MATTHEW H. MEAD
GOVERNOR

THE STATE OF WYOMING

STATE CAPITOL
CHEYENNE, WY 82002

Office of the Governor

October 9, 2015

Mary Jo Rugwell, Acting State Director
Wyoming State Office
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U.S. Department of the Interior
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Nora Rasure, Regional Forester
Intermountain Region
Forest Service
U.S. Department of Agriculture
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Dear Acting State Director Rugwell, Regional Forester Jirón, and Regional Forester Rasure,

Wyoming's Greater Sage-Grouse Core Area Protection strategy (Strategy) – embodied in Executive Order 2015-4 – is based on the principle that preservation of important habitat essential to the maintenance of the Greater sage-grouse and activities important to the State's economy are not mutually exclusive. The basic principles of this conservation effort are avoidance, minimization and mitigation - with mitigation only employed where avoidance and minimization are either inadequate or impossible.

Executive Order 2015-4 establishes a set of requirements on future development and is based upon the most current science on the species. It is designed to protect important habitat and population attributes. Projects that demonstrate avoidance of harm to the species should proceed with appropriate monitoring and care for the species and its habitats.

There will be instances in which Greater sage-grouse habitat will be impacted by project developments. These impacts must be offset through compensatory actions that benefit Greater sage-grouse. The basic principle underlying the implementation of mitigation strategies is "the more impactful the negative action on the ground the greater the mitigation required".

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Application of this principle and maintaining project flexibility are not simple tasks, and should not be undertaken without careful deliberation. I am asking all agencies to operate under a single, manageable framework on mitigation. This will maintain consistency and ensure direct benefit to the species. I have asked the Wyoming Wildlife and Natural Resource Trust to coordinate this framework.

I have attached a document entitled "Wyoming Sage-Grouse Mitigation Assessment," developed by an interdisciplinary team organized through the Sage Grouse Implementation Team, and comprised of representatives from habitat banks, conservation exchanges, agriculture, industry, and state and federal agencies. It is based on the principle - the greater the impact, the greater the required offsetting compensation. This is essential to maintaining the desired balance and focusing the majority of development outside important habitats.

The formulas set forth compute the degree of impact (debit) and the value of a mitigation offset (credit). Debits reflect the specific project plans and the locale in which they occur. Projects impacting core area habitat generate more debits than those that do not. Impacts to different habitat types result in varying debit amounts based on the value and importance of the habitat. Similarly, credits have different characteristics and values depending on the nature, quality, durability and other attributes of the habitat.

These calculations base debits on project specifics and allow a variety of compensatory mitigation options. This approach furthers the Wyoming Strategy by weighting the credits and debits to incentivize avoidance and minimize impacts. If impacts cannot be avoided or minimized, it provides a net conservation benefit to the habitat and species. The Wyoming Wildlife and Natural Resource Trust is developing a Memorandum of Agreement which incorporates the Wyoming Sage-Grouse Mitigation Assessment. Those Wyoming Agencies that have a role in Greater sage-grouse conservation will be partners to this MOA. When finalized, this MOA will facilitate implementation of the compensatory mitigation framework outlined in Attachment H to Executive Order 2015-4, dated July 29, 2015.

In order to maintain consistency of approach, and to assure effective conservation of Greater Sage-grouse in Wyoming, I would ask that your agencies utilize the same approach to mitigation where required, and that you continue to build upon the partnership we have developed over the past decade.

Sincerely,

Matthew H. Mead
Governor

MHM:jr
Encl.

"Wyoming Greater Sage-Grouse Mitigation Assessment"

Background and Introduction

The Wyoming Core Area Strategy is grounded in the scientific principles of landscape management conservation. As such, the Wyoming Core Population Areas (core areas) collectively represent the landscapes necessary to ensure the long-term conservation of Greater sage-grouse (GSG) in Wyoming. Since the Core Area Strategy was collaboratively developed in 2008 by the Sage-grouse Implementation Team (SGIT), it has been endorsed by U.S. Fish and Wildlife Service (USFWS), adopted by the Bureau of Land Management, and implemented by the Wyoming Game and Fish Department and its partners.

The Wyoming Governor's Executive Order 2015-4 and the Wyoming Density Disturbance Calculation Tool (DDCT) defined therein established a set of conservation measures under which development can compatibly proceed in core areas while maintaining adequate GSG conservation. The 2015-4 Sage-grouse Executive Order (SGEO) recommended thresholds designed to protect the habitat based on disturbance limits and the relative importance or value of different habitats within core areas to GSG. Also included in the SGEO in Attachment H is acknowledgment of the importance of compensatory mitigation as a tool for the long-term conservation of the GSG.

Compensatory mitigation to offset impacts is appropriate only when the proposed project cannot adhere to the SGEO conservation measures because practicable measures to avoid and minimize impacts on GSG are unavailable. The SGEO conservation measures provide the framework to quantify unavoidable impacts in the form of debits. An example would be areas where existing disturbance exceeds the conservation measure thresholds and a project would not be allowed, yet valid existing rights were in place prior to the SGEO.

Interest also exists to develop mitigation options for exceptions to conservation measures in non-core areas, which can provide the incentive to keep development out of core areas. This can include but is not limited to the exclusion of timing stipulations in non-core areas

SGEO Conservation Measures

The conservation measures for the SGEO include avoidance and limitation of disturbance in important geographical habitat areas. If development activity follows the conservation measures, compensatory mitigation should not be required. The USFWS has determined that the SGEO is an effective regulatory mechanism for GSG conservation because it applies to all projects requiring a State permit regardless of land ownership, and because federal agencies in

Wyoming are applying the SGEO along with the State as a single regulatory framework. *See* 12-Month Finding on a Petition To List Greater Sage-Grouse as an Endangered or Threatened Species, 80 Fed. Reg. 59858, 59822 (Oct. 2, 2015).

Table 1
The Base SGEO Conservation Measures

Description	In/Out of Core	Dates	Conservation Measure
Timing Limitation Stipulation (TLS)	In	March 15 – June 30	Surface disturbing and/or disruptive activities are prohibited to protect sage-grouse nesting and early brood-rearing habitats.
TLS	In	December 1 – March 14	Surface disturbing and/or disruptive activities are prohibited to protect core area populations of sage-grouse that use these winter concentration habitats.
TLS	Out	March 15 – June 30	Surface disturbing and/or disruptive activities are prohibited within 2 mi. of the perimeter of occupied leks to protect sage-grouse nesting and early brood-rearing habitats.
1/640 (Density)	In	Year round	The density of disturbance of an energy or mining facility are limited to an average of one site per square mile (640 acres) within the area defined by the DDCT, subject to valid existing rights.
5% (Disturbance)	In	Year round	Cumulative disturbance within suitable habitats will not exceed 5% of the total suitable habitat within the area defined by the DDCT.
1.9 mi.	In	Year round	Major new roads that will have relatively high levels of activity (accessing multiple wells [haul roads], housing development) will be avoided within 1.9 miles of the perimeter of occupied sage-grouse leks.
0.6 mi. No Surface Occupancy (NSO)	In	Year round	Surface occupancy and surface disturbing activities are prohibited within 0.6 mi of any occupied sage-grouse lek.
0.25 mi. (NSO)	Out	Year round	Surface occupancy and surface disturbing activities are prohibited within 0.25 mile of any occupied sage-grouse lek.
Noise	In	March 1 – May 15	New project noise levels should not exceed 10 decibels above baseline at the perimeter of a lek from 6 pm to 8 am.
De minimus	In and Out	Year round	Activities exempted from general stipulations due to their minimal impact to GSG as described in Appendix C of the EO.

Debits and Credits

Historically, compensatory mitigation projects have typically exceeded a 1:1 ratio of impacted acre to mitigated acre (1:3, 1:4). The rationale behind these ratios is habitat improvement projects generally provide less than the value of the habitat lost on a per acre basis. Functionality of an acre cannot be doubled to offset lost habitat.

Compensatory mitigation boils down to the calculation of debits (impacts to GSG habitat) and credits (habitat protected to offset the debits). The unit of measure for both is an acre. A debit is based on actual disturbance but adjusted based upon the area and use of the disturbance (loss of functional habitat), whereas the credits required to offset impacts have been based on estimates of improved habitat/resource quality over the area needed to offset the loss of habitat. Past mitigation ratios varied based upon the relative importance of the habitat lost or gained.

Functional habitat is affected by more than solely the amount of direct disturbance. Poor placement of facilities can have far-reaching effects on the species. Credits and debits need to be adjusted for the additional loss of functionality for the species. A high quality vegetative credit can have little value if the surrounding area is highly disturbed.

Rarely can an equal debit-credit acreage ratio capture all life cycle stages supported by the impacted habitat. The potential for development in split estate situations, the longevity of disturbance, the incremental improvement or added value of habitat at the mitigation site, and durability of the credit must be considered.

A mitigation debit formula has been developed to provide a means by which compensatory mitigation obligations may be calculated based upon location, functionality, indirect impacts and size of both the credits and the debits. It captures the importance of both function and location of habitat impacted by a disturbance (debit determination) and the 'value' needed to offset that loss of habitat function (credit conversion rate) to ensure the overall conservation benefit is at least commensurate.

The underlying construct of the Wyoming Core Area Strategy is the recognition that core areas represent landscapes of high value to the species relative to non-core areas. Likewise, within core areas some locations are more ecologically important or "valuable" than others for protecting and sustaining the species. The Sage-grouse Core Area Strategy conservation measures ensure that the impacts of certain activities are avoided and/or minimized within

core areas. As a result, mitigation debits must reflect the relative importance of the SGEO avoidance and minimization criteria by location.

Debit Calculation

Compensatory mitigation credits or measures should be commensurate with or greater than the amount, type, and longevity of debits resulting from land use activities. How debits are calculated is described below.

If SGEO conservation measures are not adhered to and impacts indicate that compensatory mitigation is needed, the degree of compensatory mitigation debits per individual lek can be determined based on the following formula:

$$\{[a(y_1)+a(y_2)+a(y_3)+...]q\} = \text{debits}$$

Where:

- a = acres. "Area", or "a" in the above formula, may be that which is directly or indirectly impacted. Direct impacts are represented by the footprint of the project. A decay function is used to determine indirect effects.
- y = spatial multipliers representing a range of important habitats identified within the SGEO (core, 4 miles, 1.9 miles, 0.6 miles)
- q = weighted multipliers, such as suitable or unsuitable, above or below ground, and lek contribution.

Each resource has geographical areas (spatial characteristics) that are important to population stability. Some habitat needs are protected by timing or disturbance limitations. In the debit calculation, these spatially classified areas are referred to as "spatial multipliers". "Spatial multipliers", or "y" in the formula, represent weighted values given to each of the spatial classifications unique to each resource. See Table 2 for specific guidance. Table 4 provides the crosswalk between science and policy; it is not intended to replace either one. It is anticipated that with the use of the tool, there will be new science that will emerge to provide additional defensibility or rationale for change.

There are additional increases and decreases expressed as weighted multipliers:

- "Quality" is a base description of the vegetation being impacted (ie. suitable or unsuitable habitat per the SGEO).
- If the project is located in unsuitable habitat or below ground, debits are reduced because of its siting in a less impactful location.

Table 2. Weighting and Protection multipliers used in Wyoming Mitigation Assessment. The acreage from each SGEO/DDCT guidance exception is multiplied by each Spatial Multiplier and summed, then multiplied by the product of the Weighting Multiplier(s). Debits for each guidance exception are added for a total debit sum. Final debit sums may be modified based upon local circumstances. Each guidance exception is handled separately for each lek and then added for a total sum.

Core Mitigation									
		Weighting Multipliers (q)			Spatial Multipliers (y)				Potential Ratio Range
EO/DDCT Thresholds	***Indirect Effects***	***Quality Suitable or unsuitable***[1]	***Lek Contribution***[2]	***Above or below Ground***	***In Core***	***4 mi***	***<1.9***	***<0.6***	
Within the 0.6 mile buffer	Indirect effects may be added at the site level if necessary but will not be considered as common practice		1-2	1 or 0.5	2	4	8	16	1: 15-60
New Major Road w/in 0.6 mile or road class change [3]	Yes, .5 mile sigmoidal curve at 100% start	1 or 0.75	1-2		2	4	8	16	1:22.5 – 60 *includes indirect acreage
New Major Road w/in 1.9 and 0.6 mile or road class change [3]	Yes, .5 mile sigmoidal curve at 100% start	1 or 0.75	1-2		2	4	8		1:10.5-28 *includes indirect acreage
New Minor Road w/in 0.6 mile[3]	Yes, .5 mile sigmoidal curve at 50% start	1 or 0.75	1-2		1	2	4	8	1:11.25 – 30 *includes indirect acreage
Exceeds 5%[4]		1 or 0.75	1-2		2	4	8	16	1:1.5-60

[1] This refers to the SGEO suitability definition. It is not intended to address habitat quality.
[2] This weighting multiplier is based on the size and location of the lek. Lek parameters will be assigned by the SGIT.
[3] New use of existing roads can avoid penalty by using a traffic plan or potentially other best management practices.
[4] The location of the exceedence will determine the application of spatial multipliers. As an example, exceedence within 0.6 mile would include all 4 spatial multipliers times the acreage.

Core Mitigation Table 2 Continued									
		Weighting Multipliers (q)			Spatial Multipliers (y)				Potential Ratio Range
EO/DDCT Thresholds	***Indirect Effects***	***Quality Suitable or unsuitable[1]***	***Lek Contribution[2]***	***Above or below ground***	***In Core***	***4 mi***	***<1.9***	***<0.6***	
1/640 Acre Exceedance[4]		1 or 0.75	1-2		2	4	8	16	1:1.5-60
Core TLS[5]									1:1-60

Non-core Mitigation[5]									
		Weighting Multipliers (q)			Spatial Multipliers (y)				Potential Ratio
EO/DDCT Thresholds	***Indirect Effects***	***Quality Suitable or unsuitable***	***Lek Contribution***	***Above or below Ground***	***In Core***	***4 mi***	***<1.9***	***<0.6***	
Non-core .25 mile NSO		1 or 0.75							1:15-60
Non-core TLS		1 or 0.75							1:6-8 (per drill rig) per year or per project acres if no drill rig is used.

[5] These ratios were applied based on policy driven efforts. The non-core ratios were not derived from weighting or spatial multipliers with the exception of the unsuitable habitat location discount.

Credit Calculation

The State does not intend to serve as a crediting entity. The USFWS serves as a crediting approval mechanism for conservation banks and is willing to serve to review non-conservation bank credits. USFWS Conservation Bank review assures credit quantification is very rigorous. As a result, USFWS approved credits from various bank or exchange systems may already account for some of the discretionary credit adjustments suggested in the following tables. Credit description must present evidence of prior adjustment in all requests for exemption from credit reduction. Proponent sponsored project or other type of credits will be reviewed by the USFWS to meet the standards outlined below.

Potential credits can include either current existing habitat (Table 3) or habitat enhancement projects currently underway with specific parameters (Table 4).

The seven traits below (described in more detail in Table 3 and Table 4) must be present for an acre to be considered a credit, which is equal to 1. Of those traits, three have discretionary measures that if the credit condition departs from the credit standard may decrease the value of the credit. For instance, it is mandatory that surface disturbance be less than 10% for 4 miles around the credit; however, if disturbance is greater than 5% and less then 10% around the credit, the credit would be worth 0.75 credits since the preferred disturbance threshold is 5%. Another example is if the credit is in place only for the life of the project rather than in permanent protection. That too would result in a credit worth only 0.95. All deductions are additive. The traits for credit consideration are:

- Occupancy
- **Disturbance***
- **Durability***
- Financial assurances
- **Habitat suitability***
- Landscape support
- Risk reduction

** Indicate discretionary credit measures where credit value may be reduced due to a departure from credit condition.*

Table 3. Credits for Existing Habitat

The USFWS will certify all credits.
With All Conditions Being Equal, preference to proximity should be considered.

Category	Credit Condition	Credit Requirements
Occupancy	Mandatory	The credit is occupied by Greater sage-grouse.
Disturbance	Mandatory	Disturbance within 4 miles of the credit (or seasonal habitats that are used by GSG) is <10.0% as measured by the DDCT process.
Disturbance	Reduction -0.25 credit discount	Disturbance is between 5.01% and 9.9% as measured by the DDCT process.
Durability	Discretionary	The credit has permanent protection.
Durability	Reduction -.05 credit discount	The credit does not have permanent protection.
Durability	Mandatory	The credit exists for the life of the project.
Financial Assurances	Mandatory	Credits include the financial assurances, as appropriate, to guarantee the implementation and effectiveness of compensatory mitigation measures and to cover their administration, durability, monitoring, and reporting.
Habitat Suitability	Discretionary	Habitat suitability must be optimal for the bird as described through an ecological site potential (ESP) assessment. (See Table 5)[6]
Habitat Suitability	Reduction -.20 credit discount	Habitat suitability is less than optimal for the bird as described through an ESP assessment. (See Table 5) If credits are already discounted, this would not apply.
Habitat Suitability	Mandatory	Habitat suitability is greater than 5% sagebrush cover or other SGEO suitability definition.

[6] Empirically derived habitat use based on Stiver meets the standard

Table 3 Continued Category	Credit Condition	Credit Requirements
Landscape Support	Mandatory	Greater sage-grouse using the credit will have access to all four seasonal habitats.
Risk Reduction	Mandatory	The credit includes the following: a. Credits must include a description of the outcomes of compensatory mitigation measures and the performance standards to be met for the duration of the credit life. Credit descriptions should include the types and amounts of resources that will be restored, established, enhanced, and/or preserved, and how these outcomes will address species' conservation needs at the landscape scale. b. Credits include a description of the baseline condition prior to disturbance and future disturbance threats affecting the compensatory mitigation credits (e.g., are there 4 seasonal habitats located within 4 miles, what are the existing thresholds, what is the potential for future development?). c. Credits include a description of the durability (i.e. offset for life of disturbance) of the compensatory mitigation measures and how the credit sites will be maintained. d. Credits include a description of the monitoring and reporting program that will be used to report credit conditions and trends of resources at all relevant scales, to assess the effectiveness of compensatory mitigation measures, and to identify any need for adaptive management. e. Credits include a description of the triggers for adapting management, if necessary, in order to achieve the outcomes of the compensatory mitigation measures. f. Credits include a description of the implementation plan for the enhancement, restoration or funding of compensatory mitigation measure(s) that includes: 1. Specifications for implementing the compensatory mitigation measures (e.g., timing, method, source materials, specific geographic area, etc.). 2. The schedule and plan to maintain compensatory mitigation measures for the duration of the impacts. g. Credits include a description of the accounting process for tracking measures/funds/credits.

Table 4. Credits for Enhancement

The USFWS will certify all credits.
With All Conditions Being Equal, preference to proximity should be considered.

Category	Credit Condition	Credit Requirements
Occupancy	Mandatory	The credit is occupied by Greater sage-grouse.
Disturbance	Mandatory	Disturbance within 4 miles of the credit is <10.0% as measured by the DDCT process.
Disturbance	Reduction -0.25 credit discount	Disturbance is between 5.01% and 9.9% as measured by the DDCT process.
Durability	Discretionary	Credit has permanent protection.
Durability	Reduction .05 credit discount	The credit does not have permanent protection.
Durability	Mandatory	The credit exists for the life of the project.
Financial Assurances	Mandatory	Credits include the financial assurances, as appropriate, to guarantee the implementation and effectiveness of compensatory mitigation measures and to cover their administration, durability, monitoring, and reporting.
Habitat Enhancement	Discretionary	Proportionality of credits will be awarded based upon the amount of lift between the baseline condition and the ESP for optimal habitat for sage-grouse.
Habitat Restoration	Discretionary	Proportionality of credits will be awarded based upon the amount of lift between the zero habitat and the ESP for optimal habitat for sage-grouse after 3 years of data collection with a trend towards the ESP for optimal sage-grouse habitat.
Habitat Suitability	Mandatory	Habitat suitability is greater than 5% sagebrush cover.

Table 4 Continued Category	Credit Condition	Credit Requirements
Landscape Support	Mandatory	Greater sage-grouse using the credit will have access to all four seasonal habitats.
Risk Reduction	Mandatory	The credit includes the following: f. Credits must include a description of the outcomes of compensatory mitigation measures and the performance standards to be met for the duration of the credit life. Credit descriptions should include the types and amounts of resources that will be restored, established, enhanced, and/or preserved, and how these outcomes will address species' conservation needs at the landscape scale. g. Credits include a description of the baseline condition prior to disturbance and future disturbance threats affecting the compensatory mitigation credits (e.g., are there 4 seasonal habitats located within 4 miles, what are the existing thresholds, what is the potential for future development?). h. Credits include a description of the durability (i.e. offset for life of disturbance) of the compensatory mitigation measures and how the credit sites will be maintained. i. Credits include a description of the monitoring and reporting program that will be used to report on credit conditions and trends of resources at all relevant scales, to assess the effectiveness of compensatory mitigation measures, and to identify any need for adaptive management. j. Credits include a description of the triggers for adapting management, if necessary, in order to achieve the outcomes of the compensatory mitigation measures. h. Credits include a description of the implementation plan for the enhancement, restoration or funding of compensatory mitigation measure(s) that includes: 1. Specifications for implementing the compensatory mitigation measures (e.g., timing, method, source materials, specific geographic area, etc.). 2. The schedule and plan to maintain compensatory mitigation measures for the duration of the impacts. i. Credits include a description of the accounting process for tracking measures/funds/credits.

Table 5. Habitat Conditions

Habitat Type	Attribute	Indicator(s)		Desired Condition[1]
Breeding/ Nesting[2,3,4,5] (Use Period March 1-June 30; within 5.3 mi of occupied lek)	Lek Security	Proximity of trees[6]		Trees are absent or uncommon within 1.86 mi of lek[7,8]
		Proximity of sagebrush[6]		Protective sagebrush cover is within 330 ft of lek[7]
	Cover	Habitat extent[8] (% meeting desired condition)		>80%
		Sagebrush height[7]		
			Arid Sites[8,10]	4-18" in black sage; 12-32" in all others
			Mesic Sites[8,11]	12-32"
		Predominant sagebrush shape[7,12]		>50% in spreading shape[12]
		Sagebrush canopy cover[7,8,9]		5-25%
		Perennial grass canopy cover[7,8]		
			Arid Sites[7,8,10]	≥10%
			Mesic Sites[7,8,1a]	≥15%
		Perennial forb canopy cover[7,8,9]		
			Arid Sites[10]	≥5%[7,8]
			Mesic Sites[11]	≥10%[7,8]
		Perennial grass height[7,8,9]		Provide adequate overhead and lateral concealment

Table 5 Habitat Conditions Continued			
Habitat Type	**Attribute**	**Indicator(s)**	**Desired Condition[1]**
Brood-rearing/Summer[2] (Use period July 1-Nov. 30)	Cover	Habitat extent[8] (% meeting desired condition)	>40%
		Sagebrush canopy cover[7,8,9]	5-25%
		Sagebrush height[8,9]	4-18" in black sage; 12-32" in all others
		Adjacent sagebrush cover[7]	Within 328 feet
		Perennial grass canopy cover and forbs[8,9]	>15%
		Riparian Areas	Proper Functioning Condition[13]
	Food	Upland and perennial forb availability[7,8]	Preferred forbs are common with several preferred species present[14]
Winter[2] (Use period Dec.1-March 14)	Cover and Food	Habitat extent[7,8,9] (% meeting desired condition)	>80%
		Sagebrush canopy cover above snow[7,8,9]	>10%
		Sagebrush height above snow[7,8,9]	>10 inches[15]

[1] All Desired Conditions will be dependent upon site capability and local variation and should be determined through fine-scale assessment(s) of habitat.

[2] Dates may be shifted up to 14 days before or after dates listed but not both

[3] Doherty, K. 2008. *Sage-grouse and Energy Development: Integrating Science with Conservation Planning to Reduce Impacts.* University of Montana. Missoula, MT.

[4] Holloran and Anderson. 2005. *Spatial Distribution of Greater Sage-grouse nests in relatively contiguous sagebrush habitats.* Condor 107:742-752.

[5] Buffer distance may be changed only when 3 out of 5 years of data indicate 5.3 miles is inappropriate

[6] Baruch-Mordo, S., J.S. Evans, J.P. Severson, D.E. Naugle, J.D. Maestas, J.M. Kiesecker, M.J. Falkowski, C.A. Hagen, and K.P. Reese. 2013. *Saving sage-grouse from trees: A proactive solution to reducing a key threat to a candidate species.* Biological Conservation 167: 233-241.

[7] Stiver, S.J., E.T. Rinkes, D.E. Naugle, P.D. Makela, D.A. Nance, and J.W. Karl, eds., 2015. *Sage-Grouse Habitat Assessment Framework: A Multiscale Tool.* Technical Reference 6710-1. BLM and WAFWA, Denver, CO.

[8] Connelly, J., MA. Schroweder, A.R. Sands, and C.E. Braun. 2000. Guidelines to manage sage-grouse populations and their habitats. Wildlife Society Bulletin 28 (4): 967-985.

[9] Connelly, J., K. Reese, and M. Schroder. 2003. *Monitoring of Greater sage-grouse habitats and populations.* Station Bulletin 80, Contribution 979. University of Idaho, College of Natural Resources Experiment Station. Moscow, ID.

[10] <12" precipitation zones

[11] >12" precipitation zones

[12] Sagebrush plants with a spreading shape provide more protective cover than more treee or columnar shaped plants (Stiver et al. 2015)

[13] Other desired conditions for riparian areas/mesic meadows may be used so long as they meet sage-grouse habitat requirements

[14] Preferred forbs are listed in Appendix B of Stiver et al. 2015. Overall total forb cover may be greater than that of preferred forb cover.

[15] Height above snow will depends on variation in snow depth. The intent is to manage for sagebrush stands that are not severely hedged.