PETITION TO LIST THE GREATER SAGE-GROUSE *Centrocercus urophasianus* UNDER THE SOUTH DAKOTA ENDANGERED SPECIES ACT

Presented by

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PETITION FOR RULEMAKING

This petition for rulemaking is submitted pursuant to SDCL 1-26-13.

Western Watersheds Project, Prairie Hills Audubon Society of Western SD, Nancy Hiling submit this petition. NancyHilding is a resident of Meade County, SD. Prairie Hills Audubon Society is a non-profit corporation registered in SD. Western Watersheds Project is a non profit corporation registered in Idaho. As such, both organizations are persons by SD law and Federal Supreme Court decisions.

We request that the South Dakota Game, Fish and Parks Commission amend SD administrative rule 41:10:02:02 to add the greater sage grouse to SD's list of threatened bird species. Below find the rule with the proposed amendment inserted as item number (4):

41:10:02:02. List of threatened birds. Birds classified as threatened in the state are as follows:

(1) Osprey, ***Pandion haliaetus***;

(2) Piping plover, ***Charadrius melodus***;

(3) American dipper, ***Cinclus mexicanus.***

(4) Greater Sage Grouse, ***Centrocercus urophasianus***

STATEMENT OF REASONS

Western Watersheds Project and Prairie Hills Audubon Society hereby petition the South Dakota Fish, Wildlife, and Parks Commission to list the greater sage-grouse (*Centrocercus urophasianus*) as an endangered species under the South Dakota Endangered Species Law. (Chapter 34A-8 of South Dakota codified laws). SDCL 34A-8-4 gives the authority to list species to the Commission.

The greater sage-grouse has been declining in numbers for many years and is in imminent danger of extirpation across its entire range in South Dakota. Sage-grouse may be already extirpated in southwestern South Dakota, although there is reason to believe that birds may still occur in this part of the state. Current conservation measures currently in place are failing to address the causes of the decline or to compensate for habitat degradation by habitat improvement elsewhere, as evidenced by the continued decline of the species.

POPULATION STATUS

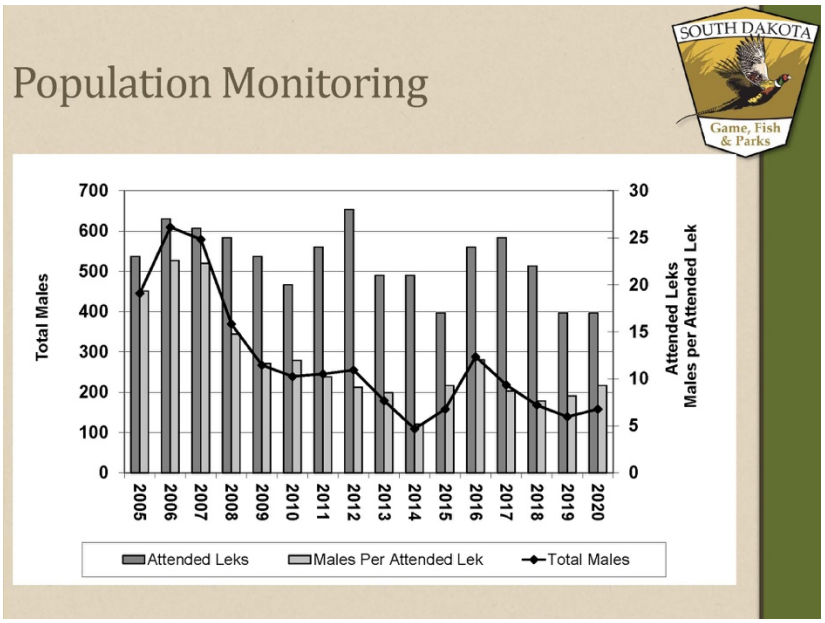
South Dakota's statewide cumulative count of sage-grouse descended to a historic low in 2019, down to 139 strutting males. This represents a 77.2% decline from the male count at the last

major peak, in 2006. In 2020, the cumulative number of strutting males stood at 158. Lek count trends, based on South Dakota Fish, Wildlife, and Parks data, follow:

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total Males	233	445	609	579	369	267	239	245	255	179	109	158	288	218	168	139
Males per Attended Lek	15.5	19.3	22.6	22.3	14.8	11.6	12.0	10.2	9.1	8.5	5.2	9.3	12.0	8.7	7.6	8.2

Conservatively assuming a sex ratio of two females per male (*sensu* Braun et al. 2015), and a conservative census success rate for strutting males of 75 percent (as demonstrated by Fremgen et al. 2016 and Coates et al. 2019, high male counts represent between 77% and 93% of males in each population) to yield the largest scientifically defensible figure, 158 strutting males can be extrapolated to a total population size of 632 birds.

The minimum viable population threshold for species generally is 5,000 individuals (Traill et al. 2010), and the 5,000-bird minimum viable population threshold has been established for sage-grouse in particular (Aldridge and Brigham 2003). Because the sage-grouse is a lekking species, in which one or two males typically do all of the breeding at a given lek, the genetic contributions of the sexes are skewed. Between the low total population, its danger of isolation from sage-grouse populations in other states, and this skewed ratio of breeding birds, the current total sage-grouse population in South Dakota is too small to prevent inbreeding and the genetic problems (birth defects, inbreeding depression reducing the number of viable offspring) that go with it.



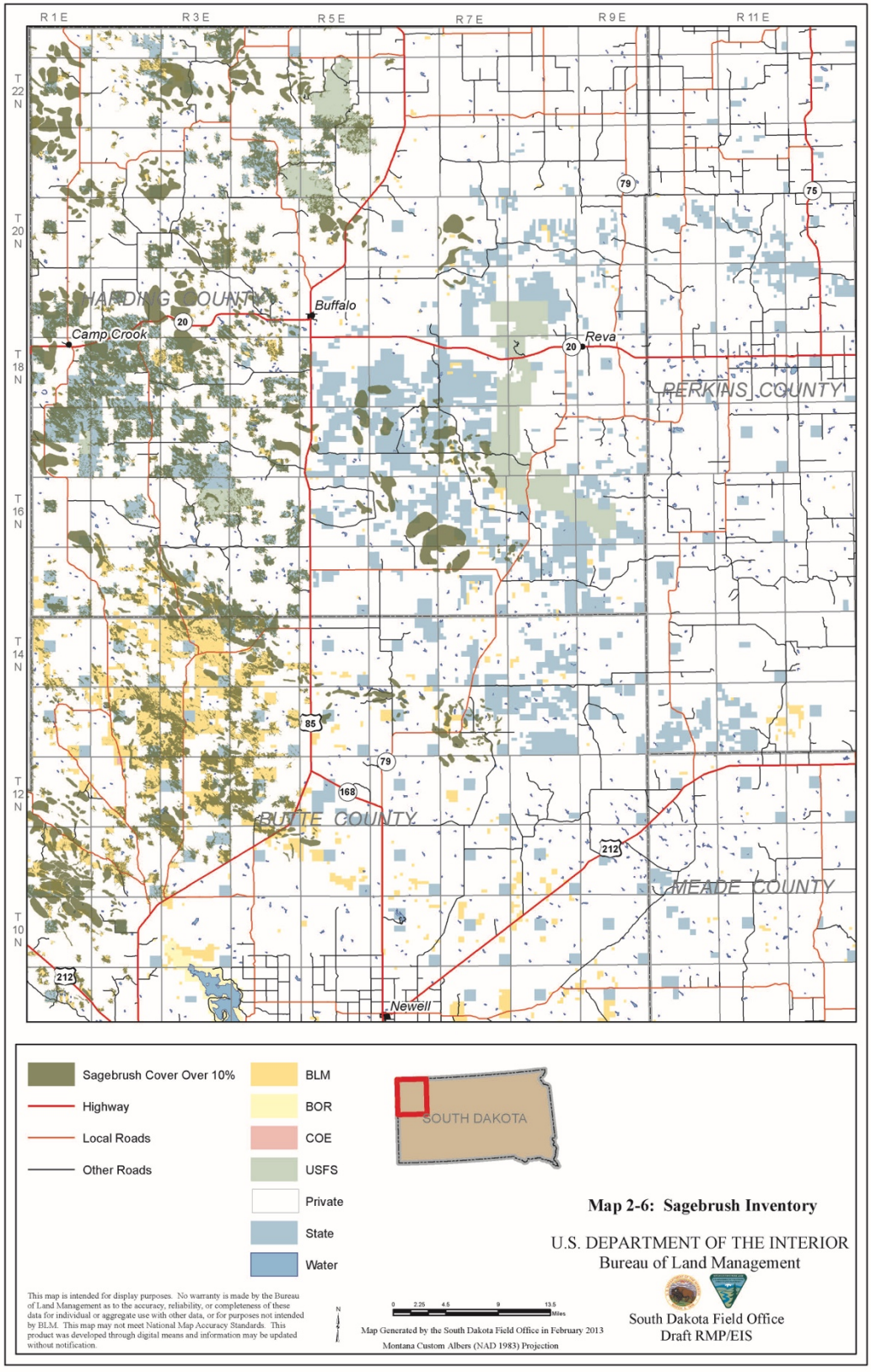
Garton (2015) performed the most current population viability analysis for the Dakotas population (encompassing North and South Dakota and small portions of Montana and Wyoming), and found a 72.5% probability that the overall multi-state population would decline below 50 strutting males for this population in 100 years, and a 21.5% chance of declining below 20 males by 2045. In effect, the South Dakota sage-grouse population may already be trapped within an extinction vortex.

According to the 2014 South Dakota Sage Grouse Plan (SDGFP 2014), greater sage-grouse habitat is currently found predominantly on private lands:

Table 1. South Dakota sage-grouse core area surface ownership acreage.

	Acres	% of Total
State		
School and Public Lands	126,347	12.86%
Game, Fish and Parks	408	0.04%
Total	126,755	12.90%
Federal		
Bureau of Land Management	116,354	11.84%
Forest Service	1,383	0.14%
Total	117,737	11.98%
Private		
Total	738,342	75.12%
Grand Total	982,834	

The Bureau of Land Management mapped sage-grouse habitats in northwestern South Dakota only, in the following map from their 2013 Greater Sage-grouse RMP Amendment Draft EIS.


R1E
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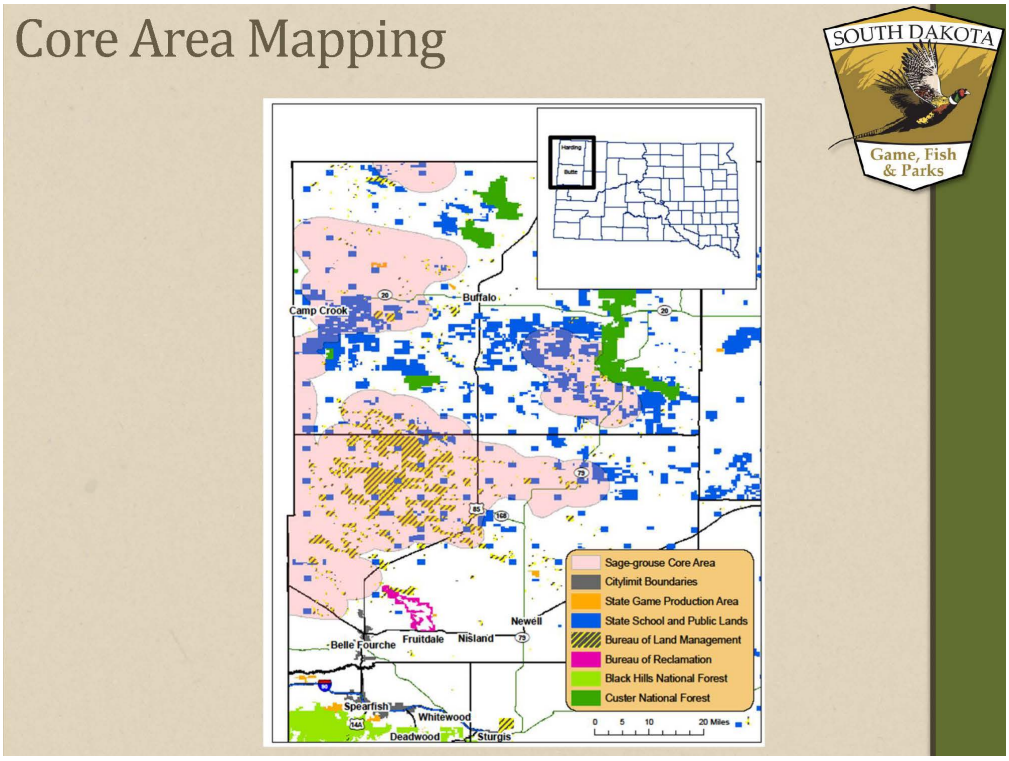
T 12 N
T 10 N
HARDING COUNTY
Buffalo
Camp Crook
Reva
PERKINS COUNTY
BUTTE COUNTY
MEADE COUNTY
Newell
20
79
75
85
168
212
Sagebrush Cover Over 10%
Highway
Local Roads
Other Roads
BLM
BOR
COE
USFS
Private
State
Water
SOUTH DAKOTA
Map 2-6: Sagebrush Inventory
U.S. DEPARTMENT OF THE INTERIOR
Bureau of Land Management
South Dakota Field Office
Draft RMP/EIS
This map is intended for display purposes. No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data, or for purposes not intended by BLM. This map may not meet National Map Accuracy Standards. This product was developed through digital means and information may be updated without notification.
0 2.25 4.5 9 13.5 Miles
Map Generated by the South Dakota Field Office in February 2013
Montana Custom Albers (NAD 1983) Projection

THREATS TO THE SURVIVAL OF THE SPECIES

South Dakota's surviving sage-grouse population in South Dakota occupies the northwestern corner of the state, a sparsely populated area with limited industrial and residential development. Nonetheless, human activity has rendered habitat changes sufficient to initiate unnatural declines of sage-grouse in South Dakota which continue to the present day. The following is a brief summary of known causes of sage-grouse habitat degradation that have been linked to population declines based on the best available scientific information.



Sagebrush buds and leaves are the dominant proportion of their diets, and they use sagebrush shrubs as cover to site their nests. Crop farming (including operations producing hay and alfalfa for livestock) directly converts the sagebrush/grassland habitats that sage-grouse require to survive and reproduce into sagebrush-free non-habitat. In addition, the common pesticides commonly aerially sprayed on cropfields can directly poison sage-grouse directly (Blus et al. 1989).

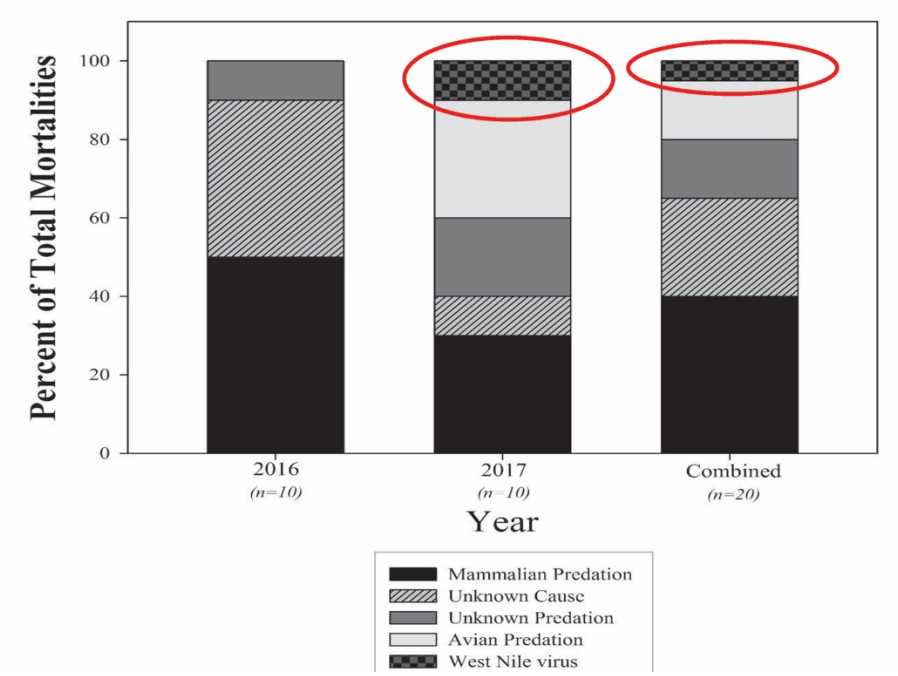
Livestock grazing is the most widespread, and likely most significant, threat to sage-grouse survival in South Dakota. The best available science has established that at least 7 inches (18 cm) of residual stubble height needs to be provided in nesting and brood-rearing habitats throughout their season of use. According to Gregg et al. (1994: 165), "Land management practices that decrease tall grass and medium height shrub cover at potential nest sites may be detrimental to sage-grouse populations because of increased nest predation.... Grazing of tall grasses to <18 cm [7 inches] would decrease their value for nest concealment.... Management activities should allow for maintenance of tall, residual grasses or, where necessary, restoration of grass cover within these stands." Hagen et al. (2007) analyzed all extant scientific datasets up to that time

and concluded that the 7-inch threshold was the threshold below which significant impacts to sage-grouse occurred (*see also* Herman-Brunson et al. 2009). The exception to this 7-inch rule is found in the mixed-grass prairies of the Dakotas, where sparser cover from sagebrush and greater potential for tall grass have led to a recognition that a 26-cm (10.2-inch) stubble height standard is warranted (Kaczor 2008, Kaczor et al. 2011). Foster et al. (2014) found that livestock grazing could be compatible with maintaining sage-grouse populations, but notably stubble heights they observed averaged more than 18 cm (7 inches) during all three years of their study, and averaged more than 10.2 inches in two of the three years of the study.

Doherty et al. (2014) found a similar relationship between grass height and nest success in northeast Wyoming and south-central Montana but did not prescribe a recommended grass height. While there are those who have attempted to cast doubt on the necessity of maintaining grass heights to provide sage-grouse hiding cover, based on timing differences in grass height measurements between failed nests and successful nests, these concerns have been refuted for Wyoming. The significance of the Doherty et al. (2014) study was explicitly tested by Smith et al. (2018a), who confirmed that grass height **continued to have a significant effect** on nest success for this Wyoming study after correction factors were applied to the data. Smith et al. (2018b) found little effect of livestock grazing on sage-grouse nest success in Montana, but the grass heights in grazed pastures differed little from ungrazed controls in this study, indicating an unusually light level of livestock grazing in sage-grouse habitat. This outcome supports management for very light livestock grazing. As yet, there has been no mechanism in South Dakota to require that at least 10.2 inches of residual grass behind to provide adequate hiding cover for sage-grouse, and this lack is likely the primary reason that these birds have been declining, and continue to decline.

Barbed-wire fencing presents multiple serious impacts for sage-grouse. Stevens et al. (2013) found that fence collisions are a significant cause of grouse mortality, with fences on flat areas near leks posing a particularly high risk for causing sage-grouse fatalities (*see also* Van Lanen et al. 2017). Christiansen (2009) documented 146 sage-grouse fence collisions and mortalities along a 4.7-mile length of barbed-wire fence in western Wyoming over a 2½-year period, and found that marking fences reduced collisions by only 61%, such that 39% of the collision rate on unmarked fences continues to occur on marked fence sections. All three of these studies documented that fence markers could reduce collision mortality, but marked fences were still the cause of major amounts of collision mortality under all three studies. Unused fences should be removed, and their rights-of-way (as applicable) withdrawn. Removal of this existing fencing would decrease potential raptor perching and subsequently the indirect impacts of raptors preying on grouse as and other prey species. The removal of fencing could also eliminate any direct mortality due to grouse colliding with problem fences. However, there is currently an absence of regulations that require or even incentivize the removal of the fences that are collision hazards for grouse.

Stock watering reservoirs and coalbed methane retention ponds provide breeding habitat for mosquitoes that carry West Nile virus. West Nile virus mortalities have been confirmed in South Dakota (Kaczor 2008), as recently as 2017 (T. Runia, SDFWP, pers. comm.). Documented West Nile deaths in South Dakota are as follows:



Source: Travis Runia presentation, August 2020. West Nile has been implicated in major sage-grouse population declines in the Powder River Basin (Doherty 2007, Walker et al. 2007a, Walker and Naugle 2011), and presents an ongoing threat to sage-grouse (Taylor et al. 2012), which have demonstrated little to no ability to develop a natural immunity to this non-native disease (Walker et al. 2007b). Accordingly, new stock watering and fluid mineral production reservoirs should be prohibited in Core Areas (BLM Priority Habitat Management Areas), and existing manmade reservoirs should be breached and eliminated to the extent possible.

There is a limited history of past oil and gas development in northwest South Dakota, although there currently are few active oil and gas wells in this area.[1] Holloran (2005) conducted the seminal study (funded by the oil and gas industry), and it found significant negative impacts from both access roads (even when shielded from the lek by intervening topography) and individual producing (post-drilling) oil and gas wells within 1.9 miles from active leks (Holloran 2005). Measurable impacts on sage-grouse from coalbed methane development in northeast Wyoming were found to extend out to 4 miles (Walker 2008), and subsequent research has recorded effects as far away as 12.4 miles from leks (Taylor et al. 2012). Holloran et al. (2007) found that yearling sage-grouse avoided otherwise suitable nesting habitat within 930m (almost 0.6 mile) of oil and gas-related infrastructure. This means that individual wellsites, and their access roads and other related facilities, will be surrounded by a 0.6-mile band of habitat that has substantially lost its habitat capability for use by nesting grouse. The consequences of industrial development in the context of inadequate lek buffers are reductions in population size and persistence. State researchers, using lek buffers of 0.25 mile, 0.5 mile, 0.6 mile, 1.0 mile, and 2.0 mile, estimated lek persistence of 4, 5, 6, 10, and 28 percent, respectively (Apa et al. 2008).

[1] See map, https://denr.sd.gov/des/og/maps/New%20Maps%2001.22.2020/State_wide_oil_gas_wells.pdf

Standard energy development within 2 miles of a lek is projected to reduce the probability of lek persistence from 87% to 5% (Walker et al. 2007a).

Advances in science make it increasingly clear that noise from roads or industrial facilities is having a major negative effect on sage-grouse and their ability to make use of otherwise suitable habitats. Noise can mask the breeding vocalizations of sage-grouse (Blickley and Patricelli 2012), displaces grouse from leks (Blickley et al. 2012a), and causes stress to the birds that remain (Blickley et al. 2012b). According to Blickley et al. (2010), "The cumulative impacts of noise on individuals can manifest at the population level in various ways that can potentially range from population declines up to regional extinction. If species already threatened or endangered due to habitat loss avoid noisy areas and abandon otherwise suitable habitat because of a particular sensitivity to noise, their status becomes even more critical." Noise must be limited to a maximum of 10 A-weighted decibels (dBA) above the ambient natural noise level after the recommendations of Patricelli et al. (2012); the ambient noise level in central Wyoming was found to be 22 dBA (Patricelli et al. 2012) and in western Wyoming it was found to be 15 dBA (Ambrose and Florian 2014, 2015; Ambrose et al. 2015). Sage-grouse lek population declines once noise levels exceed the 25 dBA level. With this in mind, ambient noise levels should be defined as 15 dBA and cumulative noise should be limited to 25 dBA in occupied breeding, nesting, brood-rearing, and wintering habitats, which equates to 10 dBA above the scientifically-derived ambient threshold.

Federal sage-grouse plans have applied a 3% limit on surface disturbance (per Knick et al. 2013), and a site density standard limiting sites to one per square mile. However, these densities are calculated across a project analysis area, which can exceed 225 square miles based on the real-world example of BLM analysis of the Lost Creek uranium project in the Red Desert of Wyoming. Knick et al. (2013) measured disturbance across an area much smaller (a 3-mile buffer around leks) than a project analysis area. Therefore, 3% surface disturbance as measured across a project area is an even higher percentage of surface disturbance when calculated using the Knick et al. (2013) protocol. According to the BLM's expert team (National Technical Team 2011) both site density and disturbance percentage should be calculated per square-mile section of land.

Currently, important sage-grouse wintering habitats have not been spatially identified in South Dakota, and even if they were, there is an absence of measurable, enforceable standards to prevent degradation of wintering habitats at the federal, state, and local levels, across all land ownerships. Doherty et al. (2008) demonstrated that Greater Sage-Grouse in the Powder River Basin avoided otherwise suitable wintering habitats once they have been developed for energy production, even after timing and lek buffer stipulations had been applied. In addition, Carpenter et al. (2010) found that wintering sage-grouse avoided otherwise suitable habitats within a 1.2-mile radius of wellsites. Dzialek et al. (2012: 12) confirmed these relationships for wintering sage-grouse in Wyoming, and concluded:

> First, we can say with increasing confidence that the winter pattern of occurrence among sage-grouse shows consistency throughout disparate portions of its distribution. Second, avoidance of human activity appears to be a general feature of winter occurrence among sage-grouse.

Holloran et al. (2015) determined that increasing wellpad density had a negative impact on sage-grouse winter habitat use regardless of whether liquid gathering systems were used to reduce human activity levels or not, and also found a negative impact of distance to wellsites (within 2.8 km or 1.75 miles) and distance to roads. To the extent that new road construction, mineral development, and transmission and utility lines continue to occur, they should be excluded from important wintering areas, which exclusion should also be applied to a buffer of 2 miles around any such habitats.

Transmission lines are known to negatively affect sage-grouse, due in part to the propensity of raptors and corvids to perch on them and/or concentrate their hunting activity nearby. Wisdom et al. (2011) found that lands within 3.1 miles of transmission lines and highways had an elevated rate of lek abandonment. Nonne et al. (2011) found that raven abundance increased along the Falcon-Gondor powerline corridor in Nevada both during the construction period, and long-term after powerline construction activities had ceased. Braun et al. (2002) reported that 40 leks with a power line within 0.25 mile of the lek site had significantly slower population growth rates than unaffected leks, which was attributed to increased raptor predation. Dinkins (2013) documented sage-grouse avoidance of powerlines not just during the nesting period but also during early and late brood-rearing. LeBeau et al. (2014) found that sage-grouse avoided habitats within 2.9 miles of transmission lines during the brood-rearing period. The National Technical Team (NTT 2011) recommended that Priority Habitats be exclusion areas for overhead powerlines, and that General Habitats should be avoidance areas for overheads lines. Regulations blocking transmission lines from being built across key sage-grouse habitats, and requiring existing overhead lines to be buried, do not exist at any governmental level in South Dakota.

The National Technical Team (2011) reviewed the best available science on wind energy facilities, noting the sage-grouse's avoidance of tall structures, and recommended that priority habitats be "exclusion areas" for these facilities. LeBeau (2012) found that sage-grouse experienced significant declines in nest and brood survival in proximity to wind turbines. Yet no moratorium is presently in place to prevent wind farm development in key sage-grouse habitats. Federal sage-grouse plans offer mere avoidance, which is discretionary, rather than exclusion.

Wisdom et al. (2011) found that extirpated range of sage-grouse was closer to highways (mean = 3.1 miles) than occupied range for sage-grouse, and Holloran (2005) found that "main haul roads" — gravel roads accessing 5 or more natural gas wells — had a significant negative effect up to 1.9 miles from the road on sage-grouse lek attendance compared to unaffected leks (regardless of whether the road was visible from the lek or not), and that increased traffic led to increased impact. At minimum, all roads need to be sited at least 0.8 miles from lekking and nesting habitat, and main haul roads should be sited at least 2 miles away. At minimum, all roads need to be sited at least 0.8 miles from lekking and nesting habitat. Patricelli et al. (2012) tested the impact or road and drilling noise on sage-grouse, and reached the following conclusions:

> "…we recommend that interim management strategies focus not on limiting traffic noise levels, but rather on the siting of roads or the limitation of traffic volumes during crucial times of the day (6 pm to 9 am) and/or season (i.e. breeding season). We estimate that noise levels will typically drop to 30 dBA at 1.3 km (0.8 mi) and to 32 dBA at 1.1 km

(0.7 mi) from the road (these levels represent 10 dB over ambient using 20 or 22 dBA ambient respectively). Therefore to avoid disruptive activity in areas crucial to mating, nesting and brood-rearing activities, we recommend that roads should be sited (or traffic should be seasonally limited) within 0.7-0.8 miles from the edge of these areas. We emphasize that we are not recommending the siting of roads 0.7-0.8 miles from the edge of the lek perimeter, but rather 0.7-0.8 miles from the edge of crucial lekking, nesting and early brood-rearing areas."

There is presently no regulation blocking road construction in nesting habitats (within 5.3 miles of leks), or within two miles of leks to prevent disturbance to breeding birds, nor is there any program in place to close or re-route existing roads that presently occur within these sensitive areas.

There has been a great deal of interest in uranium mining in southwest South Dakota, and rare-earth minerals have also been the subject of mining speculation in the local region. In addition, bentonite mining is a significant problem in northwestern South Dakota, and indeed sage grouse habitat protections have been excluded in bentonite mining areas in the past. Braun (1986) also found a significant negative effect of mining haul roads on sage-grouse leks within 1.9 miles of the road. Yet there is nothing to prevent mining within sage-grouse habitats in South Dakota.

CONCLUSIONS

It is necessary to list the greater sage-grouse under the South Dakota Endangered Species Law because of the ongoing decline of sage-grouse populations in South Dakota, and the absence of required regulatory actions to prevent new habitat impacts or to restore previously impacted sage-grouse habitats. The current state plan includes only voluntary or discretionary measures, with an absence of measurable, enforceable, and mandatory standard to protect sage-grouse and their habitats.

Listing will have the effect of preventing hunting of this species, which is of limited effect given the very few grouse taken each year. It is in the long-term best interest of hunters to increase the sage grouse population to the point where it becomes huntable once again, and listing offers the best path to achieve this result. While hunting is typically not considered a principle cause of sage-grouse population declines, when populations get as small as South Dakota's, the taking of even a few could make the difference between survival and extirpation of an individual lek population.

Various federal, state or local agencies may require environmental impact reviews prior to permitting or approving various development activities. The greater sage grouse is rated as a species of greatest conservation need in the South Dakota Wildlife Action Plan. As such, it may be reviewed in some environmental impact statements. However, some may just require review of federal species and some just federal and state species. Being listed as a state listed species may improve the quality of environmental review allocated to it and potentially result in protection by agencies of government during permitting and approval processes.

We appreciate your diligence and consideration of applying science-based state-level protections to this bird.

Literature Cited

Apa, T., J. Bohne, T. Christiansen, J. Herbert, B. James, R. Northrup, D. Olsen, A. Robinson, P. Schnurr, T.O. Smith, and B. Walker. 2008. 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). Unpublished multi-state report of game and fish agencies, 10 pp. Online at http://www.ourpubliclands.org/files/upload/ti-State_ScienceGroupDocument_FINAL_01-28-08.pdf.

Ambrose, S., and C. Florian. 2014. Sound levels at greater sage-grouse leks, Pinedale Anticline Project Area, Wyoming, April 2013. Unpublished report prepared for the Wyoming Game and Fish Department, 133 pp. Available online at http://www.wy.blm.gov/jio-papo/papo/wildlife/reports/sage-grouse/2013GSGacoustic-rpt.pdf.

Ambrose, S., C. Florian, and J. MacDonald. 2014. Sound levels at greater sage-grouse leks in the Pinedale Anticline Project Area, WY, April 2013-2014. Unpublished report prepared for the Wyoming Game and Fish Department, 79 pp.

Ambrose, S., C. Florian, and J. MacDonald. 2015. Sound levels at greater sage-grouse leks in the Pinedale Anticline Project Area, WY, April 2013-2015. Unpublished report prepared for the Wyoming Game and Fish Department, 113 pp.

Blickley, J. L. and Patricelli, G. L. 2010. Impacts of Anthropogenic Noise on Wildlife: Research Priorities for the Development of Standards and Mitigation. Journal of International Wildlife Law & Policy, 13: 4, 274 — 292. http://dx.doi.org/10.1080/13880292.2010.524564.

Blickley, J.L., and G.L. Patricelli. 2012. Potential acoustic masking of greater sage-grouse (*Centrocercus urophasianus*) display components by chronic industrial noise. Ornith. Monogr. 74: 23-35.

Blickley, J.L., D. Blackwood, and G.L. Patricelli. 2012a. Experimental Evidence for the Effects of Chronic Anthropogenic Noise on Abundance of Greater Sage-Grouse at Leks. Conserv. Biol. 26:461-471.

Blickley J.L., Word K.R., Krakauer A.H., Phillips J.L., Sells S.N., et al. 2012b. Experimental Chronic Noise Is Related to Elevated Fecal Corticosteroid Metabolites in Lekking Male Greater Sage-Grouse (*Centrocercus urophasianus*). PLoS ONE 7(11): e50462. doi:10.1371/journal.pone.0050462.

Blus, L.J., C.S. Staley, G.W. Pendleton, T.H. Craig, E.H. Craig, and D.K. Halford. 1989. Effects of organophosphorus insecticides on sage grouse in southeastern Idaho. J. Wildl. Manage. 53: 1139-1146.

Braun, C.E. 1986. Changes in sage grouse lek counts with advent of surface coal mining. Proc. Issues and Technology in the Management of Impacted Western Wildlife, Thorne Ecol. Inst. 2:227-231.

Braun, C.E., O.O. Oedekoven, and C.L. Aldridge. 2002. Oil and gas development in western North America: effects on sagebrush steppe avifauna with particular emphasis on sage grouse. In Transactions North American Wildlife and Natural Resources Conference 67:337-349.

Braun, C.E., D.A. Budeau, and M.A. Schroeder. 2015. Fall population structure of sage-grouse in Colorado and Oregon. Oregon Dept. of Fish and Wildlife Tech. Rep. 005-2015, 68 pp.

Carpenter, J., C. Aldridge, and M.S. Boyce. 2010. Sage-grouse habitat selection during winter in Alberta. Journal of Wildlife Management 74:1806-1814.

Christiansen, T. 2009. Fence Marking to Reduce Greater Sage-grouse (*Centrocercus urophasianus*) Collisions and Mortality near Farson, Wyoming – Summary of Interim Results. Wyoming game and Fish Department Report, 2 pp. Online at http://wgfd.wyo.gov/web2011/Departments/Wildlife/pdfs/SG_FENCEMARKING0000671.pdf.

Coates, P. S., G. T. Wann, G. L. Gillette, M. A. Ricca, B. G. Prochazka, J. P. Severson, K. M. Andrle, S. P. Espinosa, M. L. Casazza, and D. J. Delehanty. 2019. Estimating sightability of greater sage-grouse at leks using an aerial infrared system and *N*-mixture models. Wildlife Biology 2019(1): 1–12, https://doi.org/10.2981/wlb.00552.

Dinkins, J. B., 2013. Common raven density and greater sage-grouse nesting success in southern Wyoming: Potential conservation and management implications. PhD Dissertation, Utah State Univ. http://digitalcommons.usu.edu/etd/1700.

Doherty, M.K. 2007. Mosquito populations in the Powder River Basin, Wyoming: A comparison of natural, agricultural and effluent coalbed natural gas aquatic habitats. M.S. Thesis, Montana State Univ., 95 pp.

Doherty, K.E., D.E. Naugle, J.D. Tack, B.L. Walker, J.M. Graham, and J.L Beck. 2014. Linking conservation actions to demography: Grass height explains variation in greater sage-grouse nest survival. Wildlife Biology 20:320-325.

Dzialak, M. R., C. V. Olson, S. M. Harju, S. L. Webb, and J. B. Winstead. 2012. Temporal and hierarchical spatial components of animal occurrence: conserving seasonal habitat for greater sage-grouse. Ecosphere 3:30.

Fremgen, A. L., C. P. Hansen, M. A. Rumble, R. S. Gamo, and J. J. Millspaugh. 2016. Male Greater Sage-Grouse Detectability on Leks. J. Wildl. Manage. 80: 266–274

Garton, E.O., A.G. Wells, J.A. Baumgardt, and J.W. Connelly. 2015. Greater sage-grouse population dynamics and probability of persistence. Final Report to Pew Charitable Trusts, 90 pp.

Gregg, M.A., J.A. Crawford, M.S. Drut, and A.K. DeLong. 1994. Vegetational cover and predation of sage grouse nests in Oregon. J. Wildl. Manage. 58:162-166.

Hagen, C.A., J.W. Connelly, and M.A. Schroeder. 2007. A meta-analysis of greater sage-grouse *Centrocercus urophasianus* nesting and brood-rearing habitats. Wildlife Biology 13:42–50.

Herman-Brunson, K.M., K.C. Jensen, N.W. Kaczor, C.C. Swanson, M.A. Rumble, and R.W. Klaver. 2009. Nesting ecology of greater sage-grouse *Centrocercus urophasianus* at the eastern edge of their historic distribution. Wildl. Biol. 15: 395-404.

Holloran, M. J. 2005. Greater sage-grouse (*Centrocercus urophasianus*) population response to natural gas field development in western Wyoming. PhD Dissertation. University of Wyoming. Laramie, Wyoming.

Holloran, M.J., R. C. Kaiser, and W. A. Hubert. 2007. Population response of yearling greater sage-grouse to the infrastructure of natural gas fields in southwestern Wyoming. Completion report. Wyoming Cooperative Fish and Wildlife Research Unit, Laramie, WY, USA.

Holloran, M.J., B.C. Fedy, and J. Dahlke. 2015. Winter habitat use of greater sage-grouse relative to activity levels at natural gas well pads. J. Wildl. Manage. 79:630-640.

Kaczor, N. 2008. Nesting and brood-rearing success and resource selection of greater sage-grouse in northwestern South Dakota. M.S. Thesis, South Dakota State Univ., 85 pp.

Kaczor, N. W., K. C. Jensen, R. W. Klaver, M. A. Rumble, K. M. Herman-Brunson, and C. C. Swanson. 2011. Nesting success and resource selection of greater sage-grouse. Pp. 107–118 *in* B. K. Sandercock, K. Martin, and G. Segelbacher (editors). Ecology, conservation, and management of grouse. Studies in Avian Biology (no. 39), University of California Press, Berkeley, CA.

Knick, S.T., S.E. Hanser, and K.L. Preston. 2013. Modeling ecological minimum requirements for distribution of greater sage-grouse leks – Implications for population connectivity across their western range, USA. Ecology and Evolution 3: 1539-1551.

LeBeau, C.W. 2012. Evaluation of greater sage-grouse reproductive habitat and response to wind energy development in south-central Wyoming. M.S. Thesis, Univ. of Wyoming, 120 pp.

LeBeau, C. W., J. L. Beck, G. D. Johnson, and M. J. Holloran. 2014. Short-term impacts of wind energy development on greater sage-grouse fitness. J. Wildl. Manage. 78: 522-530.

National Technical Team (NTT). 2011. A Report on National Greater Sage-grouse Conservation Measures. Available online at www.blm.gov/pgdata/etc/medialib/blm/co/programs/wildlife.Par.73607.File.dat/GrSG%20Tech%20Team%20Report.pdf.

Nonne, D., E. Blomberg, and J. Sedinger. 2011. Dynamics of greater sage-grouse (*Centrocercus urophasianus*) populations in response to transmission lines in central Nevada. Progress Report: Year 9. Unpublished report, 55 pp.

Patricelli, G.L., J.L. Blickley, and S.L. Hooper. 2012. The impacts of noise on greater sage-grouse: A discussion of current management strategies in Wyoming with recommendations for further research and interim protections. Unpubl. report prepared for: The Bureau of Land Management, Lander Field Office and Wyoming State Office, Cheyenne and Wyoming Game and Fish Department, 25 pp.

Smith, J.T., J.D. Tack, K.E. Doherty, B.W. Allred, J.D. Maestas, L.I. Berkeley, S.J. Dettenmaier, T.A. Messmer, and D.E. Naugle. 2018a. Phenology largely explains taller grass at successful nests in greater sage-grouse. Ecol. and Evol. 8: 356-364.

Smith, J.T., J.D. Tack, L.I. Berkeley, M. Szczypinski, and D.E. Naugle. 2018b. Effects of livestock grazing on nesting sage-grouse in central Montana. J. Wildl. Manage. 82: 1503-1515.

(SDGFP) South Dakota Department of Game, Fish and Parks, Division of Wildlife. 2014. Sage-grouse management plan for South Dakota 2014-2018. Wildlife Division Report Number 2014-02. South Dakota Department of Game, Fish and Parks, Pierre, South Dakota. https://gfp.sd.gov/UserDocs/nav/SageGrouseManagementPlan.pdf

Stevens, B.S., D.E. Naugle, B. Dennis, J.W. Connelly, T. Griffiths, and K.P. Reese. 2013. Mapping sage-grouse fence collision risk: Spatially explicit models for targeting conservation implementation. Wildl. Soc. Bull. 37: 409-415.

Taylor, R. L., D. E. Naugle, L. S. Mills. 2012. Viability analysis for conservation of sage-grouse populations: Buffalo Field Office, Wyoming. BLM Contract 09-3225-0012; Number G09AC00013. Final Report. Prepared for Bureau of Land Management, Buffalo Field Office. Buffalo, WY.

Van Lanen, N.J., A.W. Green, T.R. Gorman, L.A. Quattrini, and D.C. Pavlacky, Jr. 2017. Evaluating efficacy of fence markers in reducing greater sage-grouse collisions with fencing. Biol. Conserv. 213: 70-83.

Walker, B. L. 2008. Greater Sage-grouse Response to Coal-bed Natural Gas Development and West Nile virus in the Powder River Basin, Montana and Wyoming, USA. Ph.D. Dissertation, Univ. Montana. Missoula, MT.

Walker, B. L., and D. E. Naugle. 2011. West Nile virus ecology in sagebrush habitat and impacts on greater sage-grouse populations. Pages 127–142 in S. T. Knick and J. W. Connelly, editors. Greater sage-grouse: ecology and conservation of a landscape species and its habitats. Studies in Avian Biology, Vol. 38. University of California Press, Berkeley, USA.

Walker, B.L., D.E. Naugle, and K.E. Doherty. 2007a. Greater sage-grouse population response to energy development and habitat loss. Journal of Wildlife Management 71(8):2644-2654.
Walker, B.L., D.E. Naugle, K.E. Dougherty, and T.E. Cornish. 2007b. West Nile virus and greater sage-grouse: Estimating infection rate in a wild bird population. Avian Diseases 51:691-696.

Wisdom, M.J., C.W. Meinke, S.T. Knick, and M.A. Schroeder. 2011. Factors associated with extirpation of sage-grouse. Studies in Avian Biology 38:451–472.