From: Norman, Kate
To: Alene Thomas; Craig Hansen; Dave Smith; Kevin Doherty; Mary Grim; Michael Fris; Michael Thabault; Nicole Alt; Noreen Walsh; Ren Lohoefener; Richard Hannan; Sarah Converse; Shirley Gillum; Steven Morey; Theresa Rabot
Subject: Re: GRSG 2015 - Process Framework (REVISED) added to Materials for 8/18/2014 VTC
Date: Friday, August 15, 2014 5:58:04 PM
Attachments: 20140812_draft ProcessAnalyticalFrmwrk_RL_NW.docx
20140815_v3_GeneticsWorkshop_Overview.docx
20140818_RDmtg_Agenda.docx
20140902_GRSG_ModelWrkshp_AgendaDRAFT.pdf
20140902_GRSG_ModelWrskhp_Invitation.pdf

Good Afternoon-

It was brought to my attention that access to SharePoint may limit participants' ability to access the documents for Monday.

Please find attached the following documents for Monday's meeting
(NOTE These are the same documents available on the SharePoint portal https //portal.doi.net/usfws/SG/docs/Forms/818.aspx)

- Agenda
- Genetics Expert Elicitation Overview (with list of potential invitees)
- Process Framework (revised)
- Model Workshop (Invitation and Draft Agenda)

My apologies for the late delivery of these documents.

Thank you,
K

On Fri, Aug 15, 2014 at 5:17 PM, Norman, Kate <kate_norman@fws.gov> wrote:

> Good Afternoon-
>
> Please note that a revised version of the Process Framework has been added to the SharePoint view for next week's VTC; a minor revision to the Expert Elicitation overview is also available here.
>
> LIBRARY VIEW
> https://portal.doi.net/usfws/SG/docs/Forms/818.aspx
>
> Thank you and have a pleasant weekend,
> K
> --
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Process Framework for the Greater Sage-Grouse 2015 Status Review

Introduction

In 2010, the U.S. Fish and Wildlife Service (Service) found that the greater sage-grouse warranted federal protection under the Endangered Species Act (ESA) but was precluded by higher priority actions. In 2013, following a legal settlement, which required the Service to complete status reviews for three greater sage-grouse populations, the Bi-State population of the greater sage-grouse was determined to be a valid Distinct Population Segment (DPS[1]) and was proposed for listing. The other populations of the greater sage-grouse, including the Columbia Basin population, will be evaluated by September, 2015.

Since the 2010 greater sage-grouse finding, considerable progress has been made to address the threats and provide additional information regarding the species. The Service will evaluate the best available scientific and commercial information to determine whether the species is in danger of extinction or is likely to become endangered in the foreseeable future throughout all or a significant portion of its range.

This document describes the Service's approach to the 2015 status review for the greater sage-grouse.

Guiding Principles

Our guiding principles for this evaluation include:

- Transparency
- Use of Best Available Science
- Accurate application of the ESA, its implementing regulations, and relevant policies
- Provide a clear rationale for our decision
- Effective communications with Federal, State, and Tribal partners
- Efficient use of Service capacity

Foundational Elements

The Service will rely on a number of foundational elements for our status assessment, primarily the language of the Endangered Species Act, its implementing regulations, and agency policy, as well as previous work and assessments of the species status:

Statutory, Legal, and Policy Considerations

[1] See Appendix 1 for Acronyms and Terms

- Definitions of threatened and endangered in Section 3 of the ESA:
  - Endangered is defined as: ADD STATUTORY DEFINITION
  - Threatened is defined as:
- Statutory basis for listing decisions in Section 4 of the ESA
- Legal and Policy Considerations
  - Significant Portion of the Range (SPR) Policy (ADD CITATION),
  - Solicitor's opinion regarding foreseeable future (ADD CITATION)
  - Distinct Population Segment (DPS) Policy (ADD CITATION)
  - Policy for the Evaluation of Conservation Efforts (PECE) when making listing decisions (ADD CITATION)
- Any other relevant policies or guidelines

Previous Work

- 2010 finding for the greater sage-grouse (ADD CITATION): The principle factors leading to the 2010 warranted but precluded finding were habitat loss and fragmentation, principally due to invasive species and fire, energy development and associated infrastructure, sagebrush conversion due agricultural practices, and a lack of adequate regulatory mechanisms to address those threats. These threats will be a focus of the analysis we will conduct for the species status review.
- Conservation Objectives Team (COT) report (ADD CITATION): The final COT report, a product of state and federal collaboration, outlined the key areas for conservation of the species, the key threats in those areas, and conservation objectives involving reduction of those threats. The COT report identified the most important areas needed for long-term persistence of the species, which were termed Priority Areas for Conservation (PACs). The COT report has served as the basis for our technical advice regarding current regulatory and voluntary planning efforts and will be a lens through which we analyze conservation measures during the status review.

As we conduct our review, the Service will apply the statute, regulations, and appropriate policies in the context of previous decisions for sage-grouse and similarly affected species and will explain meaningful differences based on species, threat impacts, or scale. We anticipate using a structured analytical framework and process to assess the scientific, commercial and legal information we must consider when making a listing decision.

Outline of Analytical Framework

The following outlines factors the Service must consider and the process the Service intends to follow in its analysis:

1. **Structured Decision Making**

   The Service will use the principles of structured decision making to ensure the methods we use to make decisions are clear to outside interests. We will use experts to help us with structured decision making, modeling, and statistical analyses.

2. **Key Policy Questions to be Answered Through Our Analysis**

   a. What is foreseeable in terms of threats to the greater sage grouse and how is that probability defined?

   b. How certain are we that conservation actions will be funded, implemented, and effective in the future?

   c. If federal protection for the greater sage grouse is not warranted for the species as a whole (i.e., if it is not threatened or endangered within all or a significant portion of its range), then do distinct population segments exist and if so, do they need federal protection?

3. **Status and Trend**

   A foundational element of our analysis is a current understanding of the status of the species, against which we will evaluate the impacts of threats and beneficial actions. We will work with the States and other partners to gather the most recent information to understand the current status and trend of the species at various spatial scales, including rangewide. We will compare that updated information with the information used in our 2010 finding.

4. **New Scientific Information**

   The Service will assess all of the best available scientific and commercial information about the greater sage-grouse, the species habitat needs, and potential impacts. We will address any new information and explain how our understanding of available scientific information may or may not have changed since the 2010 finding.

5. **Geographic Scale of Our Analysis**

   The greater sage-grouse's expansive range makes the evaluation of population, habitat, threats, and conservation efforts in a geospatial context a preferred option for assessing information. We will conduct all spatial analyses to predict indices of distribution and relative abundance of sage-grouse where possible.

   a. Our base spatial level of analysis is the PACs; our analyses will be scale-able up to populations, other potential areas of interest, and the remainder of the range.
   b. We anticipate identifying a number of variables that measure PAC integrity such as:

a. Percent area and percent population within a PAC not at risk
b. Relative contribution of each PAC to the total population. This analysis will provide an analysis of population importance weighed against magnitude of threats.

c. Using the PACs as a basis the Service will scale to the remainder of the range, population and potential areas of interest levels, and will focus on those threats identified in the COT as relevant to that population.

6. Assessing Threats

We will assess the degree to which the major threats of habitat loss and fragmentation and inadequacy of regulatory mechanisms have been addressed since 2010. We will also evaluate any new threats to the species. We will evaluate the threats according to the following major categories.

A. Present or threatened destruction, modification, or curtailment of habitat or range
- Fire
  - Prevention
  - Curtailment
  - Restoration
- Invasive Species
  - Cheatgrass
  - Conifers
  - Other
- Non-renewable energy habitat loss and fragmentation
- Renewable energy habitat loss and fragmentation
- Conversion to agriculture
- Losses to human infrastructure

B. Overuse

C. Disease or Predation
- West Nile Virus

D. Inadequacy of existing regulatory mechanisms
- Federal Agency Plans
- State Plans
- Other Conservation Efforts

E. Other factors
- Climate Change
- Human Population Change

For each of the major threats identified from 2010 and any significant new threats identified we will assess their impacts to both relative abundance and distribution of sage-grouse at multiple spatial scales. See Section 8 below for further discussion of analytical tools and approaches we will use.

Assessing Conservation Mechanisms to Reduce Threats

Just as we will attempt to quantify threats and predict their impacts, we will also attempt to quantify the degree to which state and federal plans, local conservation efforts, and other conservation efforts have already ameliorated threats to greater sage-grouse or are likely to do so into the future. We will seek to understand how state and federal plans, local conservation efforts, and other conservation efforts put in place since 2010 have removed or reduced impacts from threats, particularly within PACs.

Conservation efforts described in the regulatory mechanisms of recently revised or amended Federal Land Management Plans will be evaluated based upon their likelihood of effectiveness in ameliorating known threats to greater sage-grouse. Efforts that target high-priority threats will receive greater analysis; efforts that target more localized or minor threats may not be analyzed in as great detail. This analysis will be cross-walked with comments on the record from the Service to the federal land management agencies to clarify and explain any differences.

Other conservation actions will be assessed. Where appropriate, the Service's Policy for Evaluation of Conservation Efforts (PECE; ADD CITATION) will be used to assess actions that may be relied on in the listing decision.

Methods of analysis for conservation mechanisms that reduce threats will vary depending on degree of clarity within the scientific, peer reviewed literature, strength of models in our SEM, and certainty of impacts or lack of certainty in the Service's judgment. Analyses could range from modeling efforts, to expert opinion and Service's professional judgment. See Section 8 below for further discussion of analytical tools and approaches we will use.

7. Use of Analytical Tools to Assess the Future for Greater Sage-grouse based on both Threats and Conservation Actions

Impacts of threats and regulatory and voluntary conservation actions will be forecast using an analytical framework to assess percent of populations or degree of habitat persisting over time by comparing current with future situation. Since the species is not evenly distributed across the landscape, we do not believe that bird numbers or habitat acres in and of themselves are the appropriate predictors of the overall species status and its likely persistence into the future.

The Service anticipates deploying a number of analytical methods (see Appendices 2 and 3) including:

a. Running different scenarios through our analytical SEM framework. For a complete description of the modeling framework, please see the Modeling Framework.
b. Using USGS facilitators to employ modeling techniques such as Bayesian belief networks to increase transparency and help produce defensible decisions.
c. Using expert elicitation with outside parties to solicit input about the degree to which the threat will be relevant and impact sage-grouse into the future. Expert elicitation could also be used to inform both the SEM and Bayesian belief network models.
d. Using peer-reviewed quantitative spatial models that incorporate stated assumptions, knowledge of existing threat reduction measures, a range of potential input values, and all best available science (likely approach for fire risk, invasive grass risk, conifer encroachment, energy development risk, conversion to tilled agriculture risk).
    - The exact metric for such quantitative spatial models has yet to be developed but examples might be percent of populations persisting over time or percent distribution or possibly some index of habitat fragmentation into the future.

The spatially explicit modelling will focus on current and future changes to threats and conservation actions, using the COT spatial geography (i.e. PACs) and population data to project various outcomes, as measured by abundance and distribution.

The spatial analyses in 2010 ran one scenario, assuming 100 percent impact of occupied habitat. The new analysis will likely include multiple scenarios and may be at a finer scale. This finer scale may allow us to analyze changes at population levels or management zones.

Comment [WN1]: What does this mean?

The Service anticipates that SEMs, expert elicitation and internal decision analysis will require the highest level of effort and will be used on those threats that have been identified as the most important drivers for the conservation of the species (long-term persistence). These, at a minimum, include;

- Invasive species and fire, independently and in concert;
- Energy development and associated infrastructure (including oil, gas, and extractable minerals); and
- Habitat conversion due to tilled agriculture.

This will allow the Service to assess the level of risk to the highest concentrations of birds in the most important landscapes and begin placing anticipated biological outcomes into the context of the policy framework relative to the definitions of threatened and endangered. The remaining threats from the COT report, 2010 finding, and other information collected will be evaluated and considered across the remainder of the range, populations, PACs and individuals within the

species report. Areas of interest are areas where threats may be concentrated, populations may have limited connectivity to neighboring populations, or the value of the birds in that area may be exceptionally high as it relates to the rest of the range.

8. Status Determination

The ultimate evaluation of listing status (i.e., warranted for listing or not) will be informed in large part by:

a. Current status and trend of the species in the rest of the range, and
b. The degree to which we predict the species, populations and PACs will persist, with the greatest weight in our evaluation being given to those areas with the highest densities of birds.

Comment [WU2]: Already said

Given the number of threats and the uncertainty around those threats as they are likely to persist or increase into the future, as well as the evaluation of regulatory and non-regulatory conservation actions, we anticipate a wide range of modeling outcomes of abundance and distribution. These various outcomes, along with the qualitative evaluation of other threats and conservation actions, will be the basis of one or more structured discussions (Appendix 4) regarding the reasonableness of our assumptions, risk to the species, exposure to threats, how far into the future that our predictions are reliable, the likelihood of the species persistence and the degree of persistence into the future.

The various outcomes from our structured prediction processes, along with the qualitative evaluation of other threats and conservation actions, will be the basis of a structured workshop for FWS personnel during which we will present, evaluate, analyze, and discuss the best available scientific and commercial information. We will evaluate whether the species is threatened or endangered within all or a significant portion of its range, leading to a recommendation we will make to the Director of the Service as to whether the greater sage-grouse meets the definition of threatened or endangered.

If the greater sage-grouse excluding the separately addressed Bi-state DPS does not warrant listing, the Service may evaluate other potential DPSs. If so, we would determine discreteness and significance of any population segments considered, and if these two criteria are met, then we will evaluate the degree of threats and the likely effects of these threats now and into the future.

Literature Cited

Appendix 1: Acronyms and Terms

Term	Definition
DPS	Distinct Population Segment
PAC	Priority Area for Conservation
SEM	Spatially Explicit Model
SPR	Significant Portion of the Range
COT	Conservation Objectives Team

Appendix 2: Modeling Framework for Greater Sage-Grouse 2015 Status Review

Modeling in this framework refers to any way of structuring our thoughts about the greater sage-grouse to help us better understand the species' status and its potential status in the future. This will include complex analytical models, more simplistic spatial evaluation, and qualitative assessments. The purpose of this modeling framework is to: (1) identify general model outputs that could inform the Service's status review of the greater sage-grouse; (2) provide a framework for identifying existing modeling efforts and filling gaps between existing efforts and the outputs that would be helpful for our status review; (3) provide a framework synthesizing information from multiple modeling efforts; and (4) provide a method for assessing information that will not be included in the robust modeling efforts, but which may benefit from less intensive spatial assessments or qualitative review.

Identifying Model Outputs

Predictive model(s) can be helpful in projecting a species' persistence through time. Specific model outputs that we have identified as proxies for persistence that would be helpful in assessing the status of the greater sage-grouse include:

- Abundance or relative abundance
- Distribution or site occupancy; and
- Population trend or λ

Ideally, these model outputs would be available for several future scenarios that encompass the range of uncertainty in threats and would be scalable to populations, any potential DPSs, and across the species range. Factors that affect long-term persistence, including stressors and habitat conditions, will be inputs to the predictive models. We will use predictive models to serve as explicit expressions of available scientific information and knowledge on the linkages between probability of long-term persistence and factors that can affect persistence. These models will also fully represent any assumptions made as well as the uncertainty in predictions.

Existing Models and Gaps in Modeling Efforts

We propose evaluating existing models and potential results to assess their utility to our species status assessment. We have identified several relevant and ongoing research projects that are using models to assess how threats affect sage-grouse, including relevant outputs (Table 1). The Service, in conjunction with other state and federal partners, is leading one of these efforts, while others are led by independent groups including USGS, The Nature Conservancy, and WAFWA. We expect that by examining all relevant ongoing efforts we'll have a more complete picture of the level of uncertainty around model predictions which can be presented to decision makers. We suggest it would be far better to proactively incorporate and synthesize multiple independent model predictions than react to results that would otherwise appear to be unaccounted for in the status review. We have already reached out to the lead researchers (Table 1) about the possibility of including their research in help inform the FWS modeling framework for the Service's status review.

To better understand existing modeling efforts, identify gaps in modeling efforts, and strategize on how to fill these gaps, we currently plan to will convene a meeting (Modeling Workshop 1) of the greater sage-grouse researchers who are conducting modeling efforts relevant to the status review (Table 1). Other anticipated participants are the best available scientific experts that may include: members of the WAFWA sage-grouse technical committee and technical sage-grouse leads for the Service. Our goal for Modeling Workshop 1 is to define the ensemble of models that are consistent with Service needs and have a high likelihood of being completed in time. To accomplish this we will:

- Have a robust discussion with experts and review existing modeling approaches that are listed in Table 1. The Service will use these individual responses to:
    - Evaluate rationale and approach for modeling of greater sage-grouse to inform a status review under the ESA.
    - Evaluate precision and accuracy of data sources and information used in the model, including the effects of data sources, assumptions, and information strengths and weaknesses on outputs.
    - Evaluate strengths and limitations of the modeling methods including effect of assumption violation on outputs.
- The Service will ensure results are consistent with Service needs, by evaluating one or more of the following:
    - Can the modeling effort be completed within the time allowed for the status review?
    - Does the modeling address at least one of the major threats to sage-grouse identified by previous analyses (e.g., the COT Report) at the scale of the threat (e.g. Great Basin-wide analyses for fire)?
    - Does the modeling quantify the impact of one of the major identified threats on sage-grouse abundance, distribution, or population growth (or their proxy measures) AND can it be scaled to potential listable entities?
    - Does the modeling predict out to the foreseeable future, which will be defined by the Service.
    - Does the modeling integrate relevant uncertainty and explicitly state assumptions?

Synthesizing Model Results

We intend to hold a second meeting of independent greater sage-grouse researchers so the Service can review Individual research groups' modeling efforts (Table 1). The Service will attempt to engage the best available scientific experts including members of the WAFWA sage-grouse technical committee and the technical sage-grouse leads for the Service. The FWS is not seeking consensus at this meeting. Our goal for Modeling Workshop 2 is for the Service to develop a summary of results based on individual responses from workshop participants to inform the status review. To accomplish this we will:

- Present and review results from various independent modeling efforts. This workshop will allow the USFWS to directly communicate with lead research so we understand their individual interpretation of their research. The service will ask questions about the strength and reliability of their results and reasons for congruence and lack of congruence between model outputs.

- The Service will use results to characterize expectations and uncertainty in long-term persistence of sage grouse.

After the second workshop, the Service will have reviewed the ensemble of models and their outputs, which will provide multiple predictions of current condition and projected status of abundance, distribution, or population growth (or their proxy measures) based upon the main threats to sage-grouse populations. The Service will then be able to develop a summary that quantifies uncertainty based upon results of the models to present to the ARD's and RD's.

If a major threat is not covered by an existing modeling effort that meets criteria for being relevant to the status review, then expert elicitation could be used to help assess the risk to sage grouse from that threat. The approach would be for the Service to develop a conceptual model for how threats relates to sage grouse and then elicit information from the expert panel to quantify the both the expectation and variability in that relationship.

- The likelihood of future scenarios can be elicited from the individual experts on the panel and then used by the Service to evaluate the expectation and variability in future status across the range of scenarios.
- The effectiveness of a conservation action in the conservation effects database can be elicited, if effectiveness has high uncertainty or may be unknown (e.g. miles of linear fire breaks within a PAC).

The positive effect of conservation actions, including conservation plans that have regulatory certainty, will need to be evaluated when we synthesize model results. We expect expert elicitation will be required to quantify the effects of conservation efforts and that this will be a significant workload. There are a number of methods for incorporating this type of information together with model results (e.g., Bayesian Networks – see Table 1) and we intend to weigh the pros and cons of these various methods at our first modeling workshop.

Table 1: Current ensembles of research projects which are relevant to the USFWS status assessment because they are large scale, threat based and generate outputs that include the measures of long-term persistence, which the Service has identified as relevant to the status review. All analyses below are consistent across the range or the scale of a threat (i.e. cropland conversion MZ1 and Washington), but can be queried at the population scale. This is important because it will allow consistent comparisons of risk across populations as opposed to ad hoc population by population analyses.

Modeling approaches	Types and references	USFWS Listing Metric Addressed
Population Modeling	1. Integrated population model (Coates et al., USGS. This work was pioneered for the Bi-State Sage-grouse Population). 2. Hierarchical Dynamic Occupancy Model (The Nature Conservancy). The input data will be lek data which they have already obtained from the states. Risks modeled will be: cropland conversion, conifer encroachment, oil & gas development, invasive and wildfire. It will require a contract with TNC to ensure work is completed within the USFWS timelines.	1. *Population growth rate* (λ). This analysis will be projected spatially across a landscape and should be able to assimilate many threats. 2. *Probability of occupancy* for each lek into the future based upon risk of main threats. This can then be turned into a future distribution map. The future Species Distribution map(s) can then be linked to our Species Distribution Models to ascertain the relative % of population impacted by each threat.
Spatially Explicit Relative Abundance Modeling & Connectivity Modeling	1. Machine learning methods, such as, Random Forests and Maximum Entropy (Doherty et al working with input from WAFWA tech committee). 2. Connectivity Analyses & Multivariate statistics (USGS Knick et al. 2013)	1. This will create a spatially explicitly population model of the *current distribution & relative abundance* of sage-grouse across their range. 2. *Connectivity* of Sage-grouse populations. The overall importance of this analysis will likely depend on the genetics expert workshop. The multivariate analyses underway could also help inform how risks could affect the *distribution* of sage-grouse.
Spatially Explicit Risk models	Spatially explicit risk models (below) may be linked by juxtaposition to the models listed above via GIS, or they could be used as model inputs to predict grouse relative abundance, distribution, or population trend. 1. Fire Risk & Resiliency- WAFWA Expert Group 2. Cropland Risk (TNC Evans et al.) MZI & Land Capability Class in Washington. 3. Conifer Risk (Funded through SGI; U Michigan study). 4. Energy Development Risk (Julliusson et al Sage Grouse Energy Team, following methods of Copeland et al).).	1. Impacts to *relative abundance & distribution* will be assessed by working with various research groups (1 - 4). The Service will use our sage-grouse species distribution model to translate risk models to population level impacts of sage-grouse and have already reached out to the various research groups (1 - 4). 2. How other research groups are modeling risk will be determined and discussed in the first modeling workshop.

Modeling approaches	Types and references	USFWS Listing Metric Addressed
Statistical Population Reconstruction	1. Updating the 2007 WAFWA trend analyses (Runge et al)) 2. TNC- trend analyses (working in collaboration with statistician) Projects below are not currently underway at a meaningful scale, however they are identified because they were a large part of the last decision (3) or another potential role for the states to participate in data processing (4). 3. Garton et al. (2011) updated? 4. Using Harvest Data to generate population estimates.	1. *Population Trajectory* 2. *Population Trajectory* OR *probability of persistence*. This group is assessing the validity of using linear trend methods on populations that clearly cycle (i.e. Fedy and Doherty 2011). 3. *Probability of Persistence.* This analysis was a big part of the 2010 assessment, but has been contentious. 4. *Abundance Estimate*. The methodology has been used extensively in Fisheries. Recent examples exist for both sage-grouse (Hagen et al.) and Columbian Sharp tail grouse (Gifford et al.).
Bayesian Networks	1. Armstrup et al. (2008). Bayesian Networks are an alternative way to integrate information from both quantitative and qualitative sources.	1. Will already expect that methods like these may be needed to understand the conservation database and regulatory certainty. 2. Allows one to assess multiple scenarios, incorporate uncertainty, quantitative models, and expert elicitation in a single framework. Can also test model sensitivity to various assumptions.

Appendix 3: Other Threats to Sage-grouse Populations, Conservation Efforts Database, and Conservation Plans: A Simple Geospatial Assessment

Addressing Conservation Efforts Intended to Ameliorate Major Threats:

The positive effect of conservation efforts, including recent and anticipated actions described in conservation plans, will need to be incorporated within the larger modeling framework. Unfortunately, in most cases there is more scientific literature establishing impacts to sage-grouse populations than demonstrating how the proactive measures will effectively alleviate or address the threat. We therefore expect expert elicitation may be required to quantify the effectiveness for certain conservation efforts. We also expect that the relationship between some conservation actions and sage-grouse will be discrete and straightforward (e.g., conservation easement will prevent conversion of sagebrush to cropland). Conservation efforts will be evaluated as they relate to alleviating threats to greater sage-grouse. Further, assessing these efforts will need to be done by relating them to greater sage-grouse abundance, distribution, or population growth (or their proxy measures). In this way, the impact of conservation actions can be effectively incorporated into the modeling framework. We expect that assessing the effects of conservation efforts should involve the BLM NOC office when evaluating BLM land use plans.

Addressing Conservation Efforts Directed at Lesser and Localized Threats:

We recognize the importance of utilizing robust models for understanding potential impacts to sage-grouse abundance, distribution, and population trends related to driving threats (e.g. oil and gas development and associated infrastructure, invasives and wildfire, cropland conversion, and conifer encroachment). Beyond the primary threats, we recognize that there are secondary or more localized threats and associated impacts, which may be reduced through conservation efforts reported in the Conservation Efforts Database (CED). Analysis of the baseline extent of these lesser threats will help us to better understand the level at which each threat has been reduced.

The Service recognizes the potential limited availability of spatial information that clearly illustrates threats consistently range-wide or minimally region-wide (for threats that may exist regionally). Therefore, we are proposing a simplified analysis to capture the current 'exposure to risk' (risk of exposure of greater sage-grouse to the potential threat) as well as the potential risk in the foreseeable future, and to identify where conservation actions have taken place (or will take place) to address the threats to the species.

We propose to illustrate existing areas of habitat loss and degradation related to oil and gas, mining, infrastructure (including roads, power lines, wind turbines, and other vertical structures), and lastly urban development. In addition to identifying areas of existing disturbance and degradation, we propose to illustrate areas of resource potential (for minerals, wind, solar, etc.) from existing sources. Then, we could overlay spatial data associated with regulatory mechanisms (land use allocations/decisions) and on-the-ground conservation actions, regulatory and non-regulatory, to spatially identify and quantify areas of overlap through an area of intersect analysis. The supplemental information provided in the CED, as well as information related to the likelihood of implementation and

effectiveness (self-reported by users of the CED) would assist in identifying the relative value of the efforts. The Service may not rely solely upon this information, but will include it in the overall assessment. Where applicable, expert elicitation could also provide information to reduce uncertainty in outputs from these simplified analyses.

Remaining Threats

The remaining threats which are difficult to quantify or are likely to be localized will be evaluated qualitatively through the species report. They include:

- Recreation (captured through roads and trails designated for recreation AND/OR through area's open/closed for recreation on state or federal lands)
- Sagebrush Elimination (While the most important, this is more of a combination of other factors/threats).
- Grazing
- Wild Equids
- Small and Isolated population

The species report will collectively provide a summary of all the evaluations related to threats and conservation actions.

Appendix 4: Role of Structured Decision-Making in the greater sage-grouse 2015 status determination

Provided by U.S. Geological Survey

Introduction

Structured decision making (SDM) is applicable to decisions made challenging by high scientific uncertainty and differences of opinion[2]. Structured decision making relies on the recognition that *every* decision has a common set of components. Anyone who makes any type of decision confronts each of these components, either implicitly or explicitly:

1. Problem definition – what is the decision that is to be made?
2. Objectives – what do we want to achieve by making this decision? What are our values relevant to this decision?
3. Alternatives – what are the different options open to us?
4. Consequences (also known as predictive modeling) – what do we predict will occur in the future, e.g., what will be the likely outlook for the species?
5. Trade-offs – how do we evaluate choices among the alternatives, given our predicted consequences? What is the best solution to our decision problem?

Structured decision making allows deliberation on each component, thereby separating policy (risk tolerance) from science (risk profile), bringing the components together to provide risk analyses for the decision-maker. Structured decision-making is value-focused; identification of objectives comes first and drives the rest of the decision analysis. By using SDM, decisions are (1) logical, thorough, deal with uncertainty and therefore more likely to achieve identified objectives, and (2) transparent, explicit, easy to document, and therefore more likely to be understood by others.

Application of SDM to greater sage-grouse status determination

U.S. Geological Survey (USGS) has been requested to provide technical assistance to the U.S. Fish and Wildlife Service (Service) on the application of SDM to the greater sage-grouse status review. As part of this effort, an initial workshop was held in Lakewood CO in April 2014, during which the participants (core team) worked to define the decision problem, specify the objectives and identify the alternatives. A workshop will be held to support the Modeling Framework (i.e., the consequence component of SDM) by helping to facilitate model development, expert elicitation and synthesis of relevant uncertainty and predictions. At the final workshop, decision-makers will review potential outcomes (sage-grouse risk forecasts), evaluate risk, and apply policy to arrive at a status determination.

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[2] Gregory, R., J. Arvai, and L. R. Gerber. 2013. Structuring decisions for managing threatened and endangered species in a changing climate. Conservation Biology **27**(6): 1212-1221

The SDM workshops, which have occurred or are proposed, are summarized below. The workshop descriptions place elements of the Process Framework and Modeling Framework~~s~~ (Appendix 2~~separate documents~~) into the structure provided by SDM.

Initial SDM workshop to discuss problem definition, objectives, and alternatives:

Problem definition:

As stated in the Process Framework, "The Service will evaluate the best available information to determine if the remainder of the range or other DPSs (including the Columbia Basin) warrant listing and, if so, whether the entity (remainder of the range or other DPSs) is in danger of extinction throughout all or a significant portion of its range or likely to become endangered in the foreseeable future throughout all or a significant portion of its range." Further, the Service will "use the best available information to evaluate current species trends, threats (as identified in the 2010 finding and Conservation Objectives Team report), habitat changes, regulatory changes, and implementation of conservation actions. The Service will also use this information to predict threats and habitat changes into the future and evaluate the likely species' response." The *evaluation or status review* will be completed by April 2015 in order to inform listing determinations due in September 2015. Particular challenges of this decision identified by the core team include the limited time available for analyses, the staffing needed to complete products, limits to the availability of information or data and the confounding effect of scientific uncertainties and uncertainties about conservation effectiveness and implementation.

Comment [WN3]: Match to language in body of Process Framework doc

Objectives:

The *fundamental objective* for this decision problem is to ensure long-term persistence of greater sage-grouse consistent with the Endangered Species Act (ESA). "Long-term" will be defined within the context of "foreseeable future" by taking into account the biology of the species and our inability to predict threats with certainty. Proxy measures for long-term persistence, including abundance, distribution, and trend or related measures of relative abundance and site occupancy, will be used for the purpose of predicting likely species response to future threats and habitat change. To be relevant to the status review, predictive modeling outputs should include, at a minimum, one or more of these proxy measures for species' persistence. *Means objectives* are identified to ensure long-term persistence of greater sage grouse are 1) conserving and restoring healthy sagebrush shrub and native perennial grass and forb communities, and 2) reducing threats to long-term persistence.

In addition, *process and strategic objectives* (referred to as "Guiding Principles" in the Process Framework) include transparency, the use of the best available science; legal defensibility; articulation of a clear rationale for decision-making; effective communications with federal, state, and Tribal partners; and efficient use of Service capacity.

Alternatives:

The Service will determine if the status of the remainder of the range or other DPSs (including Columbia Basin) is endangered, threatened, or not warranted as defined by the ESA and informed by the status review.

Workshops to support the Modeling Framework and discuss consequence:

Consequences (predictive modeling):

The Modeling Framework describes the process of developing, conducting, and synthesizing the appropriate evaluations likely species' response to future threats and habitat change. Understanding the future outlook for the species under the status quo (i.e., if the species is not protected by the ESA) will guide, under the law, a determination of whether it is necessary to list the species. Therefore, the analyses will assess status and trends, assess whether new scientific information available since the 2010 "warranted" finding changes the analyses, and determine whether new threats have emerged and assess their likely impact. The output for the appropriate analyses will be species' response (i.e., the proxies for long-term persistence as described in the Modeling Framework) and inputs will be the factors that significantly affect species' response, including threats, conservation efforts, and habitat conditions. The base spatial scale will be the Priority Areas of Conservation (PACs) and analyses will be scaled up to populations, Potential Areas of Interest, and remainder of the range. Species' response to change in major threats (as identified in the 2010 finding) will require a more detailed analysis than for response to other lesser threats. Methods to analyze effects of conservation actions will vary depending on level of specificity within the scientific, peer-reviewed literature, strength of predictive models, and certainty of impacts (or lack thereof) in the Service's judgment. Formal and established methods for expert elicitation will be used when empirical information needed for the analyses is not available[3]. The analyses will reflect the uncertainty in species' response, including the likely species' response under different scenarios of future threats. Given the number of threats and the uncertainty

[3] Examples of when expert elicitation might be relied upon during the status review:

- If a major threat is not covered by an existing modeling effort that meets criteria for being relevant to the status review, then expert elicitation could be relied upon to assess the risk to sage grouse from that threat. The approach would be to develop a conceptual model for how the threat or threats relate(s) to sage-grouse and then elicit information to both the expectation and variability in that relationship.
- The likelihood of future scenarios can be predicted and then that prediction used to evaluate the expectation and variability in future status across the range of scenarios.
- Shouldn't this say that "opinions about the effectiveness can be elicited?" The effectiveness of a conservation action in the conservation effects database can be elicited, if data on effectiveness is not available.

around those threats into the future, as well as the evaluation of regulatory and non-regulatory conservation actions, a range of species' responses will be estimated.

Final Service workshop to discuss status determination:

Evaluation:

The synthesis of the various outcomes from the predictive analyses, along with additional qualitative evaluations of threats and conservation efforts, will be presented and discussed by Service personnel at the final workshop. USGS personnel will assist with facilitation of this workshop. Broadly speaking, the synthesis of the analyses based on best available information will provide the Service with the *risk profile* for species extinction. (The risk profile, as indicated above, will include a range of predicted species' responses.) The Service reflects the values of society at large, as expressed through the ESA legislation, the ESA regulations and policies, and relevant court decisions. These legal requirements and policy considerations establish formal guidelines through which the science and evaluation will be viewed and will then apply to the analysis-based risk profile to make the status determination. Techniques will be employed that have been developed to understand risk tolerance and reach consensus among the decision-makers. Application of appropriate policies regarding reasonableness and certainty will provide a transparent distinction between the appropriate roles of science (risk profile) and legal requirements and policy (risk tolerance) in the status determination.

(b) (5) [redacted] (b) (5)

Framework for Eliciting Expert Input on Genetic Data to Evaluate Potential Conservation Units for the Greater Sage-grouse

Comment [Craig1]:
We highlighted sections in yellow , with corresponding explanatory text bubbles labeled **DECISION QUESTION:** that require decisions from the decision-makers.

Purpose

This document provides questions and lists of potential participants for a Service-organized, expert elicitation workshop focused on the genetics of the greater sage-grouse (sage-grouse). This document also describes the approach, processes, and schedule we recommend using for this expert elicitation workshop. Service decision-makers (the Regional Directors) can use this document to:

1. Select the scientific experts to invite to the workshop; and
2. Refine and finalize the questions to ask experts during the workshop regarding the significance of any genetic differences between populations or potential conservation units.

Genetic differences exist among individuals and populations across the range of the greater sage-grouse; however the degree to which these genetic differences create distinct or markedly isolated conservation units is largely unclear. Additionally, the techniques and metrics used to analyze genetic isolation or divergence may have changed or improved since previous studies were published in 2005. Therefore, this workshop will investigate questions about potential patterns in and impediments to gene flow across the species' range, and about the magnitude and source of such impediments, or potential barriers to gene flow. Consequently, the workshop will also help the Service identify potential conservation units within the range of the sage-grouse. Examining these questions with an expert panel will help inform the Service's status review and could be used during an evaluation by the Service under the Distinct Population Segment (DPS) policy.

Approach:

This expert elicitation workshop will bring together a diverse body of scientific experts to share and discuss their individual opinions regarding genetics, conservation genetics, and the Greater sage-grouse. Facilitators from the USGS will query each expert for their professional judgment on topics relevant to the Service's status review. The elicitation will involve facilitated discussion and formal elicitation on specific technical questions[1]. The Service is not seeking consensus from this workshop. The workshop will obtain facts and information, and if needed, advice and opinion from each individual expert. Information will be discussed and exchanged, and individual opinions informed by professional judgment will be discussed and compiled. Participants will be expected to follow standard norms of behavior, which the facilitators will present at least one week before the workshop by webinar and again at the start of the workshop.

[1] Drescher, M., A. H. Perera, C. J. Johnson, L. J. Buse, C. A. Drew, and M. A. Burgman. 2013. Toward rigorous use of expert knowledge in ecological research. Ecoshpere 4:Article 83. http://dx.doi.org/10.1890/ES12-00415.1

Criteria for Identification of Experts and Selection of Participants:

We provide the following criteria to assist selecting scientific experts to participate in the workshop. These criteria will help ensure that invitations to participate are made only to scientific experts familiar with the topic and that the selections are transparent, unbiased, and capture a broad diversity of expertise and opinions related to the topic. The questions may also help filter any potential conflicts of interest. When selecting potential participants to invite to the workshop, consideration will be given to ensuring that the group will represent the diversity of expert judgment on greater sage-grouse genetics within the scientific community and will able to participate in group discussions effectively.

These criteria ensure that participants are scientific experts.

Potential participants must meet all of the following criteria 1-3:

1. Participant holds a graduate degree in wildlife biology, zoology, genetics, or a related field.
2. Participant holds a research position in government, academia, or in the nonprofit research sector; or participant holds a governmental management agency position with responsibility for sage-grouse.
3. Participant has expertise in wildlife genetics or ecology of sage-grouse or lekking grouse species, demonstrated by recent (within the past 10 years) peer-reviewed publications and related types of professional scientific expression.
    - The science and techniques of genetics have advanced rapidly within the last decade, so we define recent as the past 10 years to ensure that participants are qualified and proficient in the latest genetic research and applications.

These criteria ensure that participants are experts familiar with the workshop topic.

Each participant must meet one or more of the following criteria 4-6:

4. Participant is directly engaged in analysis of connectivity of sage-grouse populations or sage grouse habitat.
5. Participant is directly engaged in the study of sage-grouse population genetic structure.
6. Participant is a government or academic research scientist with expertise in conservation, population or landscape genetics, demonstrated by recent (within the past 10 years) peer-reviewed publications and related types of professional scientific expression.

These criteria ensure that the group of invited participants represent the diversity of expert judgment within the scientific community.

Consistent with best practices for an effective expert elicitation workshop, we recommend selecting 9 or fewer participants. The basis for selection would be to ensure diverse and representative scientific judgment. We recommend expert selection be structured by stratifying on affiliation type (academia, government, NGO), specialty (population genetics, conservation or landscape genetics, evolutionary genetics), and taxa experience (GSG, related species, non-GSG). Then select participants to represent each strata.

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Comment [Craig2]: DECISION QUESTION: Who do we invite?

Tables of Potential Participants

Using the above criteria, we prepared the following table of potential workshop participants.

The list categories experts as:

- GREATER SAGE-GROUSE EXPERTS;
- RELATED SPECIES EXPERTS; and
- NON-GRSG EXPERTS IN CONSERVATION GENETICS.

In the table, red and yellow highlights identify experts who the team believes constitutes a group that would effectively provide information and represents a diversity of expert opinion on greater sage-grouse genetics or conservation genetics within the scientific community.

- **Experts Highlighted in Red** = Due to their specialized expertise on greater sage-grouse genetics and published body of literature relevant to the workshop topic, these are the highest priority experts that we recommend inviting to the workshop.

- **Experts Highlighted in Yellow** = These experts represent a diversity of specialties, affiliations, and taxa experience, so are high priority experts that we recommend inviting to the workshop. If these experts are not available, other listed experts within the same category could serve as alternates.

Upon selection, all experts will be vetted for any conflicts of interest. Additional information related to recent publications is available here: https://portal.doi.net/usfws/SG/docs/20140812_GRSG_EE_Genetics_Experts_DRAFT_v4_CMH.docx

Name (bio)	Organization / Affiliation	Location	Specialty / Expertise	Meets Criteria	Notes
GREATER SAGE-GROUSE EXPERTS					
Sarah Oyler-McCance (Link)	USGS	Fort Collins, Colorado	• Greater sage-grouse conservation genetics and connectivity	1-6	Indispensable, leading expert on GRSG landscape genetics. Completed most of the work on the majority of the range. Additional work on Gunnison's SG. Local, USGS. High degree of interest in staying involved. Level headed and objective. Rely heavily on paper that is used in the DPS framework.
Krissy Bird (Bush) (Link)	University of Alberta	Alberta, Canada	• Genetic Diversity Analysis of Sage-Grouse	1-3, 5, 6	
Brad Fedy (Link)	University of Waterloo	ON, Canada	• Genetics, connectivity, & habitat quality	1-3, 4, 6	Upcoming research that may be influential in the future. To the amount that he can provide

Name (bio)	Organization / Affiliation	Location	Specialty / Expertise	Meets Criteria	Notes
					updates or insight into the new information, could be useful.
Steve Knick (Link)	USGS	Boise, ID	• Expert in sagebrush ecology	1-3, 4, 6	Useful, not a geneticist. Ability to explain and interpret genetics at a landscape level, and a truly science oriented professional. May need for other expert panels.
Tom Quinn (Link)	University of Denver	Denver, Colorado	• Evolutionary genetics • Patterns and rates of change of DNA sequence in birds	1-3, 5, 6	Shared a lab with Dr. Oyler-McCance. Lots of experience, but we don't know much more about him. Unsure of recent work. Possible overlap in expertise with Sarah Oyler-McCance.
RELATED SPECIES EXPERTS					
J.L. Bouzat (Link)	University of Illinois at Urbana-Champaign	IL	• Molecular ecology conservation genetics - lesser and greater prairie chickens	1-3, 6	Lesser prairie-chicken expert. Strong background in conservation genetics. Awareness of small population sizes and genetic impacts of small populations. Work on both greater and lesser prairie chicken, which could be relevant to GRSG.
Robert Gibson (Link)	University of Nebraska-Lincoln	Lincoln, Nebraska	• Animal behavior, ecology, and evolutionary biology – birds (esp. lekking species)	1-3, 6	Has done work on lek breeding system, and on sexual selection and predation in lekking species.
Christian Hagen (Link)	Oregon State University	Bend, Oregon	• Avian ecology, Habitat Selection, Demography	1-3, 6	
Sergei Drovetski (Link)	University of Alaska Anchorage	Anchorage, AK	• Molecular and Morphological evolution, genetics, and ecology of speciation	1-3, 6	

Name (bio)	Organization / Affiliation	Location	Specialty / Expertise	Meets Criteria	Notes
Christin Pruett (Link)	Florida Institute of Technology	Melbourne, FL	• Landscape genetics, evolutionary ecologist	1-3, 6	
NON-GRSG EXPERTS IN CONSERVATION GENETICS					
Regional FWS Geneticists[2] (Link)	USFWS Conservation Genetics Community of Practice	Across regions	From FWS website: "The Service currently has a strong conservation genetics research capacity, with more than 25 employees spread over six laboratories in Regions 1, 2, 4, 5 and 7."		These people represent the Service's internal expertise in this field; perhaps one of more of them would provide useful perspective. Experience dealing with these issues in the Service.
Rob Fleischer (Link)	Smithsonian Center for Conservation and Evolutionary Genetics (Center Head)	D.C.	• Evolutionary and conservation biology of birds and mammals	1-3, 6	Wide-ranging experience in genetic analysis for conservation, but outside the GRSG world.
W. Chris Funk (Link)	Colorado State University	Fort Collins, CO	• Genomics	1-3, 6	Genomics
Sue Haig (Link)	OSU/ USGS	Corvallis, OR	• Persistence/ extinction of small populations • Conservation genetics, population genetic structure • Subspecies identification	1-3, 6	Long record of relevant experience, but outside the GRSG world
Andrew Martin (Link)	University of Colorado	Boulder, CO	• Evolutionary and conservation genetics – prairie dogs, cutthroat trout, desert fishes, plants	1-3, 6	Participated in expert elicitation workshop for the Gunnison's prairie dog. Similar genetics work on fish and mammals.
Michael Schwartz (Link)	University of Montana and USFS	MT	• SNPs • Movement, connectivity, & habitat quality • Landscape genetics	1-3, 6	Broad expertise in conservation and landscape genetics, genomics, and methodologies Coauthor with Naugle,

[2] Christian Smith (WA), Meredith Bartron (PA), Emy Monroe (WI), Wade Wilson (NM), Gregory Moyer (GA), John Wenburg (AK), Jeff Olsen (AK) (Link)

Name (bio)	Organization / Affiliation	Location	Specialty / Expertise	Meets Criteria	Notes
			and genomics		Knick, and Oyler-McCance. Methods, landscape level genetics. How to use this tool. Explains practice and techniques well.
Lisette Waits (Link)	University of Idaho	Moscow, ID	• Pure geneticist. • Maternal and paternal DNA dispersal. • Gene flow.	1-3, 6	Pure geneticist. Expertise includes both landscape and conservation genetics. Easy to understand. Explains things well. Clear and understandable.
Robert Zink (Link)	University of Minnesota	MN	• Evolution, biogeography and molecular systematics of birds at the population and species level.	1-3, 6	Some GRSG research funded by mining interests. 2014 paper analyzed existing data and the research question was quite different from topic of his workshop. Steve Knick was a student. Diversity of opinion would be valuable. Used other people's data for his paper; opportunity for valuable discussion.
Ron Van Den Bussche (Link)	Oklahoma State University	Stillwater, OK	• Conservation genetics – bats, lesser prairie chicken	1-3, 6	Some lesser prairie-chicken experience. Small mammal emphasis. One paper on LEPC. But worked mainly outside grouse.

Topics for Discussion and Elicitation:

Comment [Craig3]: DECISION QUESTION: Review topics and questions to ensure we captured the RDs' question and the uncertainties in the DPS framework.

The facilitated discussion and elicitation questions under each topic will be crafted to provide information relevant to the status review. The details under each of the two broad topics below are currently under development to best reflect the overarching workshop topic, as described under the Purpose section above.

Background, Recent and Upcoming Research and on Conservation Genetics: The Latest Science and Techniques

During this section, we will establish the baseline for the workshop topic. We will provide an opportunity for each expert to summarize and present their published or ongoing research related to the workshop topic. We will also discuss new and upcoming research.

Evaluating Genetic Evidence for Barriers to Gene Flow between Populations, Groups of Populations, or other Potential Conservation Units

The following questions will investigate the existence, location, and magnitude of potential barriers to gene-flow throughout the range of the sage-grouse.

1. Where is there is evidence (data or other scientific information) of, or professional opinion about, barriers that limit or prevent gene-flow between populations, groups of populations, or some other potential conservation unit of greater sage-grouse.
2. Provide information and your opinion informed by professional judgment about the source, type (natural or anthropogenic), age, and permeability of each identified barrier that may restrict or prevent gene flow.
    a. For areas with multiple barriers, describe the relative importance, or magnitude, of each barrier in limiting gene flow. How do these interact on the landscape? Are barriers nested in any areas?
    b. Describe the strength of evidence and uncertainty for each identified barrier.
    c. Describe the likelihood that new scientific information will become available within the next 1 to 2 years that might change our understanding of potential barriers.

Evaluating Evidence of Genetic Divergence or Isolation:

These questions investigate the criteria, or metrics, used to assess genetic differences between potential conservation units. Elicitation will be used to assess the strength of the methods and applicability to the greater sage-grouse.

3. For any species, what criteria or metrics are appropriate for evaluating the degree of genetic divergence between populations or groups of populations? Example criteria or metrics:
    a. Time of isolation
    b. Genetic distance
    c. Would new or forthcoming information or techniques (*e.g.*, genomic data that demonstrate a spatial distribution of distinct adaptive traits in particular populations) clarify criteria or metrics for identifying poten?
4. What are the strengths and weaknesses of each of these criteria or metrics for inferring genetic divergence?
5. Use existing data or expert judgment to evaluate genetic divergence for each sage-grouse population or population group in question using the appropriate criteria or metrics. Evaluate uncertainty in the evidence for genetic divergence.
6. Describe the likelihood that new scientific information will become available within the next 1 to 2 years that might change our understanding of genetic divergence.

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Appendix

Workshop Logistics: Potential Dates, Locations, Venues, Agenda, and Equipment

Dates

Comment [Craig4]: DECISION QUESTION: We identified two possible dates in September. Are these acceptable to provide in the invitations? No other dates available until mid-October.

Due to scheduling conflicts between the DPS team and USGS facilitators, September 8–12 is the only week available to host the Genetics workshop before October 2014. The team agreed that the workshop should be at least one day long and a maximum of two days long. The Service's Modeling Workshop will be held in Fort Collins, Colorado, the preceding week, and the Rocky Mountain Federal Family Meeting will be in Denver Tuesday September 9 through Thursday September 11. Multiple Service participants for the Genetics workshop will be attending the Modeling Workshop, but will not be attending the Federal Family Meeting, which presents an opportunity to reduce travel times by sequentially scheduling the two workshops. Therefore, we propose the following dates for the workshop, which maximize Service and USGS participation.

- All Day Monday September 8 and the morning of Tuesday September 9; or
- All Day Thursday September 11 and the morning of Friday September 12.

Potential Agenda

DAY 1

8:00–8:15 AM	Welcome (Service and USGS)
8:15–8:45 AM	Introductions (Service)
8:45–9:00 AM	Workshop Processes, including a FACA, APA, ESA legal reminder (standards of behavior) (Service and USGS)
9:00–12:00 AM	Conservation Genetics: Research Updates, Metrics, and Emerging Science (Service)
12:00 –1:00 PM	Lunch
1:00–2:00 PM	Conservation Genetics: Continued Discussion (if needed) (Service)
2:00–4:30 PM	Elicitation (USGS)
4:30-5:00 PM	Summary and Conclusion (USGS and Service)

DAY 2

8:00–11:30	Elicitation (USGS)
11:30–12:00	Summary and Conclusion (USGS and Service)

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Potential Invitation to Experts

Invitations could come directly from the Regional Directors, the ARDs, the four species leads, or the status review biologists, either by hardcopy or by email. Due to preexisting relationships, we recommend that the species leads collectively email the invitations, which could include an electronic copy of a letter signed by the Regional Directors. Owing to time constraints and everyone's busy schedules, we also recommend these invitations be made as soon as possible.

Comment [Craig5]: **DECISION QUESTION:** Who and how should we invite the selected experts?

Dear [Name]:

The U.S. Fish and Wildlife Service (Service) invites you to participate as a scientific expert at our upcoming workshop on the genetics of the Greater sage-grouse on DATE in City, State. The workshop will help inform our 12-month status review of the Greater sage-grouse.

Facilitators from the U.S. Geological Survey will guide the group of experts through a formal expert elicitation process. At the workshop, you will be asked to provide your individual opinion and confidence regarding a range of topics. These techniques will help ensure that the workshop captures and preserves the variation among the experts' input and avoids violation of the Federal Advisory Committee Act.

We will host one, 1-hour-long webinar at least one week before the workshop to explain the expert elicitation process and to introduce the questions we seek to examine. DETAILS of WEBINAR

[Paragraph about the workshop topic].

[Paragraph about contact for more information.]

[Closing]

Comment [Craig6]: We are working on this draft invitation. Tone and format may vary.

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Roles and Responsibilities:

The following table summarizes the roles and responsibilities for the workshop participants.

ROLE	PRIMARY RESPONSIBILITY	SUMMARY
Scientific Experts, or Experts	Provide their best professional judgment on questions about conservation genetics and landscape connectivity	• Must meet the criteria, as specified below, and must follow the expected norms of behavior during the meeting. Throughout the workshop, each expert will be asked to provide their individual opinion. The group will not be asked to reach a consensus.
USGS Facilitators	Expert Elicitation	• Before the workshop, assist the Service in crafting the questions to ask the experts. Remove any policy language and maximize effectiveness of the questions. • During the workshop, facilitate the expert elicitation components and adhere to the schedule. Follow the agenda and move questions along. • After the workshop, review and edit the meeting notes. Work with Service facilitators to prepare the workshop report.
Service Facilitators	Manage the workshop	• Facilitate the non-elicitation components of the meeting. • Maintain the agenda. • Prepare and distribute the meeting notes for review. • Work with USGS to finalize the meeting notes and prepare the workshop report.
Service logistical support	Take notes	• Take notes during the workshop. If needed, also provides logistical support to the facilitators.

The Genetics Expert Elicitation Team

The four species leads, status review biologists, USGS facilitators, and all members of the Distinct Population Segment (DPS) team participated in meetings and contributed to this document.

Region 1

- Holly Freifeld
- Jesse D'Elia
- Dawn Davis
- Jeff Everett
- Steve Morey

Region 6

- Angela Burgess
- Craig Hansen
- Jennifer Sturdivant
- Kate Norman
- Pat Deibert
- Lief Wiechman

Region 8

- Steve Abele

USGS

- Sarah Converse
- Dave Smith

SOL

- Kris Tita

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Goal

The purpose of this meeting is to further clarify the process by which we will complete the 2015 Greater Sage-Grouse Status Review. We will focus the morning on review of deliverables and immediate next steps. The afternoon will be devoted to the Structured Decision Making.

Location

*We recognize that Region 8 will not be able to access VTC for the entire meeting; we are targeting 11:00 am – 1:00 pm PT (noon – 2:00 pm MT) for **all** participants to use VTC; R1 and R6 will be on VTC for the entire meeting.*

VTC:

On Monday, up to 30 minutes before we are scheduled to begin, use the Tandberg remote, dial in to 4001 by pushing the green button, and then entering 4001 with the keypad. Then hit the [OK/Menu] button. Then hit the [OK/Menu] button again.

PHONE ONLY:

Using your telephone, dial 303-235-5460. After the voice prompts, dial 4001#

WEBINAR:

http://www.mymeetings.com/nc/join.php?sigKey=mymeetings&i=443154588&p=LEADER&t=c

Materials

Materials for this meeting can be found on the SharePoint Portal:
https://portal.doi.net/usfws/SG/docs/Forms/818.aspx

Invitees

Region 1	
RO	Robyn Thorson, Richard Hannan, Terry Rabot
Region 6	
RO	Noreen Walsh, Mike Thabault, Nicole Alt, Kate Norman
Region 8	
RO	Ren Loehefener, Mike Fris, Mary Grim
USGS	
	Sarah Converse, Dave Smith

Agenda

Monday, August 18, 2014		
Time	**Item**	**Lead**
9:30 am (8:30 am PT)	**Welcome** • Brief recap of July Meeting (please see	Mike Thabault

Monday, August 18, 2014		
Time	**Item**	**Lead**
	deliverables highlighted below) • Goals for today	
9:45 am **(8:45 am PT)**	• Update on Expert Elicitation; Genetics o Please see Framework (list of potential attendees)	Craig Hansen
10:30 am **(9:30 am PT)**	**BREAK (15 min)**	

10:45 am
(9:45 am PT)
	• Download of Director's thoughts
	  o State Workshops
	  ▪ Webinar or 1-day of Task Force
	  ▪ December (or January, February) with State Wildlife Directors
		Mike Thabault, RDs

11:30 am **(10:30 am PT)**	**PRE-LUNCH BREAK** (due to availability of VTC, we would like to give everyone time to obtain lunch beforehand)	

12:00 pm
(11:00 am PT)
	***ALL VTC* – Process and Structured Decision Making**
	• Process Framework
	  o Discuss Revisions
	  o Options for Review
	• Update on Modeling Workshop
	  o List of invitees
		Mike Thabault, Dave Smith, Sarah Converse, Kevin Doherty

2:00 pm **(1:00 pm PT)**	**BREAK (15 min)**	

2:15 pm
(1:15 pm PT)
	SDM contd.
	September Meeting
	• Objectives
	• Report out from Modeling Workshop
	  o Metrics
	  o Outputs of Models
	  ▪ Outputs could be complimentary
	  o Gaps in modeling
	  ▪ How can we address gaps?
	  o Documenting Assumptions
	  ▪ Conservation Actions
	  ▪ Regulatory Mechanisms
		Dave Smith, Sarah Converse, Kevin Doherty

3:15 pm **(2:15 pm PT)**	**BREAK (10 min)**	
3:25 pm **(2:25 pm PT)**	**Next Steps** September Meeting 1.5 days? • Thursday afternoon (housekeeping and updates) • All-day Friday (SDM – Modeling) November Meeting • How can we accommodate? • 1st week in November? • Bi-state and GRSG	Mike Thabault

Monday, August 18, 2014		
Time	**Item**	**Lead**
4:00 pm (3:00 pm PT)	**ADJOURN**	Mike Thabault

Tasks

TASKS FROM PREVIOUS MEETING					
Category	**Responsible Party**	**Task**	**Due Date**	**Compltd Date**	**Notes**
Dir. Briefing	RDs	Schedule run through prior to July 31st briefing w/ Director:	7/30/2014	7/28/2014	Done
Dir. Briefing	Nicole Alt, Kate Norman	Draft initial briefing materials for Dir. Briefing	7/25/2014	7/28/2014	Done
Workshop for State Input	Mike Thabault	1 or 2 Page proposal for a workshop. How can we engage the states in a meaningful way?	10/30/2014		Will need to have 2 mtgs. Joint briefing of Task Force/State Directors (ESA 101 + GRSG); 2nd in Dec (State Game/Fish Dir) – more focused progress report.
Scrub Letter	Mary Grim, Terry Rabot	Clean Data Call letter for WAFWA/EOC	7/19/2014 – DONE!	7/31/2014	Done
CED	Kathy Hollar	Is it possible to highlight products/reports that are "interim" when data is incomplete?	7/22/2014	7/28/2014	Done (yes)
SPR	Craig Hansen	Revise 1 map in Threat Concentration Framework to explain how threat concentrations could be used; explain in record that COT maps are not at a scale that would be most useful. - Pull out other maps, but provide one as an example	7/26/2014	7/30/2014	Done https://portal.doi.net/usfws/SG/docs/Forms/spr.aspx
SPR	Craig Hansen	Prepare presentation for State Workshop	10/30/2014		Will revise current presentation
Species Report	Nicole Alt	Ask SOL about FACA exemption for States, Feds, Tribes; Inviting these individuals to assist in writing chapters	7/26/2014	7/28/2014	In Conversation
Species Report	Mary Grim	Revise Species Outline: Organization of Threats =			Done (Reassigned to

TASKS FROM PREVIOUS MEETING					
Category	**Responsible Party**	**Task**	**Due Date**	**Compltd Date**	**Notes**
		COT+			Amy Nicholas)
Genetics Expert Elicitation	Craig Hansen (?)	Contact IDIQ to find contractor to identify workshop participants. (e.g. Dr. Stephen Courtney: 1-202-965-6382) SPCourtney@gmail.com Frame the contract so that we want the contractors to provide that report – they will work through the approach (panel, direct communication).	--------	-------	FWS and USGS are going to proceed with this process.
PECE	Nicole Alt	Revise: We may want to be more explicit. Need to explain that PECE assessment is to everyone's benefit.			Transferred to R8
PECE	RDs and ARDs	Be able to articulate why we are assessing certain programs under PECE	7/18/2014	7/18/2014	Done
Process Framework	Kate and Nicole	Final edits			Mike is working on this
Process Framework	Kevin Doherty	Revise Abundance and Distribution language to clarify "not just numbers" (Does it mean trends? Does it mean abundance (numbers) in location?)	7/22/2014	7/31/2014	Done
Process Framework	Nicole Alt	Find contractor(s) who could select a panel of individuals for review. Or Dr. Stephen Courtney (IDIQ) 3-5 reviewers (Reviewer credentials (ESA???, Decision Analysis) (Use USGS draft to start with the)	-------	------	USGS will lead this; working with TWS
Meetings	Trina Vigil	Find time to have set interim call each month	7/26/2014		INCOMPLETE
Capacity	Nicole Alt	Revise Capacity Document: (Add in contract for State Workshop/ Add in contract for Peer Review of Process Framework; --Need to clarify, here's what it will cost to support 2015 capacity – projected costs --Here are	7/26/2014	7/28/2014	Revised

TASKS FROM PREVIOUS MEETING					
Category	Responsible Party	Task	Due Date	Compltd Date	Notes
		expenses (workshops, contracts)			

UPCOMING DATES		
Date	Event	Where
8/18/2014	RD Meeting VTC	VTC
?????? 9/19/2014	RD In-Person Meeting	Denver, CO
10/21/2014	RD In-Person Meeting	Portland, OR
????? 11/18/2014 – 11/19/2014	RD In-Person Meeting	Sacramento, CA
12/16/2014	RD In-Person Meeting	Sacramento, CA

Workshop Purpose:

(1) Identify standards of model design – including output metrics, spatial and temporal scope, and threats – necessary for modeling efforts to be integrated into quantitative predictions of sage grouse persistence to inform the status assessment.
(2) Identify the ensemble of models that are consistent with USFWS information needs and have a high likelihood of being completed in time to inform the status assessment.
(3) Conduct an informal review of the various modeling efforts to better understand the strengths, potential weaknesses, and ability of these efforts to inform the status assessment.
(4) Identify gaps in USFWS information needs not covered by ongoing modeling efforts, and strategize how to fill these gaps.

Topics:

Wednesday AM

(1) The *model outputs* to inform the Service's status review of GSG includes relative abundance, distribution, and derived parameters. Are these the appropriate outputs, and if not, what should the appropriate outputs be?
(2) What *modeling approaches are available* that can meet the needs of the modeling framework and process constraints?
    a. Needs of the modeling framework:
        i. provide relevant output as projections over time for GSG as defined in Term of Reference 1,
        ii. link (major) threats to SGS directly or indirectly through sagebrush habitat, and
        iii. link conservation actions to predict effectiveness at amelioration of threats.
    b. Process constraints:
        i. complete analysis by May 2015,
        ii. temporal scale is projection into the future, and
        iii. spatial scales include PACs, populations, Management Zones, and range-wide.

Wednesday PM

(3) What are *the strengths and weaknesses of available modeling approaches* to meet the needs of the modeling framework and process constraints? AND START of 4

Thursday AM

(4) What are the *gaps where additional information would be needed* to meet the needs of the modeling framework and process constraints? What are the opportunities to fill those gaps with additional modeling tools or approaches?

(5) What *meta-analytical approaches are available to synthesize information from multiple modeling efforts*? What are the strengths and weaknesses of those approaches?

Friday

(6) What is the *work plan* for available modeling approaches? Who is responsible for individual modeling efforts, when will work be completed, and what are the work products?

Ground Rules:

- The Service is not seeking consensus. Individual judgments will be discussed and compiled.
- Participants will be expected to follow standard norms of behavior (presented at start of workshop).

Draft agenda for GSG Modeling Workshop I:

This will be a 3-day workshop scheduled over 2nd to 5th of September 2014 (start midday Tuesday and finish by midday Friday)

Duration (hour)	**Tuesday (half day: afternoon)**	**Leads**
1	• Welcome • Welcome from RISCT • Overview of workshop: o goals and objectives of workshop, o modeling framework vision (canonical conceptual model) o process constraints • Review agenda	Mike/Sarah/Kevin San Stiver/Tom Remington
3	• Background talks on o modeling approaches, o meta-analytical/synthesis approaches, and o data availability.	Dave/Steve Tightly scheduled series of lead PI talks (15 min with Q&A). Eight to 10 talks.
0.25	• Daily close-out	Sarah/Steve/Dave
	Wednesday (morning)	
0.5	• Review from Day 1. Agenda check-in	Sarah/Steve/Dave
1.5	• Discussions on Topics 1 and 2 o Breakout group discussions o Reconvene in plenary to summarize group discussions o Continue discussion in plenary	Sarah/Steve/Dave/Jonathan (4 breakout groups)
1.5	• Discussions on Topic 3 o Breakout group discussions	Sarah/Steve/Dave/Jonathan
	Wednesday (afternoon)	

0.5	• Review, Q&A, agenda check-in as needed	Sarah/Steve/Dave
1.5	• Continue discussions on Topic 3 o Reconvene in plenary to summarize group discussions • Continue discussion in plenary	Sarah/Steve/Dave

1.5	• Discussions on Topic 4
	  o Breakout group discussions
	  o Reconvene in plenary to summarize group discussions
		Sarah/Steve/Dave/Jonathan

0.25	• Daily close-out	Sarah/Steve/Dave
	Thursday (morning)	
0.5	• Review from Day 2. Agenda check-in	Sarah/Steve/Dave
1.5	• Continue discussions on Topic 4 in plenary	Sarah/Steve/Dave
1.5	• Discussions on Topic 5 o Breakout group discussions	Sarah/Steve/Dave/Jonathan
	Thursday (afternoon)	
0.5	• Review, Q&A, agenda check-in as needed	Sarah/Steve/Dave
1.5	• Continue discussions on Topic 5 o Reconvene in plenary to summarize group discussions • Continue discussion in plenary	Sarah/Steve/Dave
1.5	• Review and close out on Topics 1 to 5 in plenary	Sarah/Steve/Dave/Jonathan
0.25	• Daily close-out	Sarah/Steve/Dave
	Friday (half day: morning)	
0.5	• Review, Q&A, agenda check-in as needed	Sarah/Steve/Dave
2	• Discussions on Topic 6 (remain in plenary)	Sarah/Steve/Dave
0.5	• Daily close-out	Sarah/Steve/Dave

Workshop Products:

- Notes and summaries on Topics developed during the workshop
- Overall workshop report written shortly after the workshop by Sarah, Dave, and Kevin
- Work plan for the modeling framework, including work plan for individual modeling efforts, schedule for additional modeling workshops, schedule for meta-analysis/synthesis, and modeling work products.

Sage Grouse Population Modeling Workshop
2015 Sage Grouse Status Assessment

Workshop Date and Time

September 2, 2014, 1:00pm – September 5, 2014, 12:00pm

Workshop Location

Fort Collins, Colorado; details TBD

Workshop Facilitators

Sarah Converse, USGS Patuxent Wildlife Research Center
Dave Smith, USGS Leetown Science Center
Kevin Doherty, USFWS Region 6
Steve Morey, USFWS Region 1

Workshop Objectives

The USFWS is tasked with determining the status of the greater sage-grouse under the US Endangered Species Act by September 2015. In that context, predictive models will need to be produced to project populations through time. Therefore, a USGS/USFWS team is convening an initial population modeling workshop, which is expected to be followed by additional workshops focused on model building and expert elicitation. Our goals for the initial workshop are to:

1. Identify standards of model design – including output metrics, spatial and temporal scope, and threats – necessary for modeling efforts to be integrated into quantitative predictions of sage grouse persistence to inform the status assessment.
2. Identify the ensemble of models that are consistent with USFWS information needs and have a high likelihood of being completed in time to inform the status assessment.
3. Conduct an informal review of the various modeling efforts to better understand the strengths, potential weaknesses, and ability of these efforts to inform the status assessment.
4. Identify gaps in USFWS information needs not covered by ongoing modeling efforts, and strategize how to fill these gaps.

Workshop Invitation List

Cam Aldridge, USGS Fort Collins Science Center
Sharon Baruch-Mordo, The Nature Conservancy
John Bradford, USGS Southwest Biological Science Center
Dave Budeau, Oregon Department of Fish and Wildlife
Jeanne Chambers, USDA Forest Service Rocky Mountain Research Station
Tom Christiansen, Wyoming Game and Fish
Pete Coates, USGS Western Ecological Research Center
Dave Dahlgren, Utah State University

Dawn Davis, USFWS Region 1
Pat Deibert, USFWS Region 6\
Jesse D'Elia, USFWS Region 1
Shawn Espinosa, Nevada Department of Wildlife
Jeff Evans, The Nature Conservancy
Brad Fedy, University of Waterloo
Kathy Griffin, Colorado Parks and Wildlife
Mevin Hooten, USGS Colorado Cooperative Fish and Wildlife Research Unit
Doug Johnson, USGS Northern Prairie Wildlife Research Center
Lara Juliusson, USFWS Region 6
Don Kemner, Idaho Fish and Game
Joe Kiesecker, The Nature Conservancy
Steve Knick, USGS Forest and Rangeland Ecosystem Science Center
Jeremy Maestas, Sage Grouse Initiative/NRCS
Dave Naugle, Sage Grouse Initiative/University of Montana
Dave Pyke, USGS Forest and Rangeland Ecosystem Science Center
Frank Quamen, BLM
Tom Remington, WAFWA
Jon Runge, Colorado Parks and Wildlife
Mike Schroeder, Washington Department of Fish and Wildlife
San Stiver, WAFWA
Lief Wiechman, USFWS Region 6
Catherine Wightman, Montana Fish Wildlife and Parks

Travel Funding

Where appropriate, we ask that participants use funds from their agency or employer to attend. However, if money is not available, please indicate so in your reply, and we will assess the availability of funds on a case-by-case basis.

Invitee Criteria

All workshop invitees met a set of criteria, indicating their expertise relevant to modeling the impact of threats on sage grouse populations. Additional participants may be considered on a case-by-case basis if they meet these criteria:

Participant must meet all of the criteria 1-3:

1. Participant holds a graduate degree in wildlife biology, zoology, statistics, or a related field.
2. Participant holds a research position in government, academia, or in the nonprofit research sector; or, participant holds a governmental management agency position with responsibility for sage grouse.
3. Participant has expertise in population ecology and/or sage grouse ecology, demonstrated by publications and related types of professional scientific expression.

Participant must meet 1 or more of the criteria 4-6:

4. Participant is directly engaged in building quantitative models of sage grouse populations.
5. Participant is directly engaged in the study of threats on sage grouse populations.
6. Participant is a government or academic research scientist with expertise in statistical ecology, demonstrated by publications and related types of professional scientific expression.