Technical Comments regarding:

Using the Best Available Science to Coordinate Conservation Actions that Benefit Greater Sage-Grouse Across States Affected by Oil & Gas Development in Management Zones I-II (Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming)

Note: The complete Multi-state document is found below. ***Comments*** *are provided in italics* regarding specific statements found in the multi-state document, which are underlined.

Background

Greater Sage-grouse are widely considered in scientific and public policy arenas to be a species of significant conservation concern. Loss, degradation and fragmentation of important sagebrush grassland habitats have negatively impacted sage-grouse populations. Much of this loss of habitat function is occurring in Sage-grouse Management Zones (MZ) 1 and 2 (Stiver et al. 2006) in Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming as a result of oil and gas development (Connelly et al. 2004).

> ***Comment:*** *The impact of oil and gas development on greater sage-grouse is overstated. The core areas/lek density (Map 1) and wells drilled (Map 2 – Sage-grouse locations relative to oil and gas development) mapping for Wyoming indicates that the areas of oil and gas development do not impact the majority of the sage-grouse breeding habitat nor does it significantly impact the core areas. We used Wyoming data as it was readily available, Wyoming has one of the largest sage-grouse populations and Wyoming is the largest oil and gas producing state within the states that prepared the Multi-state document.*

Oil and gas development is rapidly increasing within these areas. In response to those concerns, states and provinces are in various stages of completing or updating management plans in order to provide for long-term sage-grouse conservation. Special emphasis is being placed on oil and gas development as it rapidly spreads across much of the eastern range of sage-grouse.

> ***Comment:*** *There is a perception that oil and gas activity is spreading across the eastern range of the sage-grouse; this is not founded in fact as can be seen in the current Wyoming situation (Map 2). Map 2 provides an illustration of all the wells drilled in the state of Wyoming (through 2003) and the location of active, inactive and un-surveyed leks, using WGFD 2007data. This mapping exercise was completed in an effort to visually assess the impact of energy development on the grouse and to test the concept, found in this Multi-State Best Available Science paper, that leks impacted by development at more that one well per square mile within 1.9 miles become inactive within 3 to 4 years of that development occurring. It is evident from this map that energy development does not impact the majority of the sage-grouse breeding habitat in Wyoming nor does it cause lek abandonment as postulated.*

The recent decision by B. Lynn Winmill, Chief U.S. District Judge (2007), which remands the original 2005 not warranted decision back to the USFWS for reconsideration, has highlighted the need for States to coordinate their application of best available science. Representatives from the state agencies with authority for managing fish and wildlife from the major sage-grouse and energy producing states comprising MZ 1 and 2 and sage-grouse researchers who have published new findings, met on January 8 and 9, 2008 in Salt Lake City. The objectives of the meeting were to better understand the application of most recent peer-reviewed science within the context of oil and gas development and coordinate and compare implementation of conservation actions utilizing that information.

> ***Comment****: The most recent peer reviewed literature comes from two specific development areas in Wyoming, the Powder River Basin (PRB) (Naugle, Walker, and Doherty) and Pinedale (Holloran, Lyon, and Kaiser). These papers provide predictive models and management implications based on limited (two to three years) information gathering that occurred in areas that are not necessarily representative of the intensity or density of energy development expected else where. These papers are, in effect, a snapshot of energy development and sage-grouse and do not reflect the broader view of multiple development and production areas through out the state of Wyoming, see Taylor et al. (2007) for this perspective. Taylor et al. (2007) was not considered in this multi-state analysis.*

Review Process

The participants at this meeting represented technical science and management advisors from each of the states. Researchers having the most recently peer reviewed and published articles concerning sage grouse and oil and gas development were invited to present their findings and answer questions.

> ***Comment:*** *Research from the Powder River Basin (Naugle, Walker, and Doherty) and Pinedale (Holloran, Lyon, and Kaiser) were reviewed, presenting basically two perspectives. These research efforts represent work in two areas and amount to two sets of papers. This does not constitute a broad base upon which to make regional policy recommendations. The study areas are relatively small, the sample sizes are small and both present predicative models un-tested outside the areas in which they were generated. The attached Map 2 illustrates the folly of extrapolating these models across the region.*

State agency participants agreed that the goal was not to establish state or regional policy or to determine the management actions that will be implemented in any or all states within MZ 1 or 2. Rather, the goal was to reach agreement on the conservation concepts and strategies related to oil and gas development that are supported by current published peer-reviewed and unpublished literature.

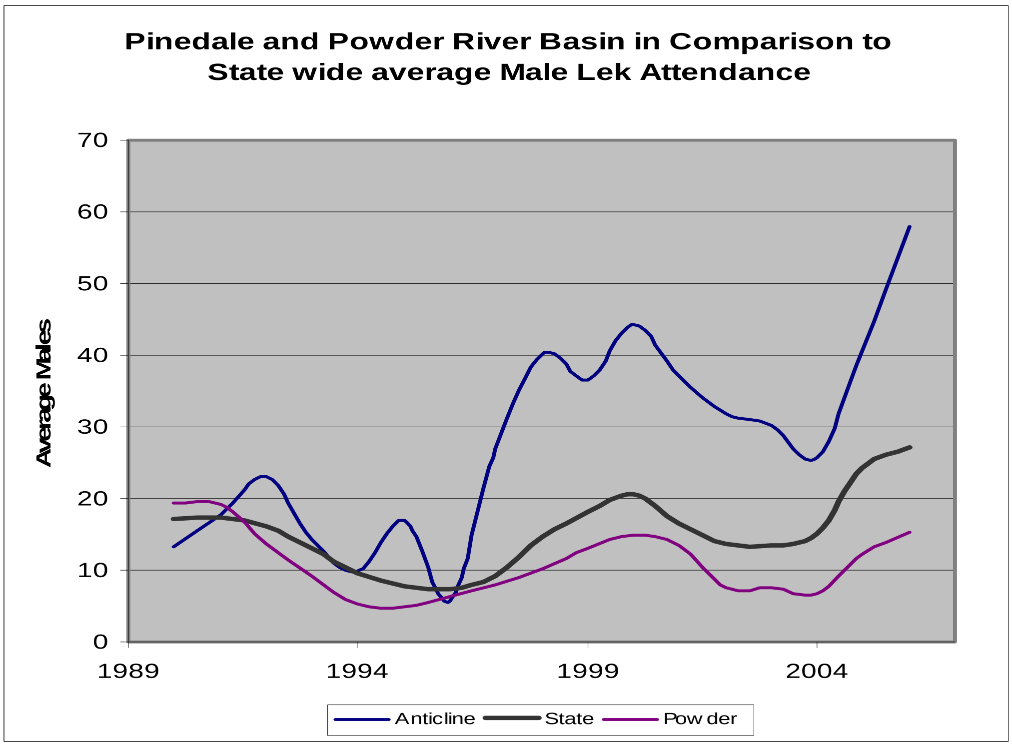
> ***Comment:*** *This statement, "peer-reviewed and unpublished literature", contradicts the statement above, "recently peer reviewed and published articles." It should be noted that Naugle et al. (2006) has not been peer-reviewed or published and we suggest that the lack of consistency in the treatment of the available literature is inappropriate.*

If implemented, these concepts and strategies likely will not eliminate impacts to sage-grouse populations that result from energy development.

> ***Comment:*** *The inference in this paper is that 85% lek survival, as predicted by the Walker models, is the best that can be hoped for given the omnipresent oil and gas development, even with application of a 0.6-mile lek NSO and 4-mile nesting habitat protection. This statement fails to recognize other impacts on the habitat or the lack of model consistency with long term data which demonstrates that leks continue to remain active in oil and gas fields even after decades of "impact" (Taylor et al. 2007).*

However, when used in combination with other conservation measures, these actions may enhance the likelihood that sage-grouse populations will persist at levels that allow historical uses such as grazing and agriculture and maintain their current distribution and abundance, thereby avoiding the need to list sage-grouse under the federal Endangered Species Act.

> ***Comment:*** *Graphing the WGFD sage-grouse data indicates that grouse numbers have increased substantially since 1994, even with increasing oil and gas development and on-going historical uses such as ranching/livestock grazing. The following graph illustrates, based on WGFD data, the average peak male attendance for leks in the Pinedale Anticline area, the Powder River Basin and the state of Wyoming as a whole through 2006.*



Each researcher was invited to present their findings and to answer questions posed by the states. Following this, each state provided an overview of their review of the science and their resulting management actions and recommendations. The group then collectively reviewed, debated and agreed on the concepts and strategies supported by that science. The focus of the meeting was on five key issues: core areas, no-surface-occupancy zones, phased development, timing stipulations, well-pad densities, and restoration. Scientific data are available to inform many other issues related to sage-grouse management and conservation that were not reviewed (e.g., BMPs).

> ***Comment:*** *It is unrealistic to consider oil and gas impacts in a vacuum in light of all the other activities that occur in the sagebrush ecosystem.*

Core Areas

Identification and protection of core areas, sometimes also referred to as crucial areas, will help maintain or achieve target goals for populations including distribution and abundance.

> ***Comment:*** *Crucial areas are typically crucial habitats such as crucial winter range where a species goes to find forage and shelter in the harshest and deepest snow winters. As defined below the core areas for sage grouse are not crucial areas but are all seasonal habitats associated with the population. This paper does not provide any definition of how important core areas will be differentiated (i.e. radius out from a lek, all defined habitat within X miles of a lek) from not so important or marginal habitats. The attached lek density map (Map 1) for Wyoming, derived from the WGFD sage-grouse data base, indicates the areas with the greatest density of males relative to all leks in the statewide data base.*

Full field energy development appears to have severe negative impacts on sage-grouse populations under current lease stipulations (Lyon and Anderson 2003, Holloran 2005, Kaiser 2006, Holloran et al. 2007, Aldridge and Boyce 2007, Walker et al 2007, Doherty et al. 2008).

> ***Comment:*** *Full field energy development (FFD) is not defined in this document. Geologically speaking, full field energy development is different for each field and is dependent on the geology, the topography and well spacing as allowed by the appropriate regulatory agency (i.e. WOGCC, MBOG, etc.).*
>
> - *Using the PRB definition found for Figure 1 a and 1b, FFD would be 160-acre spacing (where all wells within the non NSO area of the 2-mile or 4-mile radius are within 350 meters of each other).*
> - *Aldridge did his work in Canada, the "current lease stipulations" are not applicable there. Walker and Doherty were working in the PRB where the land ownership is quite diverse and the application of the BLM stipulations was rendered ineffective if stipulations are not applied "blind to surface ownership."*
> - *The BLM purposely impacted selected leks (no stipulations applied) within the Pinedale development to allow Holloran to test the efficacy of the stipulations.*
>
> *The CEQ regulations (40 CFR 1508.20: "mitigation may include one or more of the following: (b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation;")*
>
> - *Make it clear that the BLM stipulations are intended to reduce impacts to sensitive resources, not to eliminate them.*
> - *Taylor et al. (2007) demonstrates how the stipulations indeed reduce the impacts of development compared to areas where stipulations were not applied.*

Much of greater sage-grouse habitat in MZ 1 and 2 has already been leased for oil and gas development. These leases carry stipulations that have been shown to be inadequate for protecting breeding and wintering sage-grouse populations during full field development. (Holloran 2005, Walker et. al. 2007, Doherty et al. 2008)

> ***Comment:*** *If this is a true statement how do they explain the continued lek attendance and use of winter habitats in developed fields in Wyoming?*
>
> - *Model Figure 1a predicts leks persistence in the presence of development activity with a 0.25-mile lek NSO only 5% of the time. But, Taylor et al. 2007 (attached) consistently illustrates continued lek attendance, greater than 5%, within developed areas.*
> - *The 1.9-mile breeding/nesting habitat radius map (Map 2) prepared to test these models and the management suggestions provided in this Multi-state document demonstrates leks continuing to attract males (and the associated females) even*

with more than 1 well per square mile (11 wells) drilled within the 1.9-mile radius. Obviously, these predictive models do not reflect what is occurring in the field.

New leases continue to be issued utilizing these same stipulations. To ensure long-term persistence of populations and meet goals set by the states for sage-grouse, identifying and implementing greater protection within core areas from impacts of oil and gas development is a high priority.

> ***Comment:*** *Does this mean these "greater protections" (beyond the standard stipulations) would only be applied in the defined core areas? How will a "core area" worthy of greater protection be defined?*
>
> *The Wyoming Greater Sage-grouse Conservation Plan (2003) sets 2002 as the base year against which to gage the stability of the sage-grouse population in the state, it is evident from the above graph (pg. 3) that the population in 2006 is above that of 2002.*

In order to conserve core areas it is essential that they be identified and delineated. Sage-grouse populations occur over large landscapes comprising a series of leks and lek complexes with associated seasonal habitats. Therefore, core areas should capture the range required by a defined population to maintain itself. This concept is consistent with Crucial Wildlife Habitats recently endorsed by the Western Governor's Association (2007). Criteria that could be used to identify and map core areas include, but are not limited to: (1) lek densities, (2) displaying male densities, (3) sagebrush patch sizes, (4) seasonal habitats (breeding, summering, wintering areas), (5) seasonal linkages, or (6) appropriate buffers around important seasonal habitats.

> ***Comment:*** *Most of this information is not available on a fine scale (sagebrush patch size) or at all (mapped seasonal habitats and linkages); we suggest using lek and displaying male densities as the surrogate for sagebrush patch size to create core areas maps.*

Research indicates that oil or gas development exceeding approximately 1 well pad per square mile with the associated infrastructure, results in calculable impacts on breeding populations, as measured by the number of male sage-grouse attending leks (Holloran 2005, Naugle et al. 2006).

Comment:

- *"Calculable impacts" does not necessarily equal threatening the population. Both research efforts had very small sample sizes in areas of intensive gas development unlike anything seen before and do not represent broad based response of sage-grouse to energy development activity.*
- *Holloran (2005) included leks that were purposely impacted (the standard stipulations were not applied) in an effort to determine if the stipulations were effective in reducing the impact of development on sage-grouse.*
- *Holloran (2005) demonstrated that the standard BLM stipulations were effective in reducing impact but did not eliminate impact on leks within 3 km of a well.*

Because breeding, summer, and winter habitats are essential to populations, development within these areas should be avoided. If development cannot be avoided within core areas, infrastructure should be minimized and the area should be managed in a manner that effectively conserves sagebrush habitats within that area.

> ***Comment:*** *Is this discussion specifically targeted toward core areas (see question above) and minimizing impacts to those defined habitats? As currently written, this document, while intended to inform the discussion and decisions related to sage-grouse conservation in areas undergoing energy development, does not adequately describe or*

define key components that must be reconciled before concrete conservation agreements can be made. This document erroneously extrapolates the findings from two studies that resulted in predictive models of impact and then applies those findings across the region without consideration of existing population data, the location of core population areas or the anticipated energy development.

No Surface Occupancy (NSO)

At the scale that NSOs are established, they alone will not conserve sage-grouse populations without being used in combination with core areas. <u>The intent of NSOs is to maintain sage-grouse distribution and a semblance of habitat integrity as an area is developed.</u>

Breeding Habitat - Leks

<u>Research</u> in Montana and Wyoming in coal-bed methane natural gas (CBNG) and deep-well fields <u>suggests that impacts to leks from energy development are discernable out to a minimum of 4 miles, and that some leks within this radius have been extirpated as a direct result of energy development (Holloran 2005, Walker et al. 2007).</u>

> ***Comment:*** *While impacts may be discernable out to 4 miles we question the severity of those impacts relative to the impact on the survival and viability of the local population or the species as a whole.*
>
> - *We agree that some leks within this radius have been extirpated, likely as the result of energy development, but cannot agree with the implication that this is a common occurrence.*
> - *Taylor et al. (2007) clearly demonstrates that ubiquitous 40-acre spacing within the 0.25- and 2-mile stipulation radii (+200 wells) have resulted in leks becoming inactive in the PRB. They also demonstrated that leks have become inactive in areas of full field 80-acre spacing (+100 wells) and when wells have been drilled within the 0.25-mile lek radius. Of the few leks that did become inactive with wells inside the 4-mile radius, most had been impacted by concentrated development activity and wells within the 0.25 mile NSO.*
> - *Holloran (2005) demonstrated that leks downwind and within 3 km of year-round drilling operations or within the 0.25-mile lek radius have become inactive.*
> - *Holloran (2005) and Taylor et al. (2007) have both illustrated that leks with wells drilled outside the 0.25-mile radius may experience reduced male activity.*
> - *Kaiser (2006) found reduced male attendance was likely the result of displacement or avoidance but not mortality.*
> - *Reduced male activity may be a "discernable" impact but, as seen in the numerous examples found in Taylor et al. (2007); this does not necessarily result in lek extirpation or population decline.*
>
> *Further, we find it curious that the term "extirpation" can be used so easily by the authors of this Multi-state document or the researchers (Holloran, Walker, Naugle, and Doherty). WGFD will not identify a lek as abandoned or extirpated until there are 10 continuous years of observations of no lek activity. Leks without this level of documentation are considered inactive and continue to be provided the same level of protection as active leks. Leks deemed extirpated by the listed authors were labeled as such after only one or two years of inactivity and the cause automatically determined to be energy development.*

Walker et al. (2007) indicates that the current 0.25-mile buffer lease stipulation is insufficient to adequately conserve breeding sage-grouse populations in areas having full CBNG development. A 0.25-mi. buffer leaves 98% of the landscape within 2 miles open to full-scale energy development. In a typical landscape in the Powder River Basin, 98% CBNG development within 2 miles of leks is projected to reduce the average probability of lek persistence from 87% to 5% (Walker et al. 2007). Only 38% of 26 leks inside of CBNG development remained active compared to 84% of 250 leks outside of development (Walker et al. 2007). Of leks that persisted, the numbers of attending males were reduced by approximately 50% when compared to those outside of CBNG development (Walker et al. 2007).

Comment: *Try as we might to recreate Walker's analysis we cannot. Our analysis of the WGFD 2006 data base found 290 leks in the PRB:*

- *90 (31%) of these were inactive 2004 to 2006*
- *25 (27.7%) of the 90 had no data pre-1994,*
- *50 of the 90 or 55% never recovered from the population decline that occurred between 1989 and 1994,*
- *14 of the original 90 (15.5%) were active post 1994*
- *Of these 14 now inactive leks, 7 were impacted by oil and gas development*
- *5 were impacted by coal mining activity.*

Therefore, 7.7% of the currently inactive leks in the PRB are likely inactive as a result of CBNG development. These 7 leks were impacted by CBNG development at 40- or 80-acre spacing with >100 wells drilled within the 2-mile lek radius and/or a well or wells drilled within 0.25 miles of the lek.

It should be noted that the majority of the land surface and much of the mineral estate in the PRB is privately owned and as such the BLM stipulations are not applied. Therefore, it is inappropriate to characterize this area and the resultant impacts as an example of the failure of BLM stipulations to protect the sage-grouse.

Male lek attendance pre- and post- development should be compared to determine the reduction in individual male lek attendance as a result of development activity, not impacted vs. non-impacted leks as was done in Walker et al. 2007. Taylor et al. (2007) found that impacted vs. non-impacted leks within the PRB experienced differential lek attendance prior to the beginning of CBNG development, likely as a result of habitat fitness. The majority of CBNG development activity in the PRB has occurred in grass dominated sagebrush areas.

The impact analyses provided in Walker et al. (2007) are based on a 7-year dataset where probability of lek persistence is strongly related to extent of sagebrush habitat and the extent of energy development within 4 miles of the lek and the extent of agricultural tillage in the surrounding landscape.

Comment: *We agree with the acknowledgement of the importance of sagebrush habitat within proximity to sage-grouse leks for maintaining breeding and nesting activity. Especially in an area like the PRB which is a grass-dominated sagebrush system and patches of sagebrush have greater importance to the survival and viability of the species.*

The estimated probabilities of lek persistence are only reliable for the length of the dataset, and it is not understood how other stressors (e.g., West Nile virus [Naugle et al. 2004], invasive weeds [Bergquist et al. 2007]) will cumulatively impact sage-grouse over longer time periods. While increased NSO buffers alone are unlikely to conserve sage-grouse populations, results from Walker et al. 2007 suggest they will increase the likelihood of maintaining the distribution and abundance of grouse and should increase the likelihood of successful restoration following energy development.

> ***Comment:*** *Again, we refer the reader to Map 2. The purpose of this map is to determine if leks are indeed becoming inactive in developed areas within 3 to 4 years of energy activity impact. It is interesting that the apparent density of inactive leks is similar in areas with and without oil and gas development. In addition, in the areas of the PRB where wells were not drilled on ubiquitous 40s (>200 wells within the 2 mile radius) the leks are persisting even after 3 to 4 years of energy activity and contrary to the predictions found in Walker et al. 2007.*

Additional information provided in Walker et al. (2007) allows managers and policy makers to estimate trade-offs associated with allowing development within a range of different distances from leks (Figures 1a and 1b). These probabilities will also need to be applied over larger landscapes in future analyses to better understand projected region- and state-wide population impacts under current and future development scenarios.

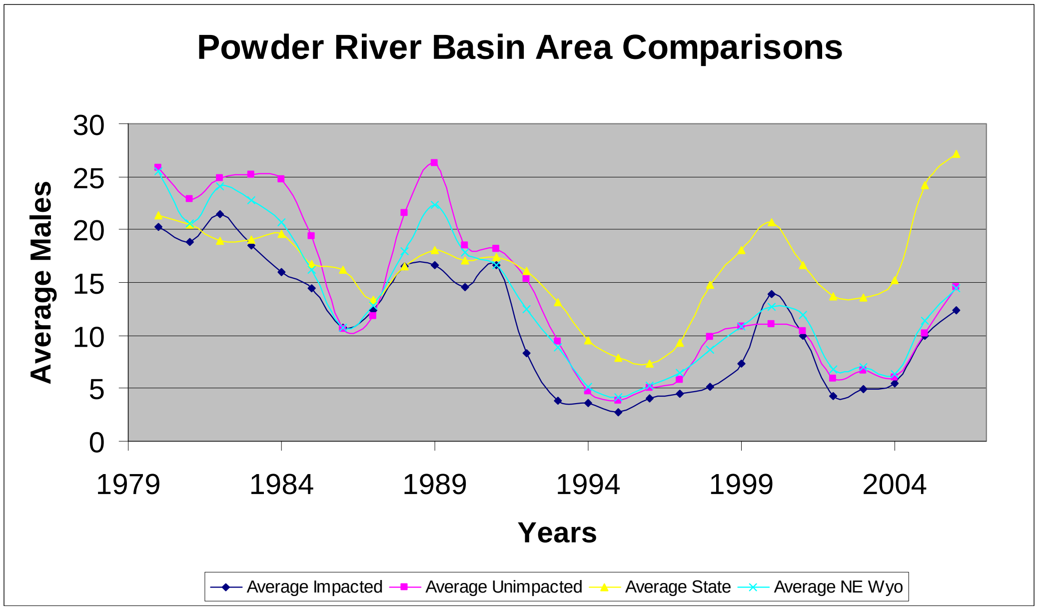
> ***Comment:*** *The attached leks and wells map (Map 2) visually applies these probabilities across the broader landscape and demonstrates that lek persistence scenarios advocating lek NSO's out to ~ 2 miles (1.9 miles) do not reflect the actual response of sage-grouse to energy development. For example, the model in Figure 1b predicts that leks with a 2.0 mile NSO and full field development beyond that only have a 28% chance of persistence, yet the WGFD 2007 database indicates 30% of the observed leks in the state were inactive for the survey period 2005-2007, irrespective of the influence of oil and gas development activity. Further, it appears from the Map 2 that the relative proportion of inactive leks within development is comparable to that outside development areas.*

Walker et al. (2007) studied lek persistence from 1997-2005 in relation to coal bed natural gas (CBNG) development in the Powder River Basin. These models are based on projected impacts of full-field development within (a) 2 miles and (b) 4 miles of the lek. We present results from these models (rather than models with impacts at smaller scales) because development within 2 and 4 miles of leks are known to decrease breeding populations as measured by the number of displaying males (Holloran et al. 2005, Walker et al. 2007), and 52% and 74-80% of hens are known to nest within 2 and 4 miles of leks, respectively (Holloran and Anderson 2005, Colorado Greater Sage-Grouse Conservation Plan Steering Committee 2008). Sizes of NSO buffers required to protect breeding populations may be underestimated because leks in CBNG fields have fewer males per lek and a time lag occurs (avg. 3-4 years) between development and when leks go inactive.

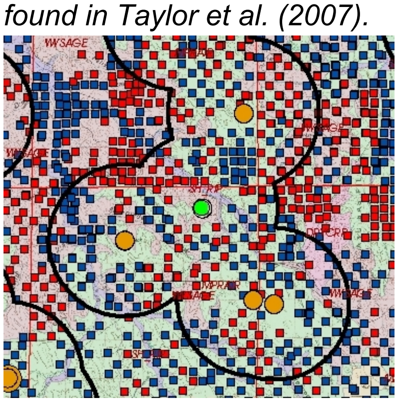
> ***Comment:*** *It is recognized that a reduction in breeding males may occur in highly developed areas (100 to 200 wells within the 2-mile radius) and in areas where leks are impacted within the 0.25-mile lek NSO (Taylor et al. 2007) and there is evidence to show that this may be the result of displacement rather than sage-grouse mortality (Kaiser 2006). But, as illustrated on Map 2 and a review of the WGFD data we do not see the lek abandonment in development areas at the scale predicted in the Walker et al 2007 models.*

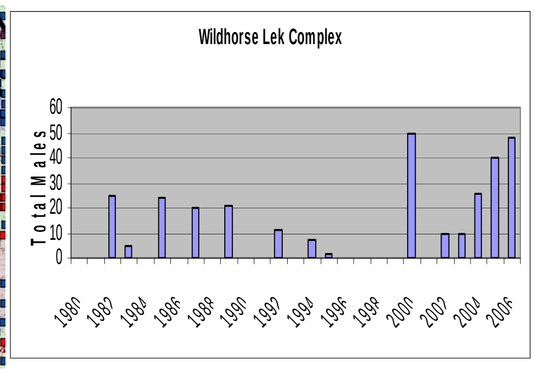
As a result, it is expected that not only will lek persistence decline, the number of males per lek will also decline.

Comment: *Taylor et al. (2007) Figure 3 clearly demonstrates that male lek attendance within oil and gas development areas increase and decrease in trends similar to leks that are not impacted by such development.*



This is also demonstrated in the following graph of the Wildhorse lek complex in the PRB (Taylor et al. 2007, Figure 5). The associated map of the complex clearly illustrates the level of CBNG development (red and blue squares) within two miles of the complex leks (green circles indicate inactive leks, brown circles are active leks). Similar examples of individual leks, lek complexes and populations throughout the state of Wyoming can be found in Taylor et al. (2007).





In contrast, sizes may be overestimated where high lek densities cause buffers from adjacent leks to overlap. Additional time is required to develop models demonstrating the probabilities of lek persistence at well-pad densities less than full development.

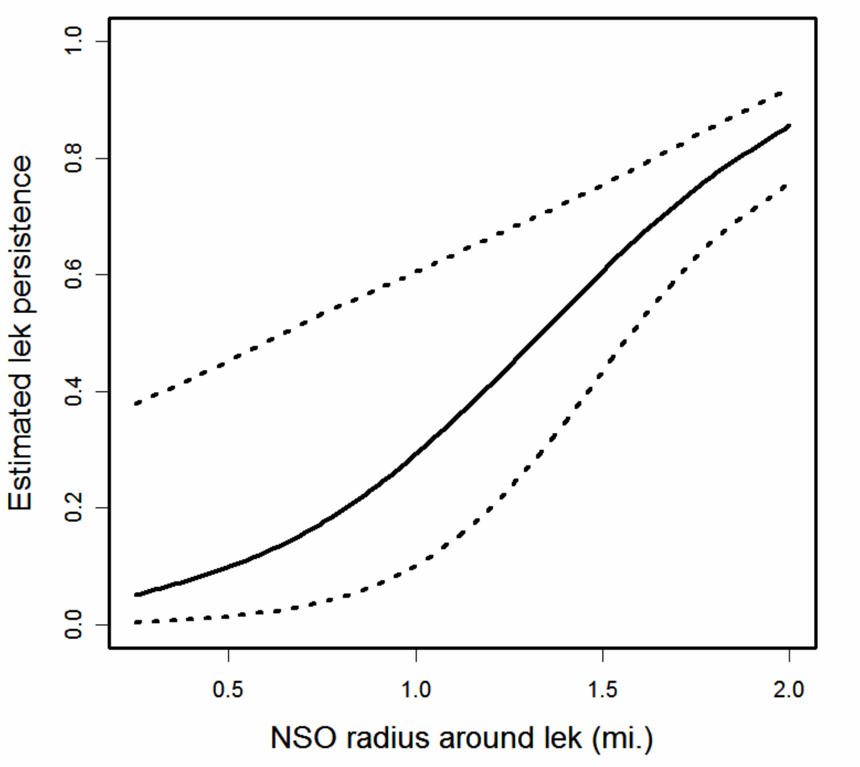


Figure 1a. Estimated probability of lek persistence (dashed lines represent 95% CIs) in fully-developed[1] coal-bed natural gas fields within an average landscape in the Powder River Basin (74% sagebrush habitat, 26% other habitats types) with different sizes of no-surface-occupancy (NSO) buffers around leks, assuming that only CBNG within 2 miles of the lek affects persistence. Buffer sizes of 0.25 mi., 0.5 mi., 0.6 mi., and 1.0 mi. result in estimated lek persistence of 5%, 11%, 14%, and 30%. Lek persistence in the absence of CBNG averages ~85%.

> ***Comment:*** *This definition of full field development could encompass development densities ranging from 40-acre spacing (16 wells per section) to 160-acre spacing (4 wells per section). This unreasoned extrapolation of effects from intensive 40-acre spacing with direct lek impact in the PRB to much less intensive development areas is unsupported by the data.*

[1] Defined as entire area outside the NSO buffer, but within 2 miles, being within 350 meters of a well.

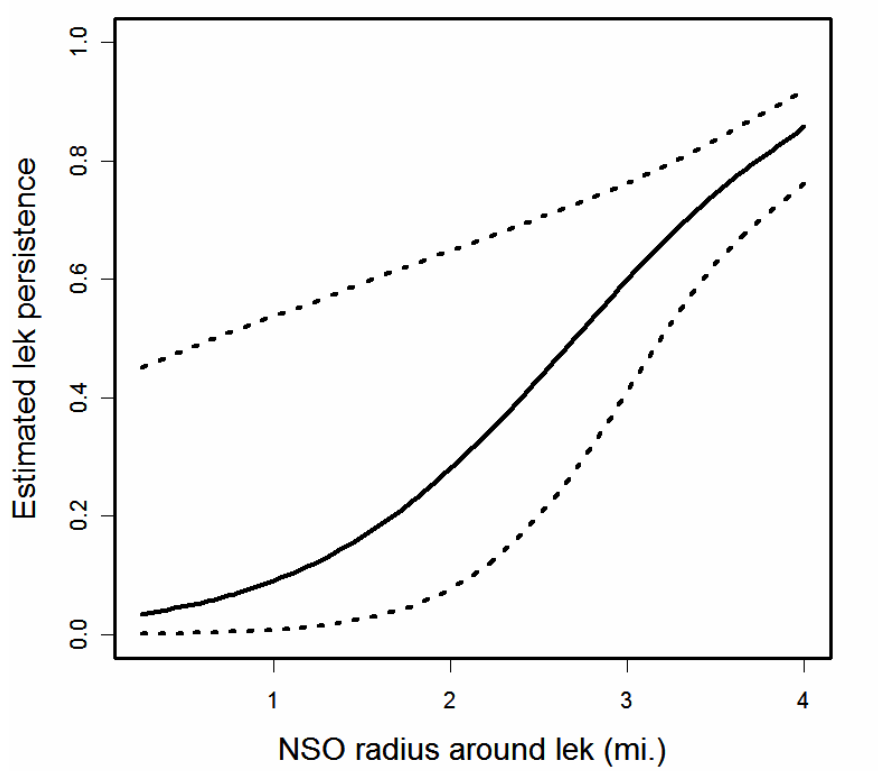


Figure 1b. Estimated probability of lek persistence (dashed lines represent 95% CIs) in fully-developed[2] coal-bed natural gas fields within an average landscape in the Powder River Basin (74% sagebrush habitat, 26% other habitats types) with different sizes of no-surface-occupancy (NSO) buffers around leks, assuming that only CBNG within 4 miles of the lek affects persistence. Buffer sizes of 0.25 mi., 0.5 mi., 0.6 mi., 1.0 mi., and 2.0 mi. result in estimated lek persistence of 4%, 5%, 6%, 10%, and 28%. Lek persistence in the absence of CBNG averages ~85%.

Figures 1a and 1b provide an illustration of the trade-offs between differing NSO buffers in relation to lek persistence in developing CBNG fields. The group does not offer a specific NSO recommendation but provides these graphs to guide decision-making.

Breeding Habitat - Nesting and Early Brood-rearing

Yearling female greater sage-grouse avoid nesting in areas within 0.6 miles of producing well pads (Holloran et al. 2007), and brood-rearing females avoid areas within 0.6 miles of producing wells (Aldridge and Boyce 2007). <u>This suggests a 0.6-mile NSO around all suitable nesting and brood-rearing habitats is required to minimize impacts to females during these seasonal periods. In areas where nesting habitats have not been delineated, research suggests that greater sage-grouse nests are not randomly distributed. Rather, they are spatially associated with lek location within 3.1 miles in Wyoming (Holloran and Anderson 2005). However, a 4-mile buffer is needed to encompass 74-80% (Moynahan 2004, Holloran and Anderson 2005, Colorado Greater</u>

[2] Defined as entire area outside the NSO buffer, but within 4 miles, being within 350 meters of a well.

Sage-Grouse Conservation Plan Steering Committee 2008). These suggest that all areas within at least 4-miles of a lek should be considered nesting and brood-rearing habitats in the absence of mapping.

> ***Comment:*** *The Multi-state team is suggesting no activity would be allowed within a 4-mile nesting radius; with mapping a 0.6-mi NSO radius around nesting habitat patches is suggested. A compromise would be to avoid impacting nesting habitat where practical and continue the timing restriction so that there is minimal activity in nesting habitat during nesting and EBR. Please refer to the discussion of* Breeding Habitat – Nesting and Early Brood Rearing *in the* ***Timing Stipulations*** *section below.*

Winter Habitat

NSO or other protections may also need to be considered for crucial winter range. Survival of juvenile, yearling, and adult females are the three most important vital rates that drive population growth in greater sage-grouse (Holloran 2005, Colorado Greater Sage-Grouse Conservation Plan Steering Committee 2008). Although overwinter survival in sage-grouse is typically high, severe winter conditions can decrease hen survival (Moynahan et al 2006). Crucial wintering habitats can constitute a small part of the overall landscape (Beck 1977, Hupp and Braun 1989). Doherty et al. (2008) demonstrated that sage-grouse avoided otherwise suitable wintering habitats once they have been developed for energy production, even after timing and lek buffer stipulations had been applied (Doherty et al. 2008). For this reason, increased levels of protection may need to be considered in crucial winter habitats.

> ***Comment:*** *We agree that the focus of concern should be crucial winter habitats as we know that during "normal" winters sage-grouse habitats are not limiting. We should focus on protection of severe winter relief habitats that can be identified using the model developed by Hayden-Wing Associates in conjunction with the Rawlins Wyoming BLM office. This model was based on field work conducted in the winter of 2000/2001 and is being "fine tuned" using data collected in the severe winter of 2007/2008.*

Phased Development

Population-level impacts and avoidance associated with energy development have been documented (Braun et al. 2002, Lyon and Anderson 2003, Holloran 2005, Kaiser 2006, Holloran et al. 2007, Aldridge and Boyce 2007, Walker et al 2007, Doherty et al. 2008). Phased development maximizes the amount of area within a landscape that is not being impacted by development at any one time, and can occur at multiple spatial scales (e.g., phased development of separate fields in a landscape, phased development of infrastructure within a single unit or field, or phased development within a single lease). Unitization, clustering, and geographically staggered development are all forms of phased development. As a tool to minimize impacts to sage-grouse, developing oil and gas resources by employing one of these phased methods may help maintain large, functional blocks of sage-grouse habitat.

> ***Comment:*** *Very localized impacts (lek specific, not population-level) have been identified by the referenced research projects. Population based impacts have not been identified in the research conducted in Wyoming and Colorado. The work conducted in Canada (Aldridge and Boyce 2007) was conducted in a very small and stressed population with limited habitat; this population is not comparable to the sage-grouse populations found in Wyoming unless it would be the Jackson Hole airport population.*

On the contrary, Wyoming Game and Fish Department data do not reveal impacts to the various Local Working Group area sub populations within the state as a result of oil and gas development activities. Taylor et al. (2007) illustrates, using WGFD data, that populations in Wyoming, regardless of proximity to energy development, follow the same growth and decline curves over time; likely in response to winter/spring precipitation (habitat condition). Taylor et al. (2007) also illustrates the localized lek declines are realized relative to the distance to and the density of energy development activities.

Phased development is a concept without definition and without experience. To advocate a process as nebulous as this concept is inappropriate without having at least experimented with it. Phased development concepts also have implications for the lease holders and the subsurface geology that could be better explained by energy industry geologists and reservoir engineers. Other methods of habitat avoidance are being implemented throughout the range of the greater sage-grouse and should be monitored to determine their effectiveness before being ruled out as appropriate mitigation.

Timing Stipulations

As with NSOs, at the scale that timing stipulations are established, they alone will not conserve sage-grouse populations without being used in combination with core areas.

Comment: *It is unclear if NSO and timing stipulations would be applied outside identified core areas which would be avoided to the extent possible. In the alternative, does this statement intend that timing and NSOs should be applied only in core areas in order to provide a greater level of mitigation of impacts of any activity that may be allowed to occur within identified core areas?*

The intent of timing stipulations is to help maintain sage-grouse distribution and a semblance of habitat integrity as an area is developed.

Comment: *The intent of BLM timing stipulations is to reduce disruptive human activities during critical or sensitive seasons. For example, the 2-mile lek radius timing stipulation is intended to avoid disrupting breeding behavior, nesting or brood rearing activities. Timing stipulations may help to maintain sage-grouse distribution throughout the area, i.e. reduce the displacement of hens from the 2-mile radius area, but timing stipulations are not related maintaining habitat integrity.*

Timing stipulations are of lesser value at the scale of full-field development.

Comment: *Taylor et al. (2007) demonstrates the reduced value of timing stipulations in areas of full field development (defined at 40- or 80-acre spacing) where the resultant development is ubiquitous within the 2-mile lek radius (i.e. 100 to 200 well locations within the 2-mile lek radius area) or in areas where the lek 0.25-mile NSO has not been applied. There is no argument that the removal of nesting habitat on a large scale in proximity to a lek is detrimental to the local population nor is there argument that direct lek impacts (construction of facilities within the 0.25-mile lek radius) will significantly impact lek activity.*

Breeding Habitat - Leks

Traffic during the strutting period when males are on a lek results in declines in male attendance when road-related disturbance is within 0.8 miles (Holloran 2005).

__Comment:__ Holloran 2005 documents traffic related disturbance as stated above relative to "main haul roads" which are defined as "Roads accessing ≥5 wells" (Holloran 2005). Further, Holloran conditions this finding by stating that traffic occurred "during the daily strutting period (i.e., vehicle activity during the early morning)" (Holloran 2005), a far more specific description of the disruptive activity than that implied by the statement "traffic during the strutting period when males are on the lek" which could be interpreted as March 1 to May 31, as opposed to 6 am to 9 am daily during the same period.

The distance traveled by males from the lek during the breeding season has been reported in varying ways but generally averages 0.6 miles from a lek (Colorado Greater Sage-Grouse Conservation Plan Steering Committee 2008 - see Appendix B).

__Comment:__ The 0.6-mile lek radius is related to the "loafing" area used by male sage-grouse in the course of the day during the breeding season. When the WGFD lek attendance data is compared to the Wyoming Oil and Gas Commission well data there is no strong correlation between lek abandonment and well drilling within the 0.6-miles. We do see lek abandonment occurring when wells are developed within 0.25 miles of a lek or on the lek site. In addition reduced male lek attendance is evident when +100 wells are drilled within the 2-mile lek radius, including that area encompassing the 0.6-mile radius.

Additionally, females breeding on leks within 1.9 miles of natural gas development had lower nest initiation rates and nested farther from the lek compared to non-impacted individuals (Lyon and Anderson 2003), suggesting disturbance to leks influence females as well. Local variations may influence the application of specific dates, which are typically within a window of March 1 and May 31.

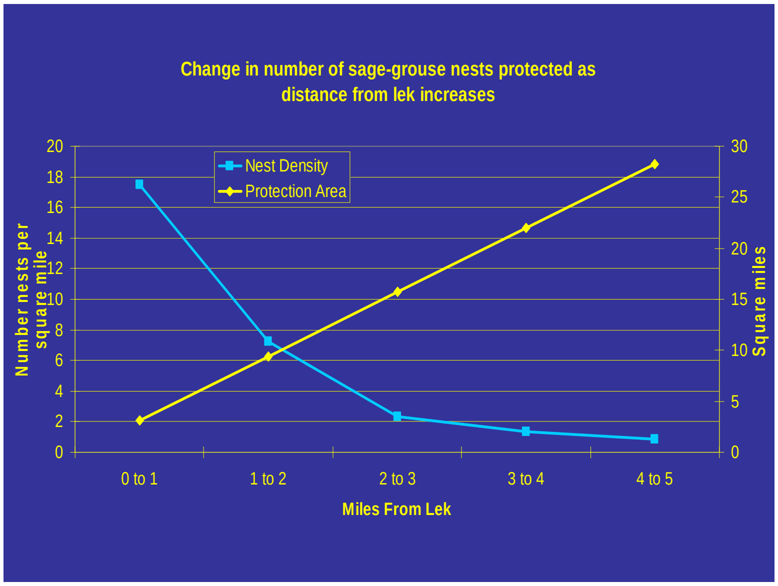
__Comment:__ Using the data found in Lyon (1999) and throwing out the migratory contingent of females that "nested off the Mesa" (Lyon 1999) we find that 90% of undisturbed females nested within 2 miles of the lek of breeding while 75% of disturbed females nested within 2 miles of the lek of breeding. A previous review of the Lyon data indicted that while the disturbed hens may have moved further from the lek of breeding to nest they went toward disturbance features (drilling wells) but stayed upwind of those features. This provides us with insight that noise and the direction of prevailing wind should be a consideration when planning development to minimize the impact on sage-grouse.

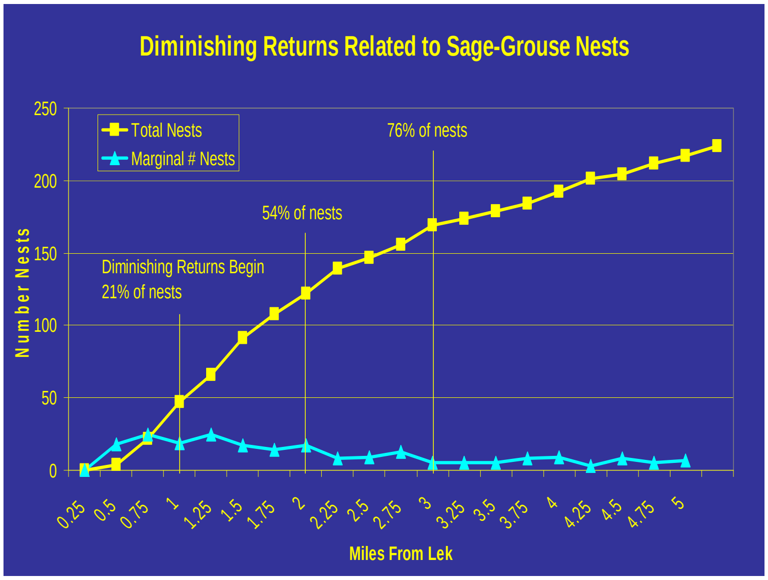
The findings of Kaiser (2006) contradicted those of Lyon and Anderson (2003), "Lek-to-nest distances based on breeding lek location and nest sites in 2005 were closer (not significant) for birds that bred on leks within the development boundary. This contradicted data from Lyon and Anderson (2003) who observed further lek-to-nest distances for hens breeding on disturbed leks."

Breeding Habitat - Nesting and Early Brood-rearing

Often, timing stipulations (periods where no activity that creates disturbance are allowed) for breeding habitat have been applied using a radius around a lek. However, nesting and brood-rearing habitat is not uniformly distributed around the lek. Mapping of habitat would allow for more accurate application of this stipulation. Research on the distribution of nests relative to leks and on the timing of nesting indicates that timing stipulations to protect nesting hens and their habitat should be in place from March through June in mapped breeding habitat or (when nesting habitat has not been mapped) within 4 miles of active lek sites (Moynahan 2004, Holloran et al. 2005, Colorado Greater Sage-Grouse Conservation Plan Steering Committee 2008).

Comment: *The suggested 4-mile radius would provide protection for +80% of nesting females. The following graph, from PAW 2004, demonstrates the "cost benefit" of such a requirement. These data consisted of the distances from the lek of 247 nesting hens on study areas in the vicinity of Casper, Farson, Pinedale, and Rawlins.*





As demonstrated above, the probability of impacting nests drops off quickly beyond 2 miles and greatly reduces the potential for impact to nests from well development.

The Petroleum Association of Wyoming (2004) had previously proposed a compromise strategy for protection of nesting habitat and nesting females. With the two mile radius 50% of nesting hens are protected, but by going out to three miles to include 12.56 sq. mi. of *suitable nesting habitat within that area we could potentially protect 67% - 76% of the nesting hens associated with a lek. This modification would put an outside limit on the total amount of nesting habitat that has to be mapped and protected, while providing significantly greater protection of nesting sage-grouse than has been accomplished historically. Further, this will provide assurance to BLM and WGFD that more effective habitat is mapped and protected, while establishing a consistent standard for industry. As an alternative for areas that are unmapped avoidance of sagebrush stands within a 3-mile radius would be suggested. This option provides incentive to nest habitat while providing the land managers and operators a non-mapping conservation alternative.*

Winter Habitat

Research suggests that no surface occupancy should also be applied to important wintering habitats (Doherty et al. 2008), but if development occurs, impacts would be reduced if development activities were avoided between December 1 and March 15.

> ***Comment:*** *We agree that crucial winter habitats should be protected from development using NSO or timing stipulations. Doherty et al. 2008 did not look at crucial or critical winter habitats but did look at the habitat used by sage-grouse during the winter months. Research shows that during "normal" winters sage-grouse habitats are not limiting, but during severe winters they are. As stated above, we should focus on protection of severe winter relief habitats that can be identified using the model developed by Hayden-Wing Associates in conjunction with the Rawlins Wyoming BLM office. This model was based on field work conducted in the winter of 2000/2001 and is being "fine tuned" using data collected in the severe winter of 2007/2008 (HWA pers. com).*

Well-Pad Densities

Leks tend to remain active when well-pad densities within 1.9 miles of leks are less than 1 pad per square mile (Holloran 2005) but leks tend to go inactive at higher pad densities (Holloran 2005, Naugle et al. 2006).

> ***Comment:*** *Again, this is not supported by the WGFD data and the response of sage-grouse in the field. The response of sage-grouse to development seen by Holloran 2005 and Naugle et al. 2006 is limited to very specific development scenarios and cannot be extrapolated as indicated in the models and the Multi-state document. The concept that leks will remain active only in areas with 11 or fewer wells within the 11.3 square mile radius around the subject lek has not been tested by either author outside of their specific study area. Taylor et al. (2007) clearly demonstrates that leks generally remain active when the 0.25-mile lek radius NSO is applied and when fewer than 100 wells are drilled within the 2-mile radius. In addition, Map 2 illustrates the overall inaccuracy of the concepts found in this Multi-state review of Best Available Science. Map 2 shows every well drilled in the State of Wyoming through 2003 as well as every lek found in the WGFD 2007 data base. Leks are identified as active, inactive or no survey. This Multi-state concept paper states that if more than 11 wells are drilled within the 1.9-mile lek radius the lek should become inactive within 3 to 4 years of being impacted. Therefore, the majority of leks surrounded by wells on Map 2 should be identified as inactive, they are not. The predictive models (Figures 1a and 1b) do not reflect what is actually occurring on the ground, the models vastly overestimate the impacts of energy development activity on the greater sage-grouse.*

Restoration

The purpose of restoration in sage-grouse habitat should be the removal of infrastructure associated with energy development from the land surface and subsequent re-establishment of native grasses, forbs, and shrubs, including sagebrush, to promote natural ecological function. Restoration should reestablish functionality of seasonal habitats for sage-grouse. Thus a field should not be considered restored until sagebrush-grassland habitats have been reestablished.

> ***Comment:*** *The purpose of surface reclamation is indeed "the removal of infrastructure associated with energy development from the land surface and subsequent re-establishment of native grasses, forbs, and shrubs, including sagebrush, to promote natural ecological function." Setting unreasonable reclamation goals (by time or by vegetative condition) is not useful. Some research indicates that the sagebrush ecosystem is decadent or even aged and in need of disturbance to enhance its value to wildlife. It should be recognized that surface reclamation activity is a successional process that begins at a variety of stages depending on the intensity of the initial surface disturbing activity. Succession is a variety of life stages providing habitat diversity over time and space. The Multi-state document infers that reclamation should equal restoration; these are two very different goals. In addition, using "restoration" as the measure or trigger that would allow the next phase of "phased development" is not workable as sagebrush communities take many years to achieve pre-disturbance condition. Again, reclamation should be considered as stages of vegetative succession.*

Future Needs

Time did not allow for a detailed discussion of specific Best Management Practices for oil and gas development and restoration, seasonal habitat mapping, or future research. These topics are all recognized as needing action in the immediate future.

> ***Comment:*** *This document should recognize the efforts that are on-going relative to these identified future needs. The state of Wyoming is taking the lead in sagebrush ecosystem mapping; the DOI/BLM/USGS Healthy Lands Initiative and WLCI are also working on this issue. Best Management Practices have been developed and cataloged in a cooperative effort between Petroleum Association of Wyoming, Montana Petroleum Association and the BLM; these are being implemented as is the research needed to determine the effectiveness of the practice. Future research is being developed and funded to support finding answers to many questions.*

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Appendix 1.

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Comment References and Attachments:

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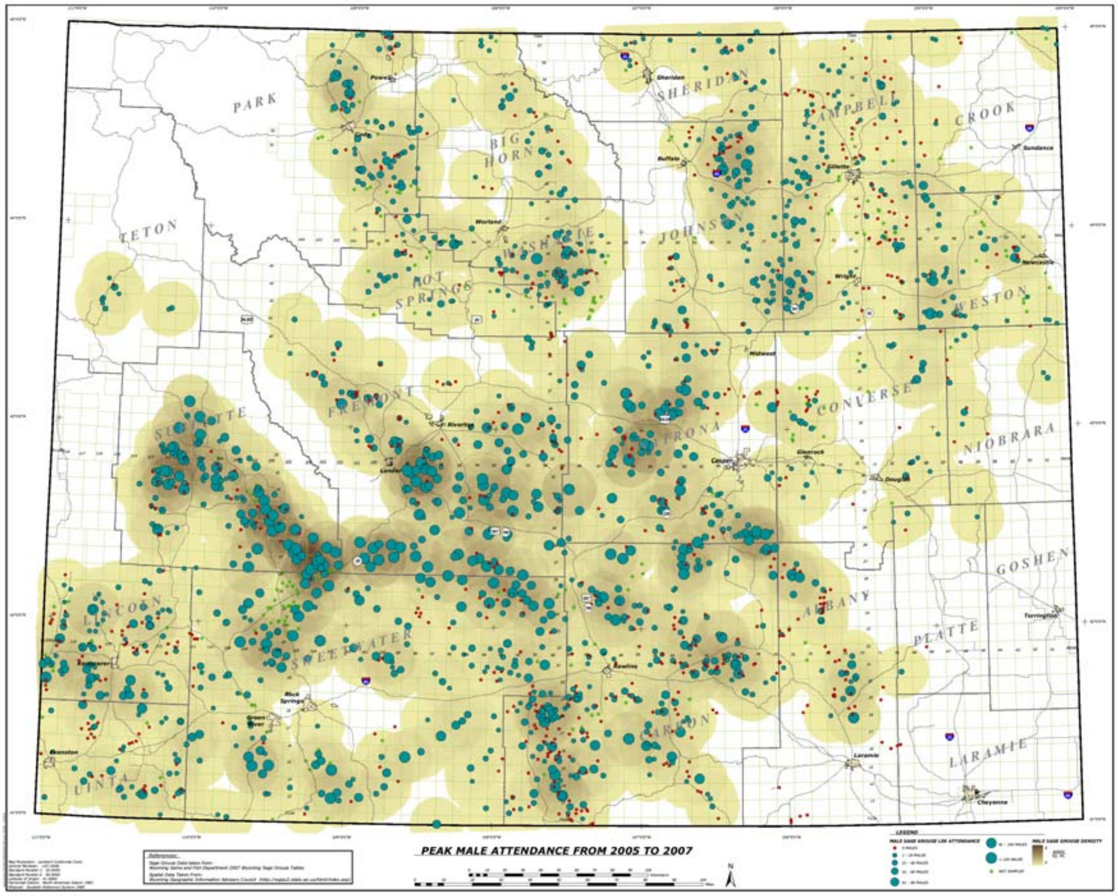
MAP 1: Sage-grouse density based on Peak Males 2005 to 2007



MAP 2: Sage-grouse Lek Locations Relative to Oil and Gas Development