for this paper is participants engaged in the Greater Sage-Grouse Range-Wide Issues Forum (Forum) being convened by the U.S. Institute for Environmental Conflict Resolution. The participants are presumed to be well aware of the general conservation concern for greater sage-grouse. Therefore this paper does not incorporate a great deal of technical and/or administrative material, other than that which is noted in the Range-wide Issues section, or by reference to source documents. In order to refine or otherwise improve the accuracy and completeness of issues to be addressed by the Forum, participants are encouraged to share and discuss known and potential issues with their colleagues, in concert with provisions of the Greater Sage-Grouse Range-Wide Issues Forum Operational Protocol (Protocol; will be provided to participants at the first meeting).

For purposes of the strategy development process, the term "issue," will be used interchangeably with the terms "problem" and "concern." These terms will be used to refer to one or more situations or topical subjects in which those involved agree that some sort of action needs to be taken to change the existing or projected situation(s) to achieve an acceptable outcome. Also for purposes of the strategy development process, the term range-wide is defined as set forth in section 1.5 of the Protocol; Scope and focus:

> *The Forum process will address Greater Sage-Grouse and related sagebrush habitat issues at the range-wide scale (which, by definition for this process, also includes sub-population, population, and eco-region scales) that cannot be adequately addressed at the local, state, and provincial scales.*

The January 12, 2005, U.S. Fish and Wildlife Service 12-Month Finding for greater sage-grouse, and the Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats (Connelly et al., 2004) (Conservation Assessment) are the primary sources used to identify range-wide issues. For ease of reading, most reference citations have been removed from text that was taken directly from those and other sources. Except for removal of the citations and deletions or summaries made in the interest of brevity, the excerpted text has not been altered. Accordingly, there is no References section in this document. Issues are presented in no particular order. For a quick reference, a summary of these issues, and their source(s), are identified in the accompanying matrix.

Preliminary range-wide issues largely focused on biological and technical considerations. Many are addressed, or mentioned but not further developed, in the 12-month Finding and/or the Conservation Assessment. Range-wide concerns of potential significance that are not mentioned in either document are also presented herein.

Learning from Other Conservation Planning Efforts
Developing the Greater Sage-grouse Comprehensive Strategy will entail consideration of multi-scale and multi-state issues, and it may be useful to consider how other conservation planning efforts that encompass either, or both of these dimensions, may apply to this effort. Three examples are the U. S. Bureau of Land Management's (BLM) national Sage-grouse Habitat Conservation Strategy (November 2004), the Gunnison Sage-grouse Range-wide Conservation Plan, and the Multi-State Conservation Plan For The Black-tailed Prairie Dog, *Cynomys ludovicianus*, in the United States (MSCP). A brief description of the potential relevance of each is presented at the end of this paper.

Energy Policy Act of 2005
A potentially significant event related to the conservation of sage-grouse habitat was the enactment of the Energy Policy Act of 2005 (Act of 2005) (P.L. 109-58). Signed into law on August 8, 2005, the Act contains provisions (sections 368(a), 368(b), and 368(c)) that mandate a series of actions, within one, two and four years after enactment, that will result in expedited designation of "corridors for oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities" on federal lands first, within the eleven contiguous western states, and subsequently in States other than the eleven contiguous Western States.

The Act of 2005 also directs federal agencies to expedite applications to construct or modify such pipelines and facilities within such corridors and identifies six BLM energy states as high priority for Oil and Gas Application for Permit to Drill (APD) States, all of which fall within the current range of the greater sage-grouse.

RANGE-WIDE ISSUES

12-month Finding:
Except as otherwise noted, 12-Month Finding issues relate to the five ESA listing factors that must be considered in making ESA listing determinations. Those factors include loss or curtailment of habitat or range, overuse of the species, disease or predation, inadequacy of regulatory mechanisms, or other factors that do not fall into the first four categories. The narratives taken from listing factor summaries in the 12-Month Finding are not necessarily issue statements, *per se*. However, within those discussions, some areas of concern are either stated or may otherwise be implied, such as a lack of information related to range-wide effects of a given subject being assessed (such as Communication Towers, under Listing Factor A). These narratives, or an abbreviated summary are being presented 1) for completeness in addressing 12-Month Finding elements, and 2) because, as in the case of the FWS comment about communication

towers, issues may exist that could warrant their consideration by the Forum. In the communication tower instance, the 12-Month Finding states "We could find no information regarding the potential impacts of communication towers to the greater sage-grouse on a range-wide basis." That statement does not necessarily mean that communication towers have no impact to the greater sage-grouse on a range-wide basis, only that the Service "could find no information regarding the potential impact … … on a range-wide basis."

RISK OF EXTINCTION: ESA LISTING FACTOR CONCLUSIONS

The U.S. Fish and Wildlife Service identified several extinction factors in the 12-Month finding. However, none of these factors was considered sufficiently imminent to propose listing the greater sage-grouse as threatened or endangered under the Endangered Species Act of 1973, as amended. The U.S. Fish and Wildlife Service did identify that continued efforts to conserve sagebrush ecosystems and address habitat threats are important to long-term persistence of the greater sage-grouse.

The following is a summary of the five listing factors and specific issues identified within the 12-Month Finding, as well as applicable information from the Conservation Assessment. Text for issues identified in the 12-Month Finding has either been taken directly, or summarized from that document. Conservation concerns for some specific issues have been presented in bulleted format for brevity. References to the complete text in the 12-Month Finding are provided if further detail is desired. In the text taken from the 12-Month finding the term "we" refers to the U.S. Fish and Wildlife Service, and does not indicate any pre-decisional commentary on the part of the Forum organizers.

Issues Identified in the 12-Month Finding and Conservation Assessment for Consideration in Developing a Range-wide Greater Sage-grouse Conservation Strategy

Risk of Extinction 1: The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

Source Document: 12-Month Finding; page 2267

Loss of sagebrush and greater sage-grouse habitat has been occurring since arrival of European settlers in the 1800s, as evidenced by the change in the sage-grouse's distribution and loss of local populations. Habitat loss and fragmentation continues today as a result of many factors. Extinction risk factors identified by the expert panel convened by the Service as contributing to habitat loss and fragmentation were invasive species, infrastructure as related to energy development and urbanization, wildfire, agriculture, grazing, energy development, urbanization, strip/coal mining, weather, and pinyon-juniper expansion. Several experts identified concerns with the synergistic effects of threat factors (e.g., infrastructure increases and invasive species expansion).

Risk of Extinction 2: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes
Source Document: 12-Month Finding; page 2269

Hunting was not identified as a primary threat factor for the greater sage-grouse in the 12-Month Finding. The expert panel identified that hunting occurs within a limited timeframe and at a time of the year when productivity is unlikely to be affected significantly. In addition, they noted that hunting is a regulated management technique that can be quickly adjusted to changing conditions. For the 12-Month Finding, no data were collected suggesting that poaching, non-consumptive use, or scientific use limit greater sage-grouse populations range-wide.

Risk of Extinction 3: Summary of Factor C: Disease and Predation
Source Document: 12-Month Finding; page 2271

Disease or predation were not identified as primary extinction risk factors for the greater sage-grouse in the 12-Month Finding. The expert panel expressed concerns about the potential effects of future West Nile virus (WNv) outbreaks, but were unable to draw any definitive conclusions about extinction risk to sage-grouse posed by this disease because insufficient information is available to do so. Connelly et al. (2004) noted that prior to the recent emergence of WNv there was little evidence to suggest that pathogens or parasites were major threats to the greater sage-grouse.

Risk of Extinction 4: Summary of Factor D: Inadequacy of Regulatory Mechanisms
Source Document: 12-Month Finding; page 2277

Various regulatory mechanisms that guide the protection and conservation of the greater sage-grouse are in place. Based on the information available at the time of the 12-Month Finding, the Service concluded that existing regulatory mechanisms do not endanger or threaten the greater sage-grouse throughout all or a significant portion of its range.

Risk of Extinction 5: Summary of Factor E: Other Natural or Manmade Factors Affecting Its Continued Existence
Source Document: 12-Month Finding; page 2279

In the 90-day petition finding for the greater sage-grouse, several other natural or manmade factors (i.e. endocrine disruption, competition with other bird species, and direct mortality from fires and snowmobiles) that might potentially pose a threat to the greater sage-grouse were identified. However, in the analysis for the 12-Month Finding the Service could find no supporting information to indicate that of any of these are endangering or threatening sage-grouse populations.

Habitat Threats

Habitat threats 1: **Habitat Fragmentation**
Source Document: 12-Month Finding, Listing Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range; pages 2255 – 2256.

"Fragmentation of sagebrush habitats has been cited as a primary cause of the decline of sage-grouse populations since the species requires large expanses of contiguous sagebrush. However there is a lack of data to assess how fragmentation influences specific greater sage-grouse life history parameters such as productivity, density, and home range. While sage-grouse are dependent on interconnected expanses of sagebrush, data are not available regarding minimum sagebrush patch sizes to support populations of sage-grouse. Estimating the impact of habitat fragmentation on sage-grouse is complicated by time lags in response to habitat changes, particularly since these long-lived birds will continue to return to altered breeding areas (leks, nesting areas, and early brood-rearing areas) due to strong site fidelity despite nesting or productivity failures. "

Habitat fragmentation is occurring, and expected to continue occur, at an increasing rate. Activities such as Oil and Gas exploration and development, and off-highway vehicle use will likely be primary sources of fragmentation.

Habitat threats 2: Powerlines
Source Document: 12-Month Finding: Listing Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range; pages 2256 – 2257.

Powerlines are common to nearly every type of anthropogenic habitat use, except perhaps some forms of agricultural development (e.g., livestock grazing) and fire. Although we were unable to find an estimate of all future proposed powerlines within currently occupied sage-grouse habitats, we anticipate that powerlines will increase, particularly given the increasing development of energy resources and urban areas. For example, up to 8,579 km (5,311 mi) of new powerlines are predicted for the development of the Powder River Basin coal-bed methane field in northeastern Wyoming in addition to the approximately 9,656 km (6,000 mi) already constructed in that area. Although raptors associated with powerlines may negatively impact individual greater sage-grouse and habitats, we could find no information regarding the effect of this impact on a range-wide basis.

Habitat threats 3: Communication Towers
Source Document: 12-Month Finding: Listing Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range; page 2257.

The 12-Month Finding states "We could find no information regarding the potential impacts of communication towers to the greater sage-grouse on a range-wide basis." In the context of other, much more abundant vertical structures on the landscape, such as

electrical transmission and distribution lines, and telephone lines, communication towers may impose relatively inconsequential impacts to sage-grouse. However as part of the much larger aggregate of such structures, communication towers may be features of consequence.

Habitat threats 4: Fences
Source Document: 12-Month Finding: Listing Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range; page 2257.

Fence collisions continue to be identified as a source of mortality, although effects on populations are not understood. Fence posts also create perching places for raptors and corvids, which may increase their ability to prey on sage-grouse. We anticipate that the effect on sage-grouse populations through the creation of new raptor perches and predator corridors into sagebrush habitats are similar to that of powerlines discussed previously. Fences and their associated roads also facilitate the spread of invasive plant species that replace sagebrush plants upon which sage-grouse depend. Greater sage-grouse avoidance of habitat adjacent to fences, presumably to minimize the risk of predation, effectively results in habitat fragmentation even if the actual habitat is not removed.

Habitat threats 5: Roads and Railroads
Source Document: 12-Month Finding: Listing Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range; pages 2257 – 2258.

Interstates and major paved roads cover … less then 1 percent of their assessment area. Secondary paved road densities … range to greater than 2 km/km^2 (3.24 mi/mi^2). Railroads presumably have the same potential impacts to sage-grouse as do roads since they create linear corridors within sagebrush habitats.

Impacts from roads and railroads may include:

a. Direct habitat loss
b. Direct mortality
c. Migration barriers – both physical and behavioral
d. Spread of predators
e. Spread of invasive vegetative species
f. Noise disturbance at the lek and nest
g. Contamination from chemicals used on roads
h. Increased human access resulting in increased disturbance and direct mortality via vehicles, hunting and poaching
i. Avoidance of suitable habitat adjacent to roads

Habitat threats 6a: Grazing
Source Document: 12-Month Finding: Listing Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range; pages 2258 – 2259.

Livestock grazing is the most widespread type of land use across the sagebrush biome. Few studies have directly addressed the effect of livestock grazing on sage-grouse, and there is little direct experimental evidence linking grazing practices to sage-grouse. Native herbivores, such as pronghorn antelope (*Antilocapra americana*), were present in the sagebrush steppe region prior to European settlement of western States, and sage-grouse coevolved with these animals. However, many areas of sagebrush-steppe did not support herds of large ungulates, as large native herbivores disappeared 12,000 years before present. Therefore, native vegetation communities within the sagebrush ecosystem developed in the absence of significant grazing presence.

Impacts from Grazing may include:

a. Changes in plant communities and soils
b. Reduction in grass heights affecting nesting and brood rearing success, increasing grouse to higher levels of predation
c. Increase of nest predators (specifically ground squirrels)
d. Reduction of forb availability (direct competition)
e. Nest destruction from trampling
f. Nest abandonment
g. Increase in invasive vegetative species
h. Degradation of riparian areas (brood habitats) from overgrazing
i. Positive influence by stimulating re-growth of forbs
j. Positive influence by using livestock to control invasive weeds and wood plant encroachment in sage-grouse habitats
k. Vegetation manipulation to reduce sagebrush and increase herbaceous forage for domestic and wild ungulates
l. Development of water for livestock in uplands artificially concentrating ungulates in important sage-grouse habitats
m. Diverting water for ungulates that results in a loss of either riparian or wet meadow habitats.

Free-roaming horses and burros have been a component of sagebrush and other arid communities since they were brought to North America at the end of the 16th century. About 31,000 wild horses occur in 10 western States, with herd sizes being largest in States with the most extensive sagebrush cover (Nevada, Wyoming, and Oregon). Burros occur in five western States, with about 5,000 of these present. Due to physiological differences, a horse consumes 20 to 65 percent more forage than would a cow of equivalent body mass. We are unaware of any studies that directly address the impact of wild horses or burros on sagebrush and sage-grouse. However some authors have suggested that wild horses could negatively impact important meadow and spring brood-rearing habitats used by sage-grouse.

Habitat threats 6b: Grazing
Source Document: Conservation Assessment

Page 13-9: The question of effects of livestock grazing at large spatial scales is difficult because we lack control areas large enough to include landscape processes (Bock et al. 1993). … … Because we could not test for an effect does not mean that livestock grazing has no effect or is a compensatory use of sagebrush habitats and therefore should be ignored. Concluding no effect when one exists (Type II error) is as significant an error as concluding an effect when none exists (Type I error) (Eberhardt and Thomas 1991, Wiens and Parker 1995). … … Livestock grazing differs from herbivory in natural systems because the interaction between food availability and number of grazers is largely decoupled. Stocking rates derived by livestock managers are based on a conceptual understanding of system response to disturbance, environmental guidelines, and on external factors such as economics. Ultimately, livestock function as a keystone species: grazing and management actions to manipulate habitats do not preclude wildlife and vegetation, but they influence the ecological pathways and frequently determine which species will persist (Bock et al. 1993). … … Until we collect the appropriate quantitative data on livestock numbers, grazing intensity, timing, location, and vegetation response at the relevant spatial and temporal scales, the issue will remain unresolved (West 2003*b*).

Habitat threats 7: Mining
Source Document: 12-Month Finding: Listing Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range; pages 2259 – 2261.

Development of mines within the distribution of the sage-grouse began before 1900. Surface mining for any mineral resource (coal, uranium, copper, bentonite, gypsum, oil shale, phosphate, limestone, gravel, etc.) will result in direct habitat loss for sage-grouse if the mining occurs in occupied sagebrush habitats. The actual effect of this loss depends on the quality, amount, and type of habitat disturbed, the scale of the disturbance, and if non-breeding habitat is affected, the availability of adjacent habitats.

Braun (1998) concluded that surface coal mining and all associated activities have negative short-term impacts on sage-grouse numbers and habitats near the mines. Sage-grouse will reestablish on mined areas once mining has ceased, but there is no evidence that population levels will reach their previous size. Additionally, the time span for population re-establishment may be 20 to 30 years. Hayden-Wing Associates (1983) concluded that the loss of one or two leks in a regional area from coal mining was likely not limiting to local populations in their study on the Caballo Rojo Mine in northeastern Wyoming. However, if several leks are affected, local population numbers may decline.

Impacts from Mining may include:
a. Direct habitat loss
b. Incomplete or inadequate reclamation of mined lands
c. Establishment of invasive species

d. Temporary habitat loss from intentional planting of nurse crops
e. Topographical changes resulting in changes in microclimates and microhabitats
f. Habitat loss and disturbance from infrastructure constructed to support mining activities
g. Reduced air quality
h. Reduced water quality/contamination
i. Disturbance from noise, increased human presence, and blasting
j. Direct mortality
k. Indirect losses of forage via fugitive dust
l. Exposure to toxic compounds
m. Increase in poaching
n. Noise disturbance

Habitat threats 8: Non-Renewable and Renewable Energy Development:
Source Document: 12-Month Finding: Listing Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range; pages 2261 – 2264.

Non-renewable energy development (petroleum products, coal) has been occurring in sage-grouse habitats since the late 1800s. Interest in development of oil and gas has been sporadic and typically focused in limited geographical areas. The re-authorization of the Energy Policy and Conservation Act in 2000 dictated re-inventory of Federal oil and gas reserves, which identified extensive reserves in the Greater Green River Basin of Colorado, Utah, and Wyoming, the San Juan Basin of New Mexico and Colorado, and the Montana Thrust Belt and the Powder River Basin of Wyoming and Montana. All … are located in primarily sagebrush-dominated landscapes.

The development of oil and gas resources requires surveys for economically recoverable reserves, construction of well pads and access roads, subsequent drilling and extraction, and transport of oil and gas, typically through pipelines. Ancillary facilities can include compressor stations, pumping stations and electrical facilities. Surveys for recoverable resources occur primarily through seismic activities, using vibroesis buggies (thumpers) or shothole explosives. Well pads vary in size from 0.10 ha (0.25 ac) for coalbed natural gas wells in areas of level topography to greater than 7 ha (17.3 ac) for deep gas wells. Pads for compressor stations require 5 to 7 ha (12.4 to 17.3 ac). Well densities and spacing are typically designed to maximize recovery of the resource and are administered by State and Provincial oil and gas agencies and the BLM (on Native American lands). Based on their review of project EIS's, Connelly et al. (2004) concluded that the economic life of a coalbed methane well averages 12 to 18 years and 20 to 100 years for deep oil and gas wells.

Reclamation of areas disturbed by oil and gas development can be concurrent with field development. As disturbed areas are reclaimed, sage-grouse may repopulate the area. However, there is no evidence that populations will attain their previous size, and re-population may take 20 to 30 years, as habitat conditions are not immediately restored. For most developments, return to pre-disturbance population levels is not expected due to

a net loss and fragmentation of habitat. After 20 years, sage-grouse have not recovered to pre-development numbers in Alberta, even though well pads in these areas have been reclaimed. In some reclaimed areas, sage-grouse have not returned.

Only a few studies have examined the effects of oil and gas development on sage-grouse. While each of these studies reported sage-grouse population declines, specific causes for the negative impacts were not determined. The development of oil reserves in Jackson County, Colorado, was concurrent with decline of sage-grouse numbers in the oil field area. Sage-grouse populations still occur in at least one long-term oil field development in Colorado where leks are not within line-of-sight of an active well or powerline. Although the number of active leks has declined in this field, sage-grouse have been consistently documented there since 1973.

Impacts from Energy Development may include:

a. Direct habitat loss
b. Habitat fragmentation from vegetation removal, roads, powerlines, and pipeline corridors
c. Reduced air quality
d. Changes in water availability and quality
e. Disturbance from noise, increased human presence, and vibroesis
f. Increase in poaching
g. Positive influence through expansion of existing wetland and riparian areas, and creation of new areas through release of produced water
h. Direct mortality
i. Lack of adequate regulatory mechanisms to protect habitats
j. Direct mortality at wind facilities from collision with turbines or meteorological towers.
k. Increased human recreational activities resulting from hydropower reservoir construction

Habitat threats 9: Fire

Source Document: 12-Month Finding: Listing Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range; pages 2264 – 2265.

The effects of fire on sagebrush habitats vary according to the species of sagebrush present, other plant species present (e.g., the understory) and the frequency, size and intensity of fires. Widely variable estimates of mean fire intervals have been described in the literature: 35 to 100 years, greater than 50 years for big sagebrush communities, 12 to 15 years for mountain big sagebrush, 20 to 100 years, 10 to 110 years depending on sagebrush species and specific geographic area, and 13 to 25 years.

In general, fire tends to extensively reduce the sagebrush component within the burned areas. Big sagebrush (*A. tridentata* spp.), the most widespread species of sagebrush, is killed by fire. It does not re-sprout after burning, and can take as many as 30 to 50 years to recolonize an area. This suggests that these sagebrush subspecies evolved in an

environment where wildfire was infrequent (interval of 30 to 50 years) and patchy in distribution. However, as noted by the expert panel, fire has been an important component in sagebrush systems.

A characteristic of natural fire in sagebrush stands is the incomplete burning that leaves areas of unburned sagebrush (sometimes referred to as islands of habitat). Huff and Smith (2000) noted that these unburned islands appear to be important to the future recolonization of the sagebrush community by providing sources of sagebrush seed. Prior to settlement by European immigrants, fire patterns in sagebrush communities were patchy, particularly in Wyoming big sagebrush, due to the discontinuous and limited fuels and unburned islands that remained after a fire. A clear positive response of greater sage-grouse to fire has not been demonstrated

Impacts from Fire may include:

a. Habitat loss, both long-term and seasonal
b. Habitat fragmentation
c. Invasion of exotic vegetative species
d. Incomplete or unsuccessful restoration

Habitat threats 10: Invasive species
Source Document: 12-Month Finding: Listing Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range; pages 2265 – 2266.

Invasive species have been defined as those that are not native to an ecosystem and whose introduction causes, or is likely to cause, economic or environmental harm or harm to human health. A wide variety of plants are considered invasive within the range of sagebrush ecosystems that the greater sage-grouse occupies. Invasive species often cause declines in native plant populations by reducing light, water, and nutrients, and they grow so quickly that they out-compete other species.

Impacts from Invasive Species may include:

a. Loss of plants necessary for food and cover
b. Habitat loss/conversion
c. Habitat fragmentation
d. Incomplete or unsuccessful habitat reclamation/restoration

Habitat threats 11: Pinyon-juniper
Source Document: 12-Month Finding: Listing Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range; pages 2266 – 2267.

There has been an unprecedented expansion of pinyon-juniper woodlands, a native habitat type dominated by pinyon pine (Pinus edulis) and various juniper species (Juniperus spp.), with an estimated 10-fold increase in the Intermountain West since European immigrant settlement. The major factor cited for the increase in the pinyon-

juniper forest type is a decrease in fire return intervals. Other factors facilitating the increase include historical livestock grazing patterns, which reduced the buildup of fine fuels that more readily carry fire, and possibly increases in global carbon dioxide concentrations and climate change.

Impacts from Pinyon-juniper expansion may include:

a. Loss of habitat suitability
b. Habitat loss

Habitat threats 12: Urbanization
Source Document: 12-Month Finding: Listing Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range; page 2267.

Low densities of indigenous peoples have been present for more than 12,000 years in the historical range of sage-grouse. By 1900, Connelly et al. (2004) reported that less than 1 person/km2 resided in 51 percent of the 325 counties within their assessment area, and densities greater than 10 persons/km^2 occurred in 4 percent of the counties. By 2000, counties with less than 1 person/km^2 occurred in 31 percent of the 325 counties and densities greater than 10 persons/km^2 occurred in 22 percent of the counties.

Impacts from Urbanization may include:

a. Habitat loss
b. Habitat fragmentation
c. Increase of predators
d. Introduction of new predators, such as domestic pets
e. Disturbance from increased human presence

Inventory and Monitoring
In addition to specific, as well as general references in the Conservation Assessment to inadequate inventory and/or monitoring information, many state and local sage-grouse conservation plans also identify a need for better habitat and population information. Technical aspects of inventory and monitoring of populations and habitats are being addressed by a separate group, and their recommendations/report will be included in the final Conservation strategy. This information is being presented here for your information and use when identifying issues.

Inventory and Monitoring 1: Sage-grouse
Source Document: Conservation Assessment

Chapter 6: " … results from our questionnaire indicated monitoring techniques continue to vary among areas and years both within and among agencies. This variation complicates attempts to understand grouse population trends and make comparisons among areas…..The sage-grouse guidelines (Connelly et al. 2000) stressed the

importance of population monitoring and collecting quality data in sage-grouse management programs."

"Although monitoring efforts have increased, there still appears to be a reluctance by some states/provinces to use established and accepted monitoring techniques (Jenni and Hartzler 1978, Emmons and Braun 1984, Connelly et al. 2003). Although data collected within these states or provinces may indicate population trends over time, these different methods confound attempts to make comparisons with other states.

Inventory and Monitoring 2a: Habitat treatments
Source Document: Conservation Assessment

Chapter 7, page 7-32, Ecological Influences and Pathways: "Early habitat treatments were directed primarily to "improve" forage conditions said to benefit livestock (Pechanec et al. 1965). Increasingly, treatments are conducted to restore hydrologic processes, wildlife habitat, stabilize and rehabilitate soils and vegetation, or reduce biomass to control fires and protect urban interface areas. More recently, objectives for land management have been set by a society interested in preserving wildland, wildlife, and aesthetic components of sagebrush habitats (Young et al. 1981, Box 1990, West 1996, West 2003). Each choice and habitat treatment has consequences for future habitat dynamics and wildlife use of sagebrush habitats because of changes in the quantity of available habitat, its composition, and configuration within the larger landscape. Treatment of large areas, use of herbicides, mechanical treatments, or planting nonnative plant species may be appropriate management tools to control exotic plants, reduce fire hazards, or rehabilitate burned areas (see Restoration and Rehabilitation below). Each potentially decreases the suitability of sagebrush habitats for wildlife that depend on large, unfragmented sagebrush habitats (Knick et al. 2003). With few exceptions, monitoring vegetation and wildlife response to habitat treatments across appropriate spatial and temporal scales is lacking (Crawford et al. 2004)**.**

Information from other sources:
It is estimated that in FY 2006, post-wildfire Emergency Stabilization and Rehabilitation (ESR) will be conducted on 2 million acres of BLM public land, of which 1 million acres will be sagebrush habitats (Jack Hamby, pers. comm.). The ESR program consists of two components – emergency stabilization, and rehabilitation. Emergency stabilization (such as seeding to prevent erosion or the establishment of invasive plants) is actions taken within one year of a wildfire to stabilize the site, prevent unacceptable degradation to natural and cultural resources, and to minimize threats to life or property resulting from wildfire. Rehabilitation (tree planting, invasive plant treatments, fence replacement) is are actions taken within three years of a wildfire to repair or improve lands unlikely to recover from wildland fire or to repair or replace minor facilities damaged by fire.

Inventory and Monitoring: Habitat treatments 2b
Source Document: Conservation Assessment

Chapter 13, page 13-10 "Large numbers of habitat treatments are conducted on sagebrush habitats each year across the biome (Chapter 7). We have changed the semantics of our actions to include objectives other than increasing forage for livestock. Nonetheless, multiple use still mandates our management of sagebrush ecosystems and simply doing nothing is rarely, if ever, considered (Wambolt and Payne 1986, Wambolt et al. 2001). Unfortunately, the effects of habitat treatments are rarely monitored at the spatial and temporal scales appropriate to the wildlife response. Without objective assessment of results, the value of these treatments to better understand ecosystem response is lost. Similarly, a true program of adaptive management necessitates unbiased feedback to evaluate the influence of actions in achieving the stated objectives (Walters 1986)."

Inventory and Monitoring 3: Monitoring Sage-Grouse Habitats and Populations
Source Document: Conservation Assessment

Chapter 11 Abstract. "Most studies of sage-grouse relied on published techniques for assessing range vegetation, monitoring, and trapping sage-grouse. However, published methods for assessing vegetation were not developed specifically for sage-grouse habitats. Some population monitoring techniques have not been described in detail while others were based on work done in a single area or over a relatively short time.

Inventory and Monitoring 4: Monitoring technique standardization
Source Document: Conservation Assessment

Chapter 11, page 11-1; Because of declines in sage-grouse populations (Connelly and Braun 1997) and continuing threats to these species and its habitats (Connelly and Braun 1997, Wambolt et al. 2002), standard techniques for monitoring populations and habitats are necessary to allow valid comparisons among areas and years and provide rigorous and consistent data sets (Connelly et al. 2003). Until recently, no effort has been made to compile and standardize all major monitoring techniques useful for assessing sage-grouse habitats and populations.

Inventory and Monitoring 5: Baseline data
Source Document: Conservation Assessment:

"… we still lack baseline information across much of the sagebrush biome against which to evaluate population and habitat changes. Therefore, most information that we present is recent but perhaps now we can begin the daunting task of providing a baseline database for future efforts. (Introduction, Chapter 11) "

With respect to analyzing seasonal habitats, Connelly et al. (2004) state "Although we attempt to provide comparable measures of seasonal habitats in the following examination, it should be noted that habitat values can depend on the techniques used to examine them (Connelly et al. 2003). Similar, *(sic)* greater sage-grouse have not been studied in detail in all portions of their range (e.g. North and South Dakota). Consequently, care should be taken when extrapolating observations for range-wide considerations" (page 4-1, Sage-Grouse Habitat Characteristics)."

Habitat Disturbance and Resiliency 1: Restoration
Source Document: Conservation Assessment

Chapter 13, page 13-10; Ecosystems that are heavily stressed lack the capacity to maintain normal function, initiating a process of degradation and lowered resilience for further disturbance (Milton et al. 1994). Many regions of the sagebrush biome now exist in an ecological state past thresholds from which recovery is likely (West 1999). … … Productivity of many areas now is less than pre-settlement (Young et al. 1981, West 1983, Holechek et al. 1999). Alteration, loss, and fragmentation of sagebrush landscapes are widespread conservation concerns (Hemstrom et al. 2002, Knick et al. 2003). Consequences of fragmentation in sagebrush habitats are increased rates of habitat loss, spread of exotic plants, and increased risk of regional extirpation of wildlife species (Knick and Rotenberry 1997, Raphael et al. 2002). Use of herbicides, insecticides, prescribed fire, and proper management of livestock grazing may be the tools best suited for the some of the large-scale actions now required to manage sagebrush habitats. However, these treatments may have negative effects on sage-grouse or other species or responses may not be monitored. We also must recognize that to benefit sage-grouse, the best approach for some habitats is to do nothing (Wambolt and Payne 1986, Wambolt et al. 2001).

[Note: see also Inventory and Monitoring 2a]

Habitat Disturbance and Resiliency 2: Soil Productivity
Source Document: Conservation Assessment:

Chapter 13, page 13-8; The cumulative impacts of the disturbances, rather than any single source, may be the most significant influence on the trajectory of sagebrush ecosystems. … … The collective human footprint was greatest in those areas that also were the most resilient because of higher precipitation and deeper soils. Many of those regions have been converted to cropland and remaining sagebrush habitats are interspersed in small patches across the landscape. In contrast, the areas in which larger patches of sagebrush remained received lower precipitation and had drier and shallower soils; those regions were the least resilient to disturbance. Those remaining landscapes of sagebrush habitats most important to sage-grouse also are the most sensitive to disturbance impacts and also will require the longest recovery periods.

Information from other sources:
Soil productivity is independent of the type of biomass being produced by the soil. Relative to surrounding soil types, more productive soils are generally deeper, finer textured, higher in organic matter, and receive more effective precipitation. Per acre, they produce a greater biomass of both plants and animals. Such productivity is the reason the most highly productive soils were the first to be converted from native vegetation communities to agricultural croplands. Attendant changes in wildlife abundance and diversity generally reflected the loss of such productive habitats. Similarly, many succeeding habitat conversions or other treatments targeted the most productive of the remaining soils and, consequently, their native vegetation communities (for example the spraying and burning of sagebrush to create dryland farms or establish crested wheatgrass seedings for livestock), resulting in further disproportionate losses of habitat and population resilience. Economically, these areas provided the greatest vegetation response for project investment. Because the plant biomass is greater on more productive soils, particularly the grass and forb components that respond more rapidly to annual variation in precipitation, these areas can also have the greatest fuel loads and be more susceptible to wildfires and/or invasion by undesirable plant species.

Habitat improvement treatments for wildlife, including sage-grouse, frequently similarly focus on the most productive soils, irrespective of the type of treatment; chaining, Dixie harrowing, interseeding, prescribed burning, roto-beating, and so on. This also presents the potential for significantly adverse ecological changes if projects do not respond as intended, or if the, number, type, size and sequencing of projects within the range of the instant sage-grouse population are not fully coordinated across the entire range of that population, including contingency plans. It is these remaining most productive soils that are in many cases also the most critical for sage-grouse production and protection. Considering the potentially large number of habitat treatment projects associated with implementation of sage-grouse conservation plans, a lack of appropriately scaled coordination could result in substantial, widespread loss of habitat from which it could be very difficult to recover.

Soils are also a consideration for infrastructure development projects, such as the energy corridors mandated by the Act of 2005, attendant transmission and distribution lines, and other factors related to human population growth in the West. Such projects generally seek soils and substrates that are the most economical on which to construct projects, *i.e.*, those areas that offer the fewest physical impediments to facility construction and maintenance. Flatter, less rocky terrain is favored over rocky soils and steep or vertical terrain.

Habitat Restoration 1: Availability of Native Seed and Equipment
Source Document: Conservation Assessment, Other

Chapter 7, page 7 – 49: "Bottlenecks to Success: Availability and cost of native seed is a major obstruction to the use native seeds in revegetation projects (McArthur 2004). The difficulties and the vagaries of collecting, growing and selling native seeds that historically have not been used within sagebrush ecosystems tends to raise the price and

increase the risk to both the seller and buyer (Dunne 1999, Roundy et al 1997, Currans et al. 1997, Bermant and Spackeen 1997) relative to tested and released plants that are widely available (Currans et al. 1997).

As sage-grouse conservation moves from planning to implementation, the demand for native plant seed and other materials for habitat restoration, including containerized stock, can be expected to increase substantially. Emergency stabilization and restoration following wildfires is the primary driver for present seed production capability, i.e., the amount and types of seeds grown or otherwise collected for restoration projects. Broader habitat restoration projects for ecological considerations are a distant second.

For species that are scarce, particularly native forbs, it may take two or more years just to collect or grow enough seed to meet supply requirements, and the price can be extremely high. The seed of some species must be used the year it is produced or collected. Others, such as many grasses, can be stored for one or more years before being planted.

"Equipment for sowing native seeds is not widely available. Most revegetation projects in the region use rangeland drills that were developed for the rough terrain of wildland environments and for the ease of seeding the introduced forage grasses. Many native seeds because of their differing sizes will require mixing within the seed boxes on the drills to insure equal proportions of all seeds are sown on a site or will require separate seed boxes to allow seeds of different sizes to be buried at different optimal depths. All these requirements will either require the purchase of new seed drills or the retrofitting of the old drills to accommodate these needs."

The demand for equipment to use in planting/manipulating rangeland vegetation can be expected to increase. Examples of such equipment include, but are not limited to, rangeland drills and other seeders, Ely chain, Dixie harrows, brush-beaters, and hydro-mowers. This equipment and associated tractors are generally expensive to purchase and maintain. Equipment seldom breaks down just as a project is being finished, affecting project implementation. There may also be logistical issues in moving such equipment.

Habitat Restoration 2: Planting expertise
Source Document: Other

The level and distribution of existing expertise related to seeding/restoration of rangelands is believed to be well below that needed, a situation compounded by expected retirements of experienced personnel from state and federal agencies over the next several years. The timing and planting techniques for successful seeding/planting of forbs and shrubs is often markedly different than for grasses, and knowledge of germination and establishment requirements is critical to success.

Technical Assistance 1: Science and Management Information
Source Document: Other

Early in 2004, BLM Director Kathleen Clarke convened a series of "listening meetings" around the West with groups of individuals engaged in sage-grouse conservation, to learn more about what was working well, and what additional resources would help support their efforts in conservation planning and implementation. One of the more frequent needs expressed was for easily accessible technical support to assist local working groups in both planning for, and implementing conservation measures.

Beginning in Fall 2004, a series of interagency meetings and discussions was held among the BLM, other federal agencies, and WAFWA, to develop a proposal for what was informally being called a "Sagebrush Center of Excellence." Such a center would be designed to be responsive to the needs identified earlier in the year, as well as further develop the science and expertise necessary to support conservation wherever the need for such information existed. It was envisioned that such a center could function much like the National Riparian Service Team.

A preliminary proposal to establish a Western Shrub and Grassland Science Information and Management Consortium (Consortium) was developed in January 2005. Based on review comments, a revision was completed in June 2005. Because of timing convergence with development of the Greater Sage-grouse Range-wide Conservation Strategy, further action on the Consortium proposal was suspended until a course of action might be considered in the range-wide conservation strategy process.

In the final report of the February 2005 Local Working Group conference, convened in Reno, NV, the need was again expressed, in recommendation #3 (of 6), "That WAFWA facilitates (*sic*) the development of a clearinghouse for research, data, funding, best management practices, and project implementation stories that local working groups can easily access."

Technical Assistance 2: Training

At present there is no range-wide assessment of support needs, including training related to conservation planning, plan implementation, and effectiveness monitoring. Training needs may be substantial with respect to the use of new planning tools, such as ecoregional assessments; habitat assessment and monitoring techniques; and, habitat project coordination and design. The retirement of large numbers of employees from agencies ("baby boomers") can significantly affect the level of institutional knowledge and expertise available to complete conservation planning, conduct environmental analyses (NEPA), and implement and monitor plan actions. The retirements will likely also trigger substantial internal movement of remaining employees within or across agencies to fill vacancies created by retirements, with attendant effects on available expertise. Some agencies have conducted workforce planning exercises in anticipation of such changes.

Coordination 1: Planning and Implementation;
Source Document: Conservation Assessment

Chapter 2, page 2-13 "Many greater sage-grouse populations have distributions that span one or more jurisdictional boundaries (Chapter 6). Effective management of these populations requires coordination between the various landowner, wildlife managers and the public.

Chapter 7, page 7-48: "In an attempt to become proactive in its battle against invasive annual grasses and the loss of sagebrush grasslands, the U.S. Bureau of Land Management has begun the Great Basin Restoration Initiative. The strategy of this program is to use a three step process to achieve effective restoration in the region (Pellant 2003). The first step is to use spatial data to prioritize areas for conservation and restoration (Pyke and Knick 2003), with special emphasis on sage-grouse habitat needs. Second, they will coordinate protection and restoration plans with land users, scientists and interested people to ensure environmentally sound treatments that do not create undue hardships for local land users while using the best science to maximize restoration and conservation success. Lastly, restoration and conservation activities will target landscapes where native plant communities already exist to ensure maximize the retention of lands that remain within the nature dynamics of the sagebrush system (upper state Fig. 7.33). After these areas are protected, they will begin treatments to restore sites currently dominated by invasive plants."

Local Working Group Reno Conference report: Page 6, Implementation:
A repeated request heard from the local working groups was that they would like "success" defined. They would like to know when a LWG has been successful or a project is determined to be a success. <u>They requested assistance from the agencies to develop a system to prioritize projects. This system would prioritize implementation of local working group planned, regional and range-wide projects to maximize the impacts on sage-grouse populations. The regional and range-wide coordination will be especially critical during implementation and monitoring.</u> The local working group members felt the need for creative approaches to get things done and that waiting for all the science answers was not acceptable. There is a need to connect (monitor) project implementation to sage-grouse increases to support requests for funding. <u>Further breakdown of political boundaries and more cooperative projects across those lines need to occur for the conservation effort to be successful.</u>

Planning tools necessary to better support larger-scale coordination include ready access to GIS information, including ecoregional assessments than provide regional contexts for making management decisions, and modeling programs capable of depicting the trajectory of urbanization, infrastructure development, invasive species, wildfire, and other relevant considerations affecting sage-grouse conservation.

Coordination 2: Networking and Communication
Source Document: Local Working Group Reno Conference Report recommendations:

1) That the states conduct annual (or at least biennially) state or preferably regional workshop/conference for their local working groups (LWG) to meet, communicate, and network, and so the states can provide current information, validated science, and new conservation tools.

2) That one of the partners hosts a range-wide conference at least every three years to insure cooperation and information exchange across political boundaries. Another alternative would be for an active LWG or Region to host the conference but the partners' staff would complete the details and tasks of putting on the conference.

Coordination 3: Other Programs and Activities; State Comprehensive Wildlife Conservation Strategies (also called Wildlife Action Plans):

Congress identified eight required elements to be addressed in each state's wildlife conservation strategy. Congress also directed that the strategies must identify and be focused on the "species in greatest need of conservation," yet address the "full array of wildlife" and wildlife-related issues. The strategies must provide and make use of:

(1) Information on the distribution and abundance of species of wildlife, including low and declining populations as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's wildlife; and,

(2) Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in (1); and,

(3) Descriptions of problems which may adversely affect species identified in (1) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats; and,

(4) Descriptions of conservation actions proposed to conserve the identified species and habitats and priorities for implementing such actions; and,

(5) Proposed plans for monitoring species identified in (1) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions; and,

(6) Descriptions of procedures to review the strategy at intervals not to exceed ten years; and,

(7) Plans for coordinating the development, implementation, review, and revision of the plan with Federal, State, and local agencies and Indian tribes that manage significant land and water areas within the State or administer programs that significantly affect the conservation of identified species and habitats.

(8) Congress also affirmed through this legislation that broad public participation is an essential element of developing and implementing these plans, the projects that are carried out while these plans are developed, and the Species in Greatest Need of Conservation that Congress has indicated such programs and projects are intended to emphasize.

Coordination 4: Policy for Evaluating Conservation Efforts (PECE)
Source Document: Other

The Policy for the Evaluation of Conservation Efforts when Making Listing Decisions (PECE; 68 FR 15100) identifies criteria used by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service in determining whether formalize conservation efforts that have yet to be implemented or to show effectiveness contribute to making listing a species as threatened or endangered unnecessary. Conservation efforts are reviewed using the following criteria:

Certainty of Implementation:

a. The conservation effort is adequately staffed and funded;
b. The legal authorities of the parties to implement the effort are described;
c. The legal procedural requirements (e.g. NEPA) necessary to implement the effort are described and information is provided indicating that fulfillment of these requirements does not preclude commitment to the effort;
d. Authorizations necessary to implement the conservation effort are identified and a high level of certainty is provided that the parties to the agreement will implement the efforts;
e. The type and level of voluntary participation necessary to implement the conservation effort is identified and a high level of certainty is provided that the participation will be achieved;
f. Regulatory mechanisms necessary to implement the conservation effort are in place;
g. An implementation schedule is provided; and
h. The agreement is approved by all parties to the agreement or plan.

Certainty of effectiveness:

a. nature and extent of threats being addressed by conservation effort , and how that threat will be reduced, is described;
b. Explicit objectives for the effort, including dates are included;
c. Detailed steps necessary to implement the effort are identified;
d. Quantifiable, scientifically valid objectives are identified, along with measurable parameters;
e. Provisions for monitoring and reporting progress on implementation and effectiveness are provided; and
f. Principles of adaptive management are incorporated.

Coordination 5: Policy consistency and coordination

There is no comprehensive analysis of agency policies, programs and regulations at national, regional and/or state levels to address issues that may adversely affect sage-grouse conservation and which are not within the purview of local working groups.

Local working groups and States are not positioned to address federal agency policies and regulations at national and regional levels, and likely not at state levels, as well. However national policies are usually sufficiently generalized that their existence does not, or should not, preclude the issuance of lower level (state and regional) guidance and policy (e.g., supplemental guidance) where delegated authority exists.

Other References

BLM Sage-grouse Habitat Conservation Strategy (BLM Strategy)
The issues and scales addressed by the BLM Strategy represent a broad-scale, multi-state perspective with several parallels potentially applicable to developing a range-wide conservation strategy for greater sage-grouse. Many of the issues, or issue themes addressed by the BLM Strategy also appear appropriate for consideration by the Forum. Some individual actions in the BLM Strategy include elements that may be appropriate for a greater sage-grouse range-wide strategy.

The uniqueness of the BLM Strategy is that it represents a single, multi-state entity with the authority to enforce compliance with its policies on lands it administers across the range of sage-grouse. The Strategy entailed extensive participation by state and other federal agencies, interest groups, including directly affected stakeholders, and the public-at-large.

Gunnison Sage-grouse Range-wide Conservation Plan (GuSG Plan)
The Gunnison Sage-grouse Plan presents a broad-scale, albeit very limited in geographic extent, multi-state perspective that may be useful in developing a range-wide conservation strategy for greater sage-grouse.

Multi-State Conservation Plan For The Black-tailed Prairie Dog
Several of the eight elements of the MSCP, at least thematically, appear appropriate for consideration by the Forum (Attachment).