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Sage Grouse

Sage grouse have been declining across their range over the past 50 years. Wyoming sage grouse populations are some of the largest left in the nation and have experienced lower levels of population loss (showing a 17% decline from 1985-1994); nonetheless, sage grouse populations have experienced major declines rangewide in recent decades (Connelly and Braun 1997). WGFD (2000) reported that since 1952, there has been a 20% decline in the overall Wyoming sage grouse population, with some fragmented populations declining more than 80%; Christiansen (2000) reported a 40% statewide decline over the last 20 years of the 20th Century. Garton et al. (in press) also reported declining trends for the period of 1965-2007. These declines can be attributed to habitat loss (due to agriculture, mining and energy development, reservoirs, roads, and buildings), habitat fragmentation (due to fences, powerlines, roads, and reservoirs), habitat degradation (due to overgrazing, changes in fire regime, and mechanical and chemical sagebrush control efforts), drought, predation (the importance of which is controlled by the amount and quality of sage grouse habitat), and hunting (Braun 1998). These declines are sufficiently serious that the sage grouse has been listed as a Candidate Species under the Endangered Species Act. It is crucially important that the new plan provide for the maintenance and recovery of sage grouse populations, because this bird is headed for the Endangered Species List if population losses continue.

The sage grouse is a reasonably good ‘umbrella species’ for many types of sagebrush obligate wildlife from pronghorns to pygmy rabbits and BLM Sensitive songbirds, although protecting sage grouse habitat does relatively little for sensitive reptiles (Rowland et al. 2006). Thus, protecting large swaths of sage grouse habitat provides benefits for other types of sensitive wildlife. Large sage grouse Core Areas like South Pass and the Kinney Rim/Vermillion core have been proposed for protection from future oil and gas leasing under the BLM’s Wyoming sage grouse plan amendment process as Sage Grouse ACECs as a means of providing a reservoir of healthy populations of sagebrush obligate wildlife; these lands should also be closed to oil shale leasing for the same reasons.

Sage Grouse Habitats

Sagebrush steppe is the dominant plant community type found on lands under consideration for oil shale and tar sands development. In the sagebrush steppe habitat type, which encompasses the area proposed for oil shale leasing, some 41% of the historical sagebrush habitat has been converted to other vegetation types or human land uses (Miller et al. in press). Included within this area is southwestern and south-central Wyoming, one of the last bastions of the sagebrush steppe, and although large expanses have been badly fragmented by oil and gas projects like the Continental Divide – Wamsutter projects, large expanses of essentially untouched sagebrush grassland still remain in the oil shale area. In fact, south-central and southwestern Wyoming have been projected to be the most likely place in the nation to retain the sagebrush ecosystem required by sage grouse (and other sagebrush obligates) in the face of changing climate, based on

the area of agreement between 9 climate change models (Neilson et al. 2005, Attachment ___). Rangeland, climate change is expected to favor the expansion of exotic invasive species at the expense of native vegetation species (Miller et al. in press). The sagebrush steppe ecosystem is home to many rare or declining wildlife species, including the ferruginous hawk, sage grouse, burrowing owl, white-tailed prairie dog, swift fox, pygmy rabbit, Wyoming pocket gopher, black-footed ferret, and mountain plover. The fact that south-central Wyoming is perhaps the last major stronghold of the sagebrush steppe ecosystem and the species that are dependent on it presents a compelling reason that the oil shale/tar sands RMP amendments should regulate development and human use in a way that promotes the persistence of large blocks of intact sagebrush steppe rather than allowing the continued fragmentation of sagebrush habitats until only a few tatters of sagebrush steppe remain.

The Core Area system as currently envisioned by the Wyoming state government is a conceptually useful framework for this, although it incorporates certain political compromises that reduce the Core Area system's effectiveness as a conservation tool, such as excluding some of the highest-value sage grouse habitats from Cores based on the desires of industry to develop them, and the implementation of biologically inadequate protection measures for grouse both inside and outside of Core Areas. BLM has full authority to manage sage grouse habitats on BLM lands; these weaknesses in the state's Core Area strategy can and should be corrected on federal lands through BLM management decisions, including the OSTTS plan amendments.

To ensure the viability of sage grouse populations, it is important to consider nesting, brood-rearing, and winter habitats (Call and Maser 1985). Holloran and Anderson (2005) found that 64% of sage grouse females nested within 5 km of a lek. Connelly et al. (2000) proposed comprehensive guidelines regarding the management of sage grouse, focused around the conservation of breeding/nesting habitat, late summer brood-rearing habitat, and wintering habitat. We recommend that these guidelines be implemented in the forthcoming RMP amendments, with the modification of a 3-mile NSO and no surface disturbance/vegetation treatment buffer at minimum (5 miles would be preferable) for sage grouse leks in order to protect the leks themselves as well as adjacent nesting habitat. These alternatives should be fully explored and considered in the forthcoming DEIS.

Breeding and Nesting Habitats

Autenreith (1985) considered the lek site "the hub from which nesting occurs" (p. 52). Grouse exhibit strong fidelity to individual lek sites from year to year (Dunn and Braun 1986). During the spring period, male habitat use is concentrated within 2 km of lek sites (Benson et al. 1991). Young males may establish new leks in order to take part in breeding (Gates 1985). Because lek sites are used traditionally year after year and represent selection for optimal breeding and nesting habitat, it is crucially important to protect the area surrounding lek sites from impacts.

The maintenance of high-quality sagebrush steppe habitats, particularly nesting and wintering habitats, is necessary to maintain sage grouse viability on the landscape scale. Regarding energy development, according to Naugle et al. (in press), "Severity of current and projected impacts indicates Severity of current and projected impacts indicates the need to shift from local to landscape conservation." Sage grouse are dependent on sagebrush steppe habitats, and sage grouse distribution is closely linked with the distribution of big sagebrush (McCall 1974).

Numerous studies have shown that female sage grouse show strong fidelity to specific nesting areas from year to year (Berry and Eng 1985, Fischer et al. 1993, Lyon 2000). Fischer et al. (1993) concluded, "Because Sage Grouse hens appear to seek suitable habitat within a relatively small area, nest-area fidelity may reduce nesting if large areas of nesting habitat are destroyed" (p. 1040). Thus, it is important to foster sagebrush growth at levels useful to sage grouse and to avoid activities that destroy suitable sagebrush habitat.

The optimum height and cover of sagebrush for sage grouse nesting habitats varies from region to region. In their eastern Oregon study, Call and Maser (1985) reported that sagebrush between 30 and 60 cm made the best nesting habitat, while a range of 15-80 cm was suitable for nesting. In the foothills of the Sierra Madres, shrub height at nest sites averaged 22 cm (Klott and Lindzey 1989). In other studies, nesting habitat is typified by greater shrub height and shrub cover (Wallestad and Pyrah 1974, Sveum et al. 1998). Dunn and Braun (1986) found that grouse selected areas with taller shrubs and more homogeneous sagebrush densities, and closer distance to wooded or meadow edges. But in Idaho, Klebenow (1969) found that sage grouse did not nest in areas where sagebrush cover exceeded 35%. Within suitable nesting habitat, nest sites tend to be located under taller-than-average shrubs, particularly sagebrush (Hulet et al. 1986).

Habitat attributes have a direct effect on sage grouse population dynamics. Connelly et al. (1991) found that nest success was higher for birds nesting below sagebrush (53%) versus other shrubs (22%), and hypothesized that avian predation was the key to nest success. In central Washington, Sveum et al. (1998) found that sagebrush cover at successful nest sites averaged 51%, and height averaged 64 cm, while at depredated nests cover and height averaged 70% and 90 cm, respectively. Wallestad and Pyrah (1974) found that sagebrush cover exceeded 15% for all nest sites, and cover of sagebrush was positively correlated with nest success. Several studies have shown that successful nest sites have greater cover of tall grass (Gregg et al. 1994, Sveum et al. 1998). With this in mind, Holloran (1999) recommended leaving residual grass heights greater than 12 cm following removal of livestock in autumn. Thus, not only sagebrush height and density but also understory grass cover are important to maintain in sage grouse nesting areas. BLM should incorporate the sagebrush remote-sensing mapping projects occurring in Wyoming and elsewhere across the sage grouse's range into its OSTs DEIS analysis of baseline information, as a means for evaluating sage grouse habitat attributes beyond the useful index of lek size and location.

Early and Late Brood Rearing Habitats

Sage grouse may move some distance from nesting sites for early and late brood rearing. In western Wyoming, Lyon (2000) found that sage grouse moved an average of 1.1 km from the nest site for early brood-rearing, and late brood-rearing habitats averaged 4.8 km distant from the early brood-rearing areas. In Bates Hole, Holloran (1999) found that early brood rearing habitats are typified by decreased sagebrush cover and height and increased forb abundance, and movement to riparian sites occurred as uplands became desiccated. This pattern of movement and habitat selection is echoed in the findings of Oakleaf (1971). In western Wyoming, wet meadows, springs, seeps, and other green areas within sagebrush steppe were important for early brood-rearing, while late brood rearing focused on irrigated hay meadows, wet meadows, and drainage bottoms which remained green when early brood rearing habitats were withering (Lyon 2000). This researcher found that most recruitment loss occurred during the early brood rearing

stage, and that this may be a limiting factor in sage grouse populations (Ibid.). In Nevada, Oakleaf (1971) found that meadows with succulent forbs, while occupying only 2.3% of grouse home ranges during the brood rearing period, were disproportionately important as brood-rearing habitat. In central Washington, Drut et al. (1994b) found that during late brood-rearing, habitat use shifted from low sagebrush to big sagebrush sites, with heightened use of meadows and lakeshores. Brood-rearing habitats should thus be identified and managed to maximize sage grouse recruitment success.

The availability of forage with a high nutritional content is an important factor determining brood success. Broods require forbs, insects and cover for growth, concealment and shade (Autenreith 1985). The diet of sage grouse chicks is dominated by insects in the first week of life, with forbs becoming more important as time progresses (Call and Maser 1985). Oakleaf (1971) reported that succulent forbs dominated the diets of brood-rearing hens and juveniles until the chicks reached 11-12 weeks of age. Drut et al. (1994a) found that in the area with high sage grouse productivity, insects and forbs made up 80% of chicks' diets, while sagebrush buds made up 65% of diets in the area of low sage grouse productivity. These researchers reached the following conclusions:

“Substantially lower consumption of forbs and invertebrates and increased reliance on sagebrush may affect chick growth and survival, which would be reflected in long-term differences in productivity between areas. Insects are a critical nutrition source for developing chicks” (p. 93).

Dunn and Braun (1986) argued that meadows, as important forb-producing areas, should be preserved. Thus, the BLM should manage sage grouse brood-rearing habitat to maximize high-quality forage for chicks.

Mesic meadows and surface waters are focal points of sage grouse activity during certain times of year. Mesic sites associated with springs, seeps, and streams are critical for sage grouse on a yearlong basis, and assume even greater importance as brood rearing habitat (Autenreith et al. 1982). Call and Maser (1985) stated, "We believe that free water is an essential component of sage grouse habitat", but noted that "[s]age grouse may do well in the absence of free water where they have access to succulent vegetation." (p. 4). Oakleaf (1971) found that the presence of surface water was an important factor that increased the value of meadows as grouse rearing habitat. Thus, BLM should map these key early brood rearing habitats as part of NEPA's baseline information gathering in the OSTs DEIS, and management of oil shale leasing and development should include special emphasis on avoiding and protecting wet meadows, springs, and seeps.

Wintering Habitats

Non-migratory sage grouse winter on their nesting and brood-rearing habitats, while migratory populations may travel some distance to winter on traditional wintering areas. For non-migratory populations, nesting habitat and wintering habitat are one and the same (e.g., Wallestad and Pyrah 1974). In a western Wyoming study, however, sage grouse were migratory and traveled at least 35 km to separate wintering grounds (Berry and Eng 1985). In Colorado's North Park, Beck (1977) found that grouse migrated 5-20 km away from breeding areas during winter. In a

southeastern Idaho study, Connelly et al. (1988) found that some adult sage grouse moved more than 60 km to winter range, and some juveniles moved more than 80 km, despite the availability of suitable wintering habitat nearby. In some cases, sage grouse may be widely dispersed during mild winters but concentrate during severe winters (e.g., Autenreith 1985).

Sage grouse may be keying in on several habitat variables when selecting appropriate wintering habitat. In the southern Red Desert, Kerley (1994) found that wintering sage grouse moved to tall sagebrush stands on steep south-facing slopes, where the sagebrush were exposed above the snow. Conversely, Beck (1977) found that in North Park, Colorado, 66% of sage grouse wintered on slopes of less than 5%, while only 13% of sage grouse use occurred on slopes greater than 10%. In Montana, Eng and Schladweiler (1972) found that 82% of winter sage grouse sightings occurred in canopy cover greater than 20%, and a preference was shown for dense stands on lands with little slope. Carpenter et al. (2010) found in Canada, sage grouse selected less rugged topography at lower elevations. Dougherty et al. (2010) found that wintering grouse selected dense sagebrush for both food and cover. The BLM must identify sage grouse wintering habitats within the planning areas and emplace strong measures to protect them from oil shale leasing and development, with an appropriate buffer to ensure that oil shale and tar sands operations immediately adjacent to important wintering habitats do not cause disturbance to birds using those habitats.

Researchers appear to be unanimous in their recommendations that sage grouse winter habitat be protected from disturbance. Kerley (1994) recommended, “Because shrub stands used during winter (category 3 stands) make up a small proportion of available habitats, these patches on south facing slopes, as well as other traditional wintering sites, should not be treated [to remove or reduce shrubs]” (p.113). Since oil shale development would remove all shrubs, it certainly falls into this category of activities that should be proscribed by BLM. Connelly et al. (2000) concurred, recommending against habitat manipulation in sagebrush stands of 10-30% canopy cover heights of at least 25 cm to protect winter habitats. According to Beck and Braun (1980), “Areas of winter concentrations of sage grouse need to be documented and afforded maximum protection” (p. 564). Lyon (2000) recommended that sage grouse wintering habitats be placed off-limits to oil and gas development. Thus, in the OSTs planning area, the BLM needs to rapidly identify sage grouse winter concentration areas and place the areas off-limits to surface disturbance.

Vegetation Treatments

Because the sage grouse is dependent on sagebrush, sagebrush treatments are likely to have major impacts on sage grouse population viability. The OSTs DEIS should consider the cumulative effects that OSTs development would have combined with past and current vegetation treatment programs, and consider the reduction and/or elimination of vegetation treatment projects as part of the overall picture of sage grouse habitat management in the context of OSTs leasing and potential development. Call and Maser (1985) asserted that the spraying of sage grouse nesting habitats is deleterious because it reduces nest cover from avian predators and suppresses forbs that are important in the sage grouse diet. According to Kerley (1994), “shrub stands of 20-40% cover are needed for successful nesting and this shrub coverage should be maintained on identified breeding complexes [within 3.2 km of leks]” (p. 113). Wamboldt et al. (2002) stated:

“Natural or prescribed burning of sagebrush is seldom good for sage-grouse. This assessment recommends that fires within sage-grouse habitat be avoided in most cases, and should be allowed only after careful study of each local situation. The evidence also indicates that habitat loss due to fire may well be the most serious of all the factors contributing to the decline of sage-grouse” (p.24).

Heath et al. (1997) went even farther: “Based on our results, we recommend no reduction or control of sagebrush in areas containing between 18-30% live sagebrush canopy coverage within 4.5 km of leks” (p.50). According to Beck and Braun (1980),

“At present we do not know the relative value of a small versus large strutting ground to the population. Therefore we should afford equal merit to all and strive to maintain the adjacent habitats, especially areas with sagebrush (*Artemesia*) suitable for nesting and brood rearing” (p. 563).

Call and Maser (1985) stated that spraying should not occur within the breeding complex (which they defined as within 2 miles of a lek), and should also be forbidden in known grouse winter ranges. Taking into account the negative effects of vegetation treatments on sage grouse nesting and lekking areas, and uncertainty in the overall extent of sage grouse nesting habitat surrounding lek sites in the Great Divide region, the BLM should prohibit vegetation treatments within *3 miles* of sage grouse lek sites.

Strip Mining

Strip mining for coal has been shown to impact sage grouse populations through major local decreases in recruitment (Braun 1986); local distribution patterns and decreases in lek use are the principal effects, with disturbance, rather than habitat loss, being the primary factor (Remington and Braun 1991). Because oil shale development either involves strip mining directly, or in the case of in situ methods, involves a level of habitat destruction roughly equivalent to strip mining, Klott (1987) recommended that areas near sage grouse leks be avoided for the purposes of strip mining. We concur, and ask the BLM to withdraw lands within 5 miles of a sage grouse lek from lands suitable for surface mining or in situ development under the OSTs plan amendments.

Road Development

Road development can lead to lek abandonment (e.g., Braun 1986). In western Wyoming, Lyon (2000) found that for sage grouse leks within 3 km of oil and gas developments, grouse hens successful at raising their broods selected habitats farther from roads than unsuccessful hens. This finding indicates that habitats near roads experience reduced brood survivorship. Thus, the oil shale RMP amendments should include a moratorium on all road-building within 3 miles of a lek site.

Lessons Learned from Oil and Gas Development

Over the past 10 years, oil and gas development has posed perhaps the greatest threat to sage grouse viability in the region. There has also been much study concerning the impacts of oil and gas development on sage grouse, the findings of which are applicable to oil shale development as well. Over 8% of the total range of sage grouse has already been impacted by oil and gas

development; in addition, the Wyoming Basin and Colorado Plateau ecoregions are among those areas that have the greatest proportion of land under lease (and therefore at risk for future industrialization) (Knick et al., in press). Oil shale development, while having a much greater intensity of development (100% landscape destruction rather than the 3-5% of a typical oil and gas field) also involves heavy vehicle traffic, human activity at the site of production, and networks of roads and potentially pipelines to support it. The BLM must consider the current level of energy development impact on sage grouse, which has been sufficient to list the sage grouse as “Warranted but Precluded” under the ESA, cumulatively with the impacts of oil shale development when performing its impact analysis for the OSTIS PEIS.

In a study near Pinedale, sage grouse from disturbed leks where gas development occurred within 3 km of the lek site showed lower nesting rates (and hence lower reproduction), traveled farther to nest, and selected greater shrub cover than grouse from undisturbed leks (Lyon 2000). According to Lyon (2000), impacts of oil and gas development to sage grouse include (1) direct habitat loss from new construction, (2) increased human activity and pumping noise causing displacement, (3) increased legal and illegal harvest, (4) direct mortality associated with reserve pits, and (5) lowered water tables resulting in herbaceous vegetation loss. Pump noise from oil and gas development may reduce the effective range of grouse vocalizations (Klott 1987). Thus, lek buffers are needed to ensure that booming sage grouse are audible to conspecifics during the breeding season. Connelly et al. (2000) recommended, “Energy-related facilities should be located >3.2 km from active leks” (p. 278). But Clait Braun (pers. comm.), the world's most eminent expert on sage grouse, recommended even larger NSO buffers of 3 miles from lek sites, based on the uncertainty of protecting sage grouse nesting habitat with smaller buffers. Thus, areas within 3 miles of a sage grouse lek should be put under year-round “No Surface Occupancy” stipulations.

Oil and gas development poses perhaps the greatest single threat to sage grouse persistence in Wyoming. Walker et al. (2007) found that sage grouse habitat within 4 miles of a lek site was important to the persistence of the lek. Conversely, Walker et al. (2007) concluded that leks heavily impacted by oil and gas development “typically became inactive within 3-4 years.” Harju et al. (2008) found a time lag of 2-10 years post-development, at which point negative effects became evident. The BLM should be able to predict, on the basis of the location of oil and gas projects both major and minor that are currently underway or are presently being approved, which sage grouse leks are likely to become inactive over the short term once development begins, and this is a key analysis that needs to be performed in order to properly evaluate the prognosis of sage grouse populations in Wyoming and other states being adversely impacted by energy development. The same is true for winter habitats. Indeed, Naugle et al. (2006) found that a model using habitat variables and coalbed methane development provided a near perfect fit for grouse distribution data. In the Powder River Basin, CBM well density within a 4 km² area provided the best fit for modeling sage grouse habitat use (Doherty et al. 2008).

Walker et al. (2007) found that coalbed methane development within 2 miles of a sage grouse lek had negative effects on lek attendance. Holloran (2005) found that active drilling within 3.1 miles of a lek reduced breeding populations, while wells already constructed and drilled within 1.9 miles of the lek reduced breeding populations. One would expect oil shale development to track within this range; it is important to note that impacts to nesting hens are a second matter,

and hens typically nest within 5.3 miles of leks. In Canada, Carpenter et al. (2010) found that sage grouse strongly avoided oil and gas infrastructure to a distance of 1.9 km, and avoided two-track vehicle trails more weakly to a distance of 1.5 km; the closest that a grouse was located to a coalbed methane well was 1,293m. Harju et al (2008) found that negative impacts of development on lek populations extended 4.8 km (3 miles) from the development. Both Holloran (2005) and Walker et al. (2007) documented the extirpation of breeding populations at active leks as a result of oil and gas development in the Upper Green River Valley and Powder River Basin, respectively. Rowland et al. (2006: A4-3 through A4-7) provide a useful literature review of the distance that impacts spread beyond the edge of disturbed areas into adjacent habitats.

Road construction related to energy development is a primary impact on sage grouse habitat from habitat fragmentation and direct disturbance perspectives. Rowland et al. (2006) modeled sage grouse distribution, and reached the following conclusions:

“The secondary road network is a highly significant factor influencing processes in this landscape and is being developed and expanded rapidly across much of the WBEA (Thomson et al. 2005). Secondary roads are being built as part of the infrastructure to support non-renewable energy extraction (Chapters 2, 4). For example, within the Jonah Field in the Upper Green River Valley, >95% of the area had road densities >2 mi/mi² (Thomson et al. 2005).” p. 5-10. Furthermore,

“The dominant feature affecting output of the sage-grouse disturbance model was secondary roads, which occupy nearly 8% of the study area (Table 5.2) and are presumed to negatively influence an even larger extent.”

Pp. 6-15 through 16. Holloran (2005) found significant impacts of road traffic on sage grouse habitat use, concluding that habitat effectiveness declined in areas adjacent to roads with increasing vehicle traffic, documenting the secondary effect referenced by Rowland et al.

A number of researchers have noted a time lag between initiation of mineral development and sage grouse population declines. Holloran et al. (2010) noted that yearling males avoided lekking near oil and gas infrastructure, and that yearling females avoided nesting within 950m of oil and gas infrastructure. Thus, the time lag in populations may be driven by the exodus of yearlings from affected areas, while older birds hang on until they die. These researchers stated, “Our results...suggest to land managers that current stipulations on development may not provide management solutions.”

Lek Buffers

Current BLM nest buffers for oil and gas of ¼ mile for no surface occupancy and 2 miles for seasonal stipulations are grossly inadequate to maintain sage grouse viability in the planning area. The lek buffer must be based not only on maintaining the lek but also the nesting habitat that surrounds the lek. In addition, seasonal prohibitions that prohibit only construction activities near leks are pointless: If roads or wells are built near leks during the off-season, the resulting regular vehicle traffic will have major negative impacts when the sage grouse are present, effectively circumventing any mitigative value of delaying construction activities.

As a rule, breeding and nesting activity are concentrated in the habitats adjacent to the lek site. In a Montana study, Wallestad and Schladweiler (1974) found that no male sage grouse traveled farther than 1.8 km from a lek during the breeding season. But following breeding, males may make long migrations to distant summer ranges (Connelly et al. 1988). Hulet et al. (1986) found that 10 of 13 hens nested within 1.9 miles of the lek site during the first year of their southern Idaho study, with an average distance of 1.7 miles from the lek site; 100% of hens nested within 2 miles of the lek site during the second year of this study, with an average distance from lek of 0.5 mile. In Montana, Wallestad and Pyrah (1974) found that 73% of nests were built within 2 miles of the lek, but only one nest occurred within 0.5 mile of the lek site.

But in Bates Hole, Wyoming, Holloran (1999) found that average nesting distance from lek site was 3.25 km for adults and 5.27 km for yearlings. Wakkinen et al. (1992) cautioned that leks were poor predictors of sage grouse nest sites; although 92% of sage grouse nested within 3.2 km of a lek in this study, sage grouse did not necessarily nest near the same lek where breeding took place.

Lyon (2000) pointed out that quarter-mile lek buffers were insufficient to maintain the viability of grouse populations. Several years ago, a multi-state group of fish and game biologists evaluated the standard BLM mitigation measures for grouse, and found them wholly inadequate. See Attachment ___(7). Naugle et al. (in press) reinforce this assertion with a litany of examples of development compatible with BLM's standard suite of stipulations that exceed sage grouse tolerances. Connelly et al. (2000) recommended that sage grouse habitat should be protected within 3.2 km of lek sites under ideal habitat conditions, within 5 km when habitat conditions are not ideal, and within 18 km where sage grouse populations are migratory. Furthermore, these researchers stated that in areas where 40% or more of the original breeding habitat has been lost, all remaining habitat should be protected. Holloran (2005) provided a critical test of BLM's lek buffers' effectiveness in the Jonah and Pinedale Anticline fields, and found that in the face of full-field gas development, finding that extirpation was expected for sage grouse in both fields within 19 years if conditions remained the same (and, of course, conditions have become much worse for grouse under the continued intensification of drilling and road construction in these two fields).

But Beck (1977) cautioned that protection of lek sites only is insufficient to maintain sage grouse winter habitats. And Connelly et al. (1988) later cautioned, "Protection of sagebrush habitats within a 3.2 km radius of leks may not be sufficient to ensure the protection of year-long habitat requirements" (p. 116). And Braun recommended even larger buffers of 3 miles from lek sites where surface disturbance and vegetation treatments should be prohibited, based on the uncertainty of protecting sage grouse nesting habitat with smaller buffers. See Attachment ___(4). Thus, areas within 5 miles of a sage grouse lek should be put under year-round stipulations preventing habitat alterations for the purposes of oil shale leasing and development.

Sage Grouse Predators

A number of raptors and medium-sized mammalian carnivores prey on sage grouse. Sage grouse nest predators include bobcats, golden eagles, red fox, badgers, common ravens, and coyotes (Heath et al. 1997). Coates and Delahanty (2010) found that increases in raven populations were correlated with sage grouse declines in Idaho. Hulet et al. (1986) found that the Uinta ground

squirrel was the most important nest predator in their southern Idaho study area. Interestingly, Mezquida et al (2006) postulated that “coyote control is likely detrimental to sage grouse conservation” because coyotes may have a negative influence on foxes, badgers, and ravens, which are the most important nest predators for sage grouse. The maintenance of appropriate habitat and adequate cover, particularly on nesting and brood-rearing habitats, is important to ensure that predation rates do not increase to abnormal levels. In addition to maintaining cover, it is important to avoid the construction of tall structures that serve as raptor perches and concentrate predation pressure, like powerlines and gas condensate tanks, near these habitats. BLM should evaluate in its DEIS the cumulative effects that oil shale will have with predation on sage grouse, and the possible changes to interactions which oil shale development might cause between sage grouse and their predators.

Monitoring

The number of active sage grouse leks can be a useful index of sage grouse population trends (Emmons and Braun 1984). Autenreith et al. (1982) provide a sound monitoring protocol which the BLM should adopt to monitor sage grouse trends. Aerial lek surveys should be undertaken each spring to determine presence/absence of grouse on known lek sites and to locate new lek sites, and a subset of leks should be censused at regular intervals at dawn throughout the breeding season to gain an index of population trend. It is important to note that the number of grouse at a lek site can vary greatly from day to day (Beck and Braun 1980), so repeat censuses will be needed to establish a mean value. Emmons and Braun (1984) pointed out that timing of lek counts may affect number of grouse observed, as lek attendance is not constant and males commonly move between leks. These researchers recommended that four separate lek counts be taken for each lek, about 10 days apart. Brood counts should be undertaken 11-13 weeks after the peak of hatch using chick distress calls, and average number of chicks per hen should be derived, using both successful and nullparous hens. The OSTs EIS should include a detailed monitoring protocol for recording the response of sage grouse to oil shale development on neighboring lands.

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