FWP "STRAW DOG" RATIONALE – DRAFT

July 29, 2013

GOAL: "*Provide for the long-term conservation and enhancement of the sagebrush-steppe/mixed-grass prairie complex within Montana in a manner that supports sage-grouse, a healthy diversity and abundance of wildlife species, and human uses.*" (Montana Sage-grouse Working Group 2005)

RELEVANT RESEARCH

Sage-Grouse Breeding Activities:

Holloran (2005) – western WY radio-marking study.

- Male lek attendance declined as distance from leks to drilling rigs, producing wells and haul roads decreased and as densities of those infrastructure facilities increased. Effects were detectable out to various distances (3.0 – 6.2 km; 1.9-3.9 mi.) depending on the disturbance variable. These observations were similar to that reported for sage-grouse associated with energy development in Alberta (Aldridge and Brigham 2003) and Colorado (Remington and Braun 1991).
- Well densities exceeding 1 producing well every 283 ha (1 well/699 acres) appeared to negatively influence male lek attendance.
- Main haul roads within 3 km (1.9 mi.) of leks negatively influenced male lek attendance largely through increased traffic volume. Investigators reported a prominent drop in lek attendance when daily traffic exceeded 50 axles per day.
- Male attendance decreased with traffic volume of < 12 vehicles per day and leks became inactive when volume exceeded 75 vehicles per day.
- To maintain continued nesting for future sage-grouse generations the author recommended, at a minimum, all potential nesting habitat within 5km (3.1 miles) of an active lek be protected from development.

Walker et al. (2007a) - northeast WY and southeast MT radio-marking study.

- From 2001-2005, the number of males counted on leks in coal bed natural gas (CBNG) fields declined more quickly than counts on leks outside of CBNG fields.
- By 2005, active leks within CBNG had 46% fewer males than leks outside of CBNG fields. Leks with energy development within 6.2 km experienced decreased male attendance.
- Of those leks considered active in 1997, only 38% remained active within CBNG fields by 2004-2005, compared to 84% of leks outside CBNG fields.
- CBNG development as distant as 6.4 km from a lek had a detectable impact on lek persistence.
- From 2000-2005, leks in CBNG fields had 11-55% fewer males per active lek than leks outside CBNG development. All known remaining leks with ≥25 males occurred outside CBNG fields in 2005.
- Findings showed that CBNG development is having negative effects on lek persistence over and above other habitat effects including power lines, preexisting roads, West Nile Virus mortality, or tillage agriculture, even after controlling for availability of sagebrush habitat.
- Research findings show a lag effect, with leks predicted to disappear, on average, within 4 years of CBNG development.
- Leks typically remained active when well spacing was ≥ 500 acres (1.3 wells per section), whereas leks typically were lost when spacing exceeded 4.2 wells per section.

Tack (2009) – lek analysis within eastern Montana, southwest North Dakota, northwest South Dakota, southwest Saskatchewan, and southeast Alberta.

- Showed steep decline in probability of occurrence of larger leks (> 25 males) associated with oil or gas development, even at levels of less than 1 well/640 acres within a 12.3 km (7.8 mile) radius of leks.
- Showed probability of occurrence of leks with >25 males dropped off as density of roads within 3.2 km of a lek increased.

Doherty et al. 2010 – Wyoming statewide lek survival and male attendance retrospective analysis relative to oil and gas development.

- Developed research-based matrix revealing how increases in well density within 3.2 km (2 mi) of a lek affects lek attendance and lek survival.
- The authors did not detect any impacts to male counts or lek survival with well densities of up to 1 well/640 acres.
- For Management Zone I, Well densities spanning 1.03-3.1 wells/640 acres experienced an 11.5% decline in the number of active leks and a 31.4% decline in number of males on remaining leks.
- For Management Zone II, well densities spanning 1.03-3.1 wells/640 acres experienced a 12.1% decline in the number of active leks and a 55.5% decline in number of males on remaining leks.

Harju et al. 2010 – Seven study areas in different parts of Wyoming involving a retrospective lek attendance and oil and gas development analysis.

- Leks with at least one well within a 0.4 km (0.25-mile) radius had 35-91% fewer attending males compared to leks that lacked any wells within that radius.
- In two of five project areas, negative effects of well surface occupancy was detectable out to 4.8 km (3 miles), which was the largest buffer tested.
- Analysis showed a general trend of declining male numbers with an increase in well pad densities.
- Negative impacts on male counts were first detectable at well pad densities as low as 2/640 acres on one project area, 1 /640 acres on one project area, and 0 to 1 well pad/640 acres on two project areas.
- Well pad densities of 4 /640 acres experienced male attendance that was 13-74% lower than leks that lacked well pads within 8.5. km. For those areas with a well pad density of 8/640 acres, male attendance at leks was 74-79% lower than leks that lacked well pads within 8.5 km (5.3 mi.).
- A time lag effect between the time of development and when it was detectable via male counts on leks ranged from 2-10 years.

Holloran et al. 2010 – Southwest Wyoming, investigated behavior of yearling male and female sage-grouse associated with natural gas development.

- Found leks that recruited more than the expected number of males were 2.1-2.9 times further from drilling rigs, producing wells, and main haul roads compared with leks that recruited fewer males than expected.
- Radiomarked males were 4.6 times more likely to establish on leks outside of developed areas.
- Treatment yearling males (with natal brooding areas—a radius of 1.65 km of nest site of origin—that had greater than 1 producing well pad or greater than 1 km of main haul road) were 50% less likely to establish a breeding territory compared to control yearling males.
- Annual survival of treatment yearling males associated with development areas (54%) was significantly lower than survival of yearling males that were reared outside of development (100%). In similar fashion, annual survival of treatment yearling females associated with development areas (69.4%) was significantly lower than survival of yearling females that were reared outside of development (100%).

- Concluded that yearling dispersal distances suggest the need to "manage landscapes where sagebrush-dominated regions within those landscapes remain undeveloped for sage-grouse."

Johnson et al (2011) – range-wide analysis of leks associated with a variety of anthropogenic features.

- Measured lek trends at 3 scales and found that trends of leks within 5 km (3.1 mi.) of a producing oil or natural gas well were depressed. Trends were also lower on leks with more than 10 producing wells within 5 km (3.1 mi) or more than 160 wells within 18 km (11.2 mi.) of the lek.
- Found that a density of more than one producing well/6.4 km^2 (1 well/2.5mi^2) within 18 km (11.2 mi) of leks negatively influences lek count trends.
- Declines in lek trends occurred across a Management Zones if the median human footprint score >3 regardless of the activities that contributed to the score.
- Found length of pipeline within 5-km of lek negatively influences lek count trends

Knick et al. (2013) – minimum requirements for distribution of greater sage-grouse leks

- Found that sagebrush land cover within 5 km of the lek averaged 79% at currently occupied leks, 28% at historic but no longer occupied leks, and 35% throughout study area
- Found <2% of the leks were in areas surrounded by >25% agriculture within a 5-km radius, and 93% by <10% agriculture.
- 99% of active leks were in landscapes with <3% developed; all lands surround leks were <14% developed.
- 93% of active leks fell below 0.01 km/km^2 densities of interstate highways
- Leks were absent from areas where power lines densities exceeded 0.20km/km^2, pipeline densities exceeded 0.47 km/km^2 or communication towers exceeded 0.08 km/km^2.

Copeland et al. (2013) – measuring efficacy of sage-grouse conservation in Wyoming

- Predict WY's core area strategy plus $250 mil in targeted conservation easements reduces sage-grouse population declines from 14-29% (no conservation measures) to 9-15% (with conservation measures). This cuts anticipated losses by roughly 1/2 statewide and nearly 2/3 within sage-grouse core breeding areas.

Summary: Impacts of anthropogenic activities on sage-grouse can vary depending on activity and local habitat conditions but cumulative impacts of multiple activities can have significant, negative impacts on sage-grouse populations. Oil and gas well densities commonly permitted in Montana and Wyoming can severely impact sage-grouse breeding populations (Naugle et al. 2011). A number of studies involving both radio-equipped birds and regional and range-wide lek analyses report declining trends of male counts where leks are associated with oil and gas developments. These associations varied by density and nearness of lek. Densities as low as 1 well/6.4 km^2 (1 well/2.5 $mi.^2$) showed negative impacts on male counts. Four studies reported declines in lek male counts associated with oil and gas development that were detectable at development distances of more than 6 km (3.8 mi.) from the lek. As development densities increase and encroach closer to leks, the impact in population trends is more severe. Drilling rigs, haul roads, and producing wells were all found to have impacts on male attendance and lek persistence. Lag times between onset of development and population response averaged 4 years but extended out to 10 years. This lag time is explained in large part by annually returning adult males (as long as they survive) but yearling males associated with gas development experienced lower survival and moved to leks outside of development areas to establish a breeding territory. Yearling females raised in the vicinity of producing wells or main haul roads also showed significantly lower survival, directly affecting annual population recruitment and trends. Current well pad placement restrictions that allow development as close as 0.4 km (0.25 mi.) of a lek are wholly inadequate for effectively conserving sage-grouse. Landscape scale set asides or incremental development that leaves large habitat expanses undeveloped may be most appropriate for assuring long term sage-grouse viability.

Sage-Grouse Nesting and Brood Rearing:

Holloran and Anderson (2005), Holloran (2005) - western WY:

- Sage-grouse nest locations are spatially related to lek locations and a 5 km (3.1 mi.) buffer included 64% of known nests. Moynahan's (2004) work in north central MT supports this finding.
- The substantial number of females nesting > 5 km (3.1 mi.) from a lek could be important for population viability.
- Observed lek to nest distances was not related to lek size.
- Successful nests were generally located further from leks than destroyed nests.
- Nests located ≤ 1 km (0.6 mi.) from another known nest tended to have lower success probabilities.
- Nesting females strongly avoided areas with high well densities but adult females can exhibit strong nest site fidelity. Mean annual survival rates for females suggest that 5 to 9 years may be required to realize ultimate nesting population response to development activities.
- Nest and brood survival probabilities were found to be higher within developed areas but those benefits were overridden by lower hen survival rates within developed areas.
- Sage-grouse population decline in developed areas were best explained when comparing nest success and hen survival pre and post-development, which revealed lower nest survival and lower annual survival of female sage-grouse post-development.

Lyon and Anderson (2003) – western WY

- Female sage-grouse disturbed by natural gas development during the breeding season had lower nest initiation rates.

Schroeder and Robb (2003) – north central WA

- Nest distribution patterns may change as a result of habitat alteration and fragmentation and the 5 km (3.1 mi.) buffer should be considered relevant only for contiguous sagebrush habitats.

Aldridge and Boyce (2007) - southeast AB

- Sage-grouse chick survival decreased as well densities increased within 1 km (0.6 mi.) of brooding locations. These brood-rearing areas acted as habitat sinks where recruitment was poor.
- Low nest success (39%) and low brood survival (12%) characterized sage-grouse vital rates in habitat fragmented by energy development in southern Alberta.

Tack (2009) – northern Valley County and southern Saskatchewan

- Average distance from lek of capture to nest site was 5.3 km. Seventy-five and 95% of nests were within 6.8 and 12.3 km (4.3 and 7.7 mi.) of lek of capture, respectively.

Holloran et al. 2010 – Southwest Wyoming, investigated behavior of yearling male and female sage-grouse associated with natural gas development.

- Yearling females avoided nesting within 950m (0.6 mi.) of infrastructure, regardless of whether they were reared in the vicinity of development or not.

Summary: Female sage-grouse are spatially grouped around a lek or lek complex during the nesting season. Females tend to move away from leks in selecting nest locations and to an extent, those movements appear to improve their rates of nest success. However, females in developed habitat moved twice as far as females in undisturbed habitat and exhibited lower rates of nest initiation. Females also select nest locations that segregate their nests from those of adjacent hens and the probability of successfully hatching those nests increases when

that distance is ≥ 1 km. When females have suitable and contiguous nesting habitat to select from, slightly over 60% of nests occur within 5 km (3.1 mi.) of the lek. This strategy of mutual avoidance reduces nest densities and therefore reduces probability of detection by nest predators. However, land use practices that fragment sagebrush habitat and reduce the amount of suitable nesting cover may lead to increased densities of nesting birds and lower rates of nest success. Even if 5 km (3.1 mi.) buffers are employed around existing leks, increased development and production activity in the zone beyond that buffer will impact the remaining 40% of nesting hens and potentially compromise the success of those birds nesting within that 5 km buffer based on the density dependent factors noted above. Population declines associated with development are attributable to lower hen survival. Seasonal surface use restrictions within 2 miles (3.2 km) of an active lek during the breeding and nesting period (1 March – 15 June) are inadequate to maintain sage-grouse populations within developed habitat.

Sage-Grouse Winter Habitat Use:

Doherty et al. 2008 – Powder River Basin (PRB) in Montana and Wyoming

- Researchers established a predictive winter habitat use model based on key habitat features that was strongly correlated with observed sage-grouse locations ($R^2 = 0.984$).
- Sage-grouse select for large intact and relatively flat expanses of sagebrush as winter habitat and avoid more rugged terrain and conifer habitat. Given that severe winter conditions (deep snow, low temperatures) could force birds into more rugged terrain, topographic variables should be considered in regions outside the PRB.
- After controlling for vegetation and topography, the addition of a variable quantifying the extent of energy development showed that sage-grouse avoid energy development in otherwise suitable habitat. Probabilities of use decrease by ≈30% at a 32 ha well spacing (80 acre spacing). Sage-grouse were 1.3 times more likely to use winter habitat if CBNG development were not present.
- The model classified only 13% of study area as high quality winter habitat (D.E. Naugle, University of Montana, unpublished data).
- Authors concluded that breeding season timing restrictions and quarter mile no surface development around leks are insufficient for preventing infrastructure and ongoing human activity associated with producing wells from displacing sage-grouse in winter.

Tack 2009 – northern Valley County and southern Saskatchewan

- All radio-collared individuals moved >20km in consecutive years to winter habitat

Smith 2013 – long-distance migration in sage-grouse

- Sage-grouse moved 240-km from breeding habitat in north-central Montana/southern Saskatchewan to winter habitat north of the Missouri River.
- Grouse migrated through gently rolling sagebrush flats (<5% slope), using native sagebrush rangeland in proportion to its availability, and avoiding cropland and badlands where food was scarce.

Summary: Sage-grouse use connected patches of relatively flat sagebrush for migration and winter habitat. Sage-grouse are sensitive to energy development associated with winter habitat. Recent advances in modeling efficiencies provide a tool to assess important winter habitat and the spatial relationship between known leks and potential winter habitat. Sage-grouse in this region can be nonmigratory when suitable seasonal habitats occur in reasonable juxtaposition while other population segments do migrate to more distant winter habitat. In some cases, these dissimilar distribution patterns may involve birds using the same lek complex or a shared winter range. Winter habitat should be conserved at an appropriate scale and with some knowledge of sage-grouse distribution patterns. Seasonal restrictions will not be effective at mitigating infrastructure development if the level of development is moderate to intense and overlays important winter habitat.

West Nile Virus:

Zou et al. 2006; Walker et al. 2007b; Walker and Naugle 2011; Doherty 2007

- West Nile Virus (WNV) was documented as an important new source of mortality in lower and mid elevation populations across the range of sage-grouse from 2003-2007, affecting all sex and age classes.
- Local and regional population declines have been attributed to WNV outbreaks.
- Research shows that CBNG ponds pose a threat to sage-grouse because they provide habitat for mosquitoes that spread WNV. Larval *Cx. Tarsalis,* the species of mosquito that spreads the disease, were produced at similar rates in CBNG and natural sites, whereas CBNG ponds produced *Cx. tarsalis* over a longer time period compared to both agricultural and natural sites.
- CBNG ponds resulted in a 75% increase in potential breeding habitat for *Cx. Tarsalis*.

Summary: West Nile Virus should be considered endemic across the northern Great Plains portion of the range of greater sage-grouse. The presence of this disease has added another stressor to sage-grouse population dynamics. The prevalence of the disease and associated level of mortality in sage-grouse appears to vary considerably from year to year based on environmental conditions. However, CBNG ponds do provide a much more consistent set of conditions favorable to the spread of WNV even in years of low natural precipitation. Conservation actions need to consider the relationship between CBNG and WNV and attempt to mitigate those conditions favorable to WNV.

SYNTHESIS

- Recent research using different techniques across many representative parts of the eastern range of sage-grouse has reached similar conclusions about the sensitivity of sage-grouse to anthropogenic disturbances, including oil and gas development. Sage-grouse avoid energy development during both breeding and wintering seasons and do so at scales that render current protective stipulations ineffective. A new conservation strategy will be necessary to balance effective sage-grouse conservation with anthropogenic stressors.
- A common theme among recent research is the level of impact to sage-grouse relative to placement of developments, density of developments, extent of developments, and level of activity associated with developments. These factors form the basis of FWP guidelines.
- Similar research has not been conducted to date on wind energy sites. The recent development of wind energy in sage-grouse habitats and lag effect of possible population responses may mask longer term population impacts (Knick et al 2011). However, human activity, roads, traffic, power lines, visual obstruction, noises, and other factors may result in responses by sage-grouse similar to that found with oil and gas developments.
- Effective sage-grouse habitat conservation must be implemented in a landscape context (Doherty et al. 2011).
- Naugle et al. (2011) characterized different approaches for achieving conservation and energy development based on biological and energy values. Those areas of high biological value but low energy value should be immediately conserved. Those areas of high biological value and high energy value will need to reform policies to reduce threats. And, those areas of lower biological value but high energy potential can emphasize development as the higher priority over conservation.
- Significant fragmentation of habitat and associated loss of populations within the PRB and other areas in Management Zones 1 and 2, could have status implications to the species within the Great Plains portion of the species' range.
- Implementation of Wyoming's Core Area policy and targeted conservation easements are predicted to reduce losses to sage-grouse but not to stop population declines completely (Copeland et al. 2013).

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