From: Kaczor, Nick
To: Matt Kales
Subject: Re: GrSG conservation on NWRS lands
Date: Tuesday, March 11, 2014 10:12:41 PM
Attachments: Kaczor_&_Artmann_SG_mgt_on_NWRS_09_25_2013.docx

Matt,

As discussed, here is the manuscript that has incorporated the peer-reviewers comments. I will try and touch base with Mike and Will when I get back, but wanted to provide you a copy to see if its something for the group to work with. Thanks for leading this charge.

Nick

On Tue, Mar 11, 2014 at 3:11 PM, Matt Kales <matt_kales@fws.gov> wrote:

> Folks,
>
> Thanks again for your participation on the call today. I think it was time well spent and hope you all feel similarly. By way of follow up, I've included below (a) the initial considerations we used to frame the conversation and (b) input from Noah Matson, who runs Defenders of Wildlife's federal lands program, on other/related considerations for our efforts going forward.
>
> As discussed, Paul and I will work to line out the specific action(s) re: refreshing our inventory of SG conservation/management activities on NWRS lands in R6 and get associated tasking/timetables out to you all soon.
>
> I'll continue to copy this group on next steps; if anyone in the larger group wants to opt out on all e-mail traffic likely to come, please let me know and I'll limit distribution to the core team members. Thanks.
>
> Matt
>
> Initial considerations: SG Conservation on NWRS lands
>
> - Background/context (SG a bureau/Dept. priority; big push; opportunity to pursue landscape conservation and elevate profile of sage-steppe ecosystems)
> - FWS is pushing FLMAs hard to adopt strong measures to conserve birds on federal

estate (~60% of range)

- We are also actively supporting partners working on private ground (states, SGI)
- Need to ensure, at a minimum, our management activities on NWRS lands are consistent with what we are recommending to others
- Ideally, we can identify opportunities to enhance above activities, both on and adjacent to NWRS lands, especially in key areas (e.g., PACs, connectivity corridors)
- NWRS as living laboratories for important SG research, e.g., ACK-55
- Today's conversation a starting point; want to expand to include R1 and 8, and HQ.
- Potential issues to consider:
    - Fire (Rx and suppression)
    - Weed control
    - Hunting
    - Strategic acquisition
    - Research
- Need feedback from the team on all the above, and on best approaches to further explore/address these issues, e.g., small teams, white papers, recommendations to management, etc.

Additional considerations from Defenders:

The National Wildlife Refuge System can actively contribute to sage-grouse conservation. These contributions should be comprehensively catalogued by the agency so they are taken into account by those deciding whether or not to list the species under the Endangered Species Act.

Additionally, we recommend that the USFWS take the following additional steps to enhance contributions by the National Wildlife Refuge System to sage-grouse conservation.

· Identify sage-grouse production as an explicit goal of refuge management where habitat is available or can be restored/improved through active and passive management.

· identify measurable habitat objectives and sage-grouse population targets for refuge units. These targets should be incorporated into CCPs along with a description of management activities that will promote the meeting of those targets.

· Have refuges and Partners program work with the USDA NRCS Sage Grouse Initiative, state agencies and other partners to leverage public and private funding to support sage-grouse conservation on and surrounding refuge lands.

· Direct those refuges currently without a CCP, where sage-grouse are present, to develop an interim species and habitat management plan

· identify what steps will be taken to defend sage-grouse habitat against invasive species and catastrophic wildfire.

From: Matt Kales [mailto:matt_kales@fws.gov]
Sent: Friday, March 07, 2014 3:30 PM

To: Elizabeth Berkley; Nick Kaczor; Tom Koerner; Bridget Nielsen; Brendan Moynahan; Lindy Garner
Cc: Ann Timberman; David Lucas; Richard Potts; Jeff King; Will Meeks; Paul Santavy; Heather Johnson; Wayne King; Barbara Boyle; Carl Millegan; Pat Deibert; Nicole Alt; Michael Thabault
Subject: RE: GrSG conservation on NWRS lands

Folks,

Thanks for the quick response to the scheduling poll. The clear winner is next **Tuesday, March 11, at 1 pm MST**. Please see below call information. We have one hour budgeted for the call and, per my earlier message, we'll review our basic goals and objectives as a team, scope and brainstorm issues, and then line out some next steps. Please come prepared to participate actively in the conversation: we are looking to you as practitioners to help us understand what's happening on the ground, opportunities to enhance sage-grouse/sage-steppe conservation on our lands and on larger landscapes, and provide other insights and perspective you may have on how we move forward as a Service with this large and complex issue.

Thanks in advance for your time, please let me know if you have any immediate thoughts, and we look forward to speaking with everyone next week.

Have a good weekend, all.

Matt

Call information: Greater sage-grouse conservation on NWRS lands

Dial: 866-663-0869

Passcode: 4006722#

From: Matt Kales [mailto:matt_kales@fws.gov]
Sent: Tuesday, March 04, 2014 3:54 PM
To: Elizabeth Berkley; Nick Kaczor; Tom Koerner; Bridget Nielsen; Brendan Moynahan; Lindy Garner
Cc: Ann Timberman; David Lucas; Richard Potts; Jeff King; Will Meeks; Paul Santavy; Heather Johnson; Wayne King; Barbara Boyle; Carl Millegan; Pat Deibert; Nicole Alt; Michael Thabault
Subject: RE: GrSG conservation on NWRS lands

And the actual link:

http://doodle.com/kytiu77h9f7g53dz

From: Matt Kales [mailto:matt_kales@fws.gov]
Sent: Tuesday, March 04, 2014 3:53 PM
To: Elizabeth Berkley; Nick Kaczor; Tom Koerner; Bridget Nielsen; Brendan Moynahan; Lindy Garner
Cc: Ann Timberman; David Lucas; Richard Potts; Jeff King; Will Meeks; Paul Santavy; Heather Johnson; Wayne King; Barbara Boyle; Carl Millegan; Pat Deibert; Nicole Alt; Michael Thabault
Subject: RE: GrSG conservation on NWRS lands

Folks,

Per my previous message(below), here is the scheduling poll for our call. If we can get a quorum of the recipients in the “To” field here, along with Will and Pat, we’ll hold the call; otherwise, I’ll send out another poll with alternate dates. Thanks in advance for your reply.

Matt

From: Matt Kales [mailto:matt_kales@fws.gov]
Sent: Friday, February 21, 2014 1:38 PM
To: Elizabeth Berkley; Nick Kaczor; Tom Koerner; Bridget Nielsen; Brendan Moynahan; Lindy Garner
Cc: Ann Timberman; David Lucas; Richard Potts; Jeff King; Will Meeks; Paul Santavy; Heather Johnson; Wayne King; Barbara Boyle; Carl Millegan; Pat Deibert; Nicole Alt; Michael Thabault
Subject: GrSG conservation on NWRS lands

Folks,

I hope this finds everyone well. Will Meeks and I have had some conceptual conversations about developing a fuller understanding about ongoing and emerging conservation efforts for Greater sage-grouse on National Wildlife Refuge System lands, both here in Region 6 and across GrSG range (i.e., in Regions 1 and 8). While our lands represent a small portion of the species' total range, we want to ensure we are maximizing opportunities to conserve the species on lands we control and that our current management activities are consistent with the Service's, and our partners', range-wide conservation goals for sage-grouse.

To advance that conversation, we'd like to pull together a small, informal team of individuals with experience working on GrSG, sagebrush-steppe conservation, and related efforts, to identify and explore some key questions related to the above issues. Will has kindly provided your names as members of that team, so by way of this message I'm asking you all to please start thinking about those key questions and potential approaches to enhance sage-grouse conservation on and adjacent to NWRS lands. Our plan is to convene an initial team call at the regional level with NWRS leadership, Dr. Pat Deibert, our National Sage-Grouse Conservation Coordinator (copied here) and generate a preliminary suite of topics to consider (e.g., fire and invasives management, hunting, research, etc.). We can then determine the best way to proceed with analyzing these topics and - where appropriate/necessary - identifying any recommendations or follow-on actions. From there, we can engage our sister regions to expand the geographic, and potentially topical, scope of the conversation.

I'll send out a scheduling poll shortly for that initial team call, which we'll seek to hold in early March. In the meantime, please let me know if you have any immediate thoughts or questions, and thanks in advance for your time on what I expect will be an interesting and productive process.

Regards,

Matt

Matt Kales

Special Assistant for Greater Sage-Grouse Conservation

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Issues and Perspectives

Greater sage-grouse and National Wildlife Refuges: An example for species conservation

Nicholas W. Kaczor,* Michael J. Artmann

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Abstract

National Wildlife Refuges have a limited footprint in sagebrush landscapes (<1 percent), however, in certain areas; refuges play a large role in supporting viable greater sage-grouse populations. Several refuges support populations greater than 1,000 birds annually while others support smaller, yet viable populations. Refuges located on perimeter of viable populations can function as important corridors between quality habitats or serve as potential restoration sites. Sage-grouse are a focal species for many refuge Comprehensive Conservation Plans and detailed objectives and strategies will be needed to increase National Wildlife Refuge System contributions to conservation of this species. The National Wildlife Refuge System and the Fish and Wildlife Service's Partners for Fish and Wildlife program are well integrated to provide shared resources and expertise to increase sage-grouse conservation across the landscape and could be example for which other land managers to look toward. We present an overview of sage-grouse on National Wildlife Refuges and then describe a variety of management tools refuge managers could use to improve sage-grouse habitats.

Keywords: Greater sage-grouse, *Centrocercus urophasianus,* National Wildlife Refuge System, best management practices, habitat management

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*Corresponding author: nick_kaczor@fws.gov

Short title: Sage-grouse and National Wildlife Refuges

Introduction

Greater sage-grouse (*Centrocercus urophasianus;* hereafter sage-grouse) have been called, and will continue to be, an icon of the West due to their visual prominence; dependence on sagebrush (*Artemisia* spp.) habitats; and political nature due to their complex management requirements. Management of sage-grouse populations is complex because multiple State and Federal agencies, non-governmental organizations, private farmers and ranchers, and commercial industries all play a part in sage-grouse conservation (USFWS 2010; Knick and Connelly 2011a). These entities, each with various missions and objectives, will all play a pivotal role in the conservation of sage-grouse and their habitats. The designation of greater sage-grouse as a warranted, but precluded species (Candidate) under the Endangered Species Act (ESA) in 2010 will motivate future management of sage-grouse and their habitats (USFWS 2010).

The U.S. Fish and Wildlife Service (Service) has recognized sage-grouse and the sagebrush ecosystem as an integral part to species biodiversity in the intermountain west. Although the National Wildlife Refuge System (hereafter, refuges) lands account for approximately 1 percent of the current sagebrush distribution, refuges can, and should, play a vital role in the persistence of viable sage-grouse populations today and into the future. For example, at least three refuges support greater than 1,000 birds annually. As the leader of wildlife conservation nationwide, refuges provide areas rich in biological diversity and native ecosystems. While most refuges were established for waterfowl and other migratory birds, refuges in sage-grouse range can provide substantial benefits for sage-grouse particularly in late summer when sage-grouse broods move to mesic sites that are abundant on many waterfowl refuges.

We compiled the following information recognizing the value the National Wildlife Refuge System could play in setting an example for sage-grouse management, and the challenges refuge managers face in managing for sage-grouse. We gathered background information on sage-grouse in relation to refuges, the legal responsibilities of the Service and refuges, and then generated a set of management techniques to benefit sage-grouse populations for refuge managers to use for maintaining or improving sage-grouse habitats. Refuge managers were sent a questionnaire on October 14, 2011 that was designed to collect information about sage-grouse population status, habitat characteristics, and conservation challenges at individual refuges. Much of the survey data is described below in the current status of sage-grouse on refuges.

Sage-grouse management is complex and it is recommended that managers investigate recent documents that provide a very comprehensive overview of sage-grouse ecology and conservation (see supplemental information). We focused this manuscript on the management of sage-grouse on Service-owned lands, however the Service is actively engaged in multiple other efforts beyond the boundaries of refuges. These include but are not limited to the private land program through the Partners for Fish and Wildlife Programs (PFW) and technical assistance through Ecological Services. These other programs are extensive and warrant further dicussion outside of this manuscript. We also included examples (see call-out boxes) of several on-going activities and events that are, or have taken place, on refuges. We used these examples to help refuge managers draw ideas from.

Sage-Grouse History in Relation to National Wildlife Refuges

The United States government acquired all sagebrush lands via the Louisiana Purchase (1803), Oregon Compromise (1846), and cessation from Mexico (1846) (Knick and Connelly 2011a). In the latter half of the 19th century, numerous land disposition programs and settlement acts allowed private individuals to acquire land primarily for agricultural development [see Knick (2011) for an extensive list]. Railroads were also provided large amounts of land to develop transcontinental shipping corridors which resulted in the extensive checkerboard land ownership pattern in Wyoming, Utah, and Nevada. These railroads facilitated the expansion of livestock grazing operations by providing direct transportation of livestock to open and unfenced rangelands, and a reliable source of supplies necessary to have a successful operation (Knick 2011). Unregulated grazing continued until the early 1900's when the passage of U.S. Forest Service Organic Act of 1897 and the Taylor Grazing Act of 1934 regulated grazing on public lands. During this time, lands not withdrawn as national wildlife refuges or national parks were subsequently retained for natural resource lands and placed under the predecessor of the Bureau of Land Management (BLM) (Knick 2011). Lands withdrawn from public domain and designated as a national wildlife refuge in sage-grouse range began in 1908 with the establishment of Malheur National Wildlife Refuge in southeast Oregon and continued into the late 1960's. The Service continues to acquire lands both in fee-title and limited interest within approved acquisition boundaries via land transfers or purchase from willing private landowners.

Lands incorporated into the refuge system are currently managed under the National Wildlife Refuge System Administration Act of 1966 as amended. Unlike BLM and Forest Service lands, which are managed according to the Multiple Use and Sustained Yield Act (1960), and the Federal Land Policy and Management Act (1976), respectively; the National Wildlife Refuge System Administration Act directs the Service to manage purposely for wildlife conservation. Currently, the Federal government manages approximately two-thirds of the sagebrush landscape, with the BLM managing approximately 51% of the sagebrush habitat in the United States (Knick 2011). The Service, via refuges, manages over 5,700 km^2 of sagebrush habitat or approximately 1% of sage-grouse range. (Figure 1).

Call-Out Box #1

Bear River Watershed Conservation Area

This recently created large-landscape conservation easement project will protect important habitat for a variety of fish, mammals, sage-grouse, migratory birds and major migration corridors connecting the northern and southern Rocky Mountains. In addition, the conservation area will facilitate watershed-wide conservation efforts and will protect valuable farmland and ranchland in Idaho, Utah and Wyoming.

Conservation easements are a partnership between a conservation entity (e.g., Federal agency or non-governmental organization) and a private landowner that keeps the land in private ownership while providing a conservation benefit. Therefore, property tax and invasive plant control remains the responsibility of the landowner, who also keeps control of public access to the land, but provides that habitats for species like sage-grouse are protected into perpetuity (USFWS 2013).

The National Wildlife Refuge System (NWRS) is a system of lands and waters administered by the U.S. Fish and Wildlife Service (Service) for "*…the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats…*" This system is comprised of over 550 refuges or conservation areas nationwide, each with one or more establishment purposes. These purposes can range from: an inviolate sanctuary for migratory birds; a refuge and breeding ground for migratory birds and other wildlife; to conserve fish, wildlife, or plants which are listed as endangered or threatened; to various other purposes, often specific to each refuge. Currently, no refuge has a directly stated purpose to manage for sage-grouse and their habitats; however, each refuge is directed to manage for species diversity and ecosystem integrity, thereby necessitating sagebrush ecosystem management. In addition, many refuges within sage-grouse range consider sage-grouse a focal species in their guiding management documents such as Comprehensive Conservation Plans

(CCP). Sage-grouse are considered an umbrella species for the sagebrush ecosystem as management for sage-grouse will have positive impacts on other sagebrush dependent species such as Sage sparrow (*Amphispiza belli*), Brewer's sparrow (*Spizella breweri*), pygmy rabbit (*Brachylagus idahoensis*), etc. (Hanser and Knick 2011).

Concerns about declining populations of sage-grouse date back almost 100 years and continue today (Hornaday 1916; Knick and Connelly 2011b). These concerns are centered on decreasing sagebrush habitats and associated declining sage-grouse populations. Recent population viability analyses have suggested that at least 13% of sage-grouse populations may decline below effective population sizes of 50 within the next 30 years, while at least 75% of the populations are likely to decline below effective population sizes of 500 within 100 years (Garton et al. 2011). Although population viability analyses carry inherent assumptions and are considered problematic, these analyses suggest declining populations across the range and a heightened concern for sage-grouse management (Garton et al. 2011). These declines have prompted the Western Association of Fish and Wildlife Agencies to define seven sage-grouse management zones (MZs) to assess populations and habitat trends independent of administrative and jurisdictional boundaries, and focus management actions in these zones (Stiver et al. 2006). Units of NWRS are found in all seven MZs; however there are no refuges within occupied sage-grouse range in the Colorado Plateau or Columbia Basin MZs.

Sage-grouse are often referred to as a landscape species as they have been documented to occupy home ranges varying from 4 to 615 km^2 (Hagen 1999, Connelly et al. 2000, Hausleitner 2003). This wide-range of habitat use and movement must be considered when managing for a landscape species. The MZs developed by Western Association of Fish and Wildlife Agencies provide a mechanism to investigate sage-grouse population dynamics, habitat relationships, impacts from management, and how they interact to affect sage-grouse populations. The MZs were also a main point of analysis in the 2010 listing decision and will be a useful tool for refuge managers (USFWS 2010).

Sage-Grouse Legal Status

Sage-grouse are currently a candidate for listing under the ESA, but further listing action has been precluded by higher priority listing actions (USFWS 2010). Sage-grouse were designated as warranted for listing due to the present or threatened destruction, modification, or curtailment of its habitat or range, and the inadequacies of existing regulatory mechanisms

(USFWS 2010). The ESA requires an annual review of a species listing in the Candidate Notice of Review. Currently sage-grouse are managed by individual states as a resident game bird (Alexander 2010; Stiver 2011). The Western Association of Fish and Wildlife Agencies has developed the "Greater Sage-Grouse Comprehensive Strategy" to assist state wildlife agencies with sage-grouse management and to promote consistency of actions across the range and with other partners (Stiver et al. 2006). The BLM developed a National Sage-Grouse Habitat Conservation Strategy in 2004 and has also recently issued several Instruction Memorandum's (IM) related to sage-grouse management. IM 2012-043 and IM 2012-044 direct BLM managers to protect unfragmented habitats, minimize habitat loss and fragmentation, and maintain, enhance or restore conditions for sage-grouse (BLM 2011a, BLM 2011b).

The Service, U.S. Forest Service, BLM, and Natural Resource Conservation Service signed an Interagency Agreement (IA) in June 2011 that focuses on an "all lands" approach to managing sagebrush habitats and sage-grouse. The IA calls for cooperation between the federal agencies and the state fish and wildlife departments, tribal governments, and other partners, to ensure sustainable management of grazing and other agricultural practices, and to restore and enhance sage-grouse habitats in sagebrush-steppe landscapes in the western United States. Although the Service has no range wide policy for sage-grouse management on refuges, many refuges incorporate sage-grouse management into their respective CCP. Furthermore, it is Service policy to manage candidate species as if they are a threatened or endangered species under the ESA (USFWS 1998).

Current Status of Sage-Grouse on Refuges

In the intermountain west, sage-grouse occupy 670,000 km^2 spanning parts of 11 states. Federal agencies manage roughly two-thirds of the sagebrush landscape (Knick and Connelly 2011a). The Service administers approximately 1 percent of the sagebrush range primarily through refuges. Fifty-four refuges are located within sage-grouse MZs but only 31 are within occupied distribution of sage-grouse (Table 1) (Schroeder et al. 2004). Nineteen refuges support sage-grouse at some level, with six refuges supporting greater than 200 birds annually and three refuges supporting greater than 1,000 birds annually. We present information for the following six refuges that have estimated populations of sage-grouse greater than 200 birds first; and then provide a description of management actions taking place on the remainder of refuges. For the

purposes of this report, we grouped the Charles M. Russell NWR and UL Bend NWR together as they share borders and are managed under the same CCP.

Management of sage-grouse on refuges with greater than 200 birds typically consists of: the control of juniper expansion; prescribed fire treatments particularly in riparian habitats; promoting desirable plant species; restriction of public access to designated roads and trails; limiting mineral and oil and gas development; and, the removal of feral horses and burros (only at Sheldon NWR). Detailed information on the six refuges is provided in Table 2.

There are 13 refuges that support lower levels of sage-grouse use and population numbers. This may be in part due to the relative size of the refuge (e.g., Halfbreed Lake NWR – 4,318 acres), the historic distribution of quality sagebrush habitat, or the refuge may only provide habitat in a small area of that particular sage-grouse population (e.g., National Elk Refuge). However, these refuges may be important for providing movement corridors, serving as future restoration sites, or maintaining genetic diversity. Many of these refuges are relatively small and surrounded by large expanses of public lands, so management activities on neighboring lands will determine whether viable populations exist. Increased coordination and partnerships with neighboring agencies will contribute to sage-grouse conservation on these refuges.

In addition to the 20 refuges mentioned above, there are 11 other refuges that are either in sage-grouse historic range, or on the periphery, but currently do not support sage-grouse. Similar to the refuges with less than 200 sage-grouse, these refuges may be important for providing movement corridors, serving as future restoration sites, or maintaining genetic diversity. Several refuges in this category historically maintained or supported sage-grouse populations. Investigations into why sage-grouse no longer use these refuges would aid in sage-grouse conservation. This could be related to refuge management activities, actions by other entities outside the jurisdiction of the refuge, or a combination of both. After these investigations, if it is determined that there is management potential to restore habitats conducive for sage-grouse, refuge managers could work with all partners and interested stakeholders to restore high quality habitats.

Management Techniques for Refuge Managers

Refuge managers could consider the following options in managing for sage-grouse. Options are based on current literature and management recommendations (Connelly et al. 2000). Managers should consider individual refuges in the context of the sagebrush ecosystem, and sage-grouse distribution and life cycle needs. For example, refuge habitats may only provide an important component of sage-grouse habitat needs during one season with sage-grouse occupying off refuge habitats during other seasons. Working closely and in collaboration with neighbors, other land managers, and staff with the Service's Partners for Fish and Wildlife Program will be critical to maintaining healthy sage-grouse populations and reducing potential negative impacts (USFWS 2010). A thorough understanding of the refuge's management capabilities, based upon abiotic and biotic features, is a necessary component in developing a management strategy for sage-grouse in the refuge's habitat management plan (Service Policy 620 FW 1). All of the techniques described below may not be appropriate and/or compatible on all refuges.

Call-Out Box #2

A refuge providing winter refugia

In the winter of 2011, the Charles M. Russell NWR (National Wildlife Refuge) provided relief from an extreme winter event for much of the Canadian population of sage-grouse when heavy snow made sagebrush inaccessible. Typically, this migratory population of sage-grouse winters on lands administered by the Bureau of Land Management in Northern Montana, but in 2011 the extreme snowpack buried much of the sagebrush thereby, covering their food source. The approximately 300 birds traveled an additional 40 miles to Charles M. Russell NWR where the sagebrush was of taller stature and more available. During this 80-year winter event, the wildlife refuge saved this population of sage-grouse (USFWS 2011a).

Grazing (Including Fencing and Water Developments)

Sage-grouse and wild ungulates (bison, moose, elk, deer, and pronghorn) evolved together and it is believed that grazing by wild ungulates does not negatively impact sage-grouse populations (USFWS 2010). However, an understanding of wild ungulate population levels and associated herbivory is necessary in developing a management plan, as the diets of species such as pronghorn largely overlap with sage-grouse. Careful consideration of these possible conflicts caused by localized excessive herbivory and the ability to manage wild ungulate populations at appropriate levels where applicable and achievable, will be necessary to benefit sage-grouse populations.

While grazing by domestic livestock has been shown to have negative impacts to sagebrush; properly managed grazing was not considered a reason for listing sage-grouse under the ESA (USFWS 2010). Impacts from grazing occur at varying scales and determining impacts from grazing are difficult to determine (USFWS 2010). Grazing by domestic livestock can directly remove herbaceous cover and reduce plant height which has been shown to decrease nest success, and have mixed results on brood survival (Connelly et al. 2011). Grazing can also directly reduce sagebrush height and canopy cover which is a necessary component during the fall and winter season. However, grazing has been shown to improve sage-grouse conditions under very specific conditions (Evans 1986, Klebenow 1981).

When developing a habitat management plan refuge managers should consider the Service's Biological Integrity, Diversity, and Environmental Health Policy (601 FW 3) which states *"…livestock grazing, haying, and other extractive activities are permissible habitat management practices only when prescribed in plans to meet wildlife or habitat management objectives, and only when more natural methods, such as fire or grazing by native herbivores, cannot meet refuge goals and objectives..."* The refuge's habitat management plan should specify when management tools, such as grazing by domestic livestock, are needed, however the use of prescribed fire should be limited (see discussion below).

When developing a habitat management plan refuge managers should first have an understanding of current habitat conditions and prior grazing history to determine a baseline

Call-Out Box #3

Owl Mountain Partnership

The Owl Mountain Partnership is a coalition of local government agencies (approximately 8) and private sector stakeholders implementing an on-the-ground partnership in north central (North Park), Colorado. The Partnership, by identifying land health as its common ground, has brought diverse interested parties to the same table. Included in this partnership is the Arapaho National Wildlife Refuge which has provided staff time and expertise to implement projects.

Furthermore, one of the most successful projects the refuge has assisted with, is partnering with neighboring ranchers who graze on lands administrated by the Bureau of Land Management or U.S. Forest Service, and allowing them to graze on the refuge while rangeland in others areas can rest. This allows the ecosystem as a whole to benefit and thereby increasing habitat conditions for local sage-grouse populations.

assessment. Managers could investigate soil types, precipitation trends, plant composition, and historic livestock consumption [by animal-unit-months (AUMs)] to assess the management potential of a site and what historic (pre-European settlement) conditions existed. Second, managers should determine if grazing by domestic livestock will have a negative, null, or positive impact to sage-grouse by working in close coordination with state managers and grazing partners. A goal of achieving minimal to positive impacts to sage-grouse, while helping to maintain working landscapes is desired. This step must consider the impacts of the potential for decreased water infiltration, increased soil compaction, direct livestock-sage-grouse interactions (trampling), and increased expansion of invasive species such as cheatgrass (*Bromus tectorum*) from livestock grazing (USFWS 2010). Third, if grazing is determined by the habitat management plan to be a management tool that will have beneficial impacts to sage-grouse, refuge managers should continue coordination with stakeholders and grazing partners to develop a grazing plan. This plan should clearly identify the objectives and strategies necessary to achieve the goal of improving sage-grouse habitat. Habitat goals as outlined in the refuge CCP could also be carefully considered and incorporated into the habitat management plan.

Fourth, managers should be aware of the impacts of rangeland management infrastructure such as fences and water developments. Collisions with fences by sage-grouse has become increasingly documented in the literature with researchers noting some fences with 11.7 sage-grouse strikes per mile of fence and an additional 3.6 strikes per mile by other avian species in high quality sage-grouse habitat (Christiansen 2009). Marking of fences with vinyl siding with high visibility tape attached has been shown to decrease sage-grouse impacts by up to 70 percent. Further research is needed as detectability of sage-grouse mortality can be difficult to estimate (Christiansen 2009; Stevens et al. 2011). While each fence is different and may pose no direct ability to cause mortality, consideration of fence movement could occur. It is recommended that fences be placed: 1) away from areas with high sage-grouse use; 2) ridge-tops; 3) flat areas; 4) >2km away from leks; or 5) in areas with already high fence density (> 2.6km of fence per 259ha) (Stevens 2011). Fences provide predator perches, create the potential for predator corridors, and increase habitat fragmentation. The use of temporary fencing may be an alternative to more permanent type fences, but consideration of direct mortality must be considered as well.

Water developments for livestock do allow for increased management of livestock distribution and use; however detailed planning must occur to decrease impacts to sage-grouse. Water developments have the potential to degrade natural hydrology and congregate livestock in areas that sage-grouse may be heavily dependent upon, at the same time. This is especially evident during late summer when sage-grouse use more mesic sites for invertebrates, forbs, and water intake, while livestock are also using these areas. This directly results in altered plant communities and increases the potential for negative impacts to sage-grouse. Water developments also have the potential to increase conditions conducive for mosquito breeding. Mosquitos are documented vectors of the West Nile virus which is covered in more detail below. Water developments are not necessary for sage-grouse management, but if used for livestock management, they could be placed in areas that reduce overlapping resources, and planned to have: steep banks to reduce shallow water with submerged vegetation; be lined with crushed rock; have wildlife escape ramps in place, and do not provide predator perch sites (Doherty 2007).

Finally, grazing and habitat alteration by feral horses and burros (e.g., Sheldon NWR) needs to be carefully considered when developing a habitat management plan. While the Service is striving to remove feral horses and burros from Sheldon NWR and other refuges where periodically found in accordance with federal regulations (50 CFR 30.11), their impact on habitat condition needs to be addressed.

Invasive Plant Species

Invasive and other nonnative species have the potential to significantly impact sage-grouse throughout their range. There are numerous plant species that present problematic issues for sage-grouse management including leafy spurge (*Euphorbia esula*), yellow starthistle (*Centaurea solstitialis*), spotted knapweed (*Centaurea maculosa*), diffuse knapweed (*Centaurea diffusa*), and other knapweed species (*Centaurea* spp.). These species, although presenting negative impacts to sage-grouse, are usually localized in occurrence and do not present a rangewide impact.

Nonnative grasses such as cheatgrass and medusahead (*Taeniatherum asperum*) are highly adaptable and able to proliferate at levels unmatched by typical sagebrush ecosystem plants. They have the ability to reduce fire return intervals, alter nutrient cycling, hydrology, and out-compete and replace native plants (USFWS 2010). They are usually found in disturbed sites,

along roadsides, powerline and pipeline corridors, or in overgrazed sites. They also do not provide quality sage-grouse habitat or are a viable food source. They could be managed to prevent establishment first, spot treatment of small areas second, and restoration of monotypic stands of cheatgrass and medusahead last, as treatment methods have at best been experimental to date. Methods of treatment have consisted of defoliation by grazing, pathogenic bacteria, other bio-controls, prescribed fire, and herbicides (USFWS 2010). All of these treatments carry inherent risks from increasing unknown organisms into the environment, directly killing sage-grouse with improperly applied herbicides, or actually increasing the invasive plant species vigor with fire. Treatment options should be chosen carefully and with contingency plans in place.

The other plant species that have been documented to negatively impact sage-grouse populations are pinyon-juniper stands (*Pinus edulis* and *Juniperus* spp.). Pinyon-juniper is a native habitat type throughout sage-grouse range, but has increased 10-fold since European settlement and has caused the loss of many bunchgrass and sagebrush-bunchgrass communities (USFWS 2010). This expansion has been the result of altered fire regimes, introduction of livestock grazing, climate change, and natural recovery from past disturbances (USFWS 2010). Encroachment and establishment of pinyon-juniper stands directly replaces or degrades sagebrush communities which decreases sage-grouse use. Furthermore, pinyon-juniper stands create perch sites for avian predators and provide predator concealment habitat. To date, management of pinyon-juniper stands by mechanical, herbicide, or burning methods has shown minimal positive impacts on sage-grouse. However, sage-grouse avoided pinyon-juniper stands before treatment and many of the post-treatment studies have only assessed short-term (<5 years) responses. It is reasonable to assume sage-grouse will show positive responses to pinyon-juniper treatments over time, but further research is warranted to investigate this interaction (Doherty et al. 2008; USFWS 2010). Similar to annual grasses, best management practices could consist of managing pinyon-juniper to historic conditions with annual monitoring and removal of encroachment stands. The use of prescribed fire and its impacts for management of pinyon-juniper stands is discussed below.

Fire

Fire has been documented as one of the primary factors linked to declines of sage-grouse populations (USFWS 2010). Fire has the ability to directly reduce or eliminate healthy sagebrush stands and greatly increase the presence and persistence of invasive species such as

cheatgrass. Recent research has shown that fire suppression has had little effect on fire in sagebrush ecosystems and instead, cheatgrass, human-induced fires, and global warming may have led to too much fire (Baker 2011). Historically, sagebrush recovers within about 35–120 or more years after fire. Fire rotation in other ecosystems is 2 or more times the recovery period. This suggests fire rotations may be a minimum of 325–450 years in low sagebrush (*A. arbuscula*), 100–240 years in Wyoming big sagebrush, and 35–100 years in mountain grasslands with a smaller sagebrush component (Baker 2006). Therefore, to aid sage-grouse populations, fire should be excluded where there is a threat of cheatgrass. In sites without the presence of cheatgrass, fire does not need to be reintroduced until native understory plants can be restored, so that sagebrush ecosystems can fully recover from fire. It is encouraged to only use mechanical means to manage pinyon-juniper stands as the risk of cheatgrass expansion is much lower than prescribed fire. However, prescribed fire could be conducted when there is a healthy understory of native plants, no presence of cheatgrass, and prescribed fire is the only way to achieve the management objectives. In the event of a wildfire, it is recommended to use resource advisors to consider the location of sage-grouse habitat when developing suppression objectives and strategies; and to inform firefighters of the high value of sage-grouse habitats.

The use of prescribed fire in riparian or mesic areas can increase grass and forb vigor; reduce litter and sagebrush densities; and release necessary nutrients for mesic plants into the soils (Baker 2011). However, riparian areas important for sage-grouse are typically nearby sagebrush stands. Therefore, these areas would have experienced similar fire rotations as the sagebrush uplands. If there is a biological reason documented in a habitat management plan that fire is necessary in a riparian area, care should be taken to reduce impacts to nearby sagebrush stands and reduce the chance of increasing invasive species.

Partnerships

Successful restoration and management of viable self-sustaining sage-grouse populations will have to be the result of partnerships throughout their range. Sage-grouse are a landscape species occupying extensive areas that often extend into multiple jurisdictions. Although a refuge may provide many of the necessary life cycle components, sage-grouse likely use habitats and features off-refuge. Furthermore, refuges may provide a habitat characteristic (taller healthy sagebrush) that may only be needed during extreme weather conditions with sage-grouse travelling large distances to use those characteristic habitats for a short duration. Therefore, it is

important for the stakeholders at the population level, or even the MZ level to have consistent management goals and an understanding of how each play a role in conserving sage-grouse.

Comprehensive Conservation Plans (CCP) are land use management plans that are being developed, or are developed, for each refuge as mandated by the National Wildlife Refuge System Improvement Act of 1997. The process of developing a CCP is designed to involve public input to the extent possible. Refuge managers are encouraged to bring experts and stakeholders to the table to develop a CCP with objectives and strategies that will not only benefit wildlife and plant species of the refuge, but also demonstrate proactive measures others could use in their land use planning. Refuge managers must also play a part and become active in other land use planning efforts such as:

Call-Out Box #4

Service's Partners for Fish and Wildlife Program Helps Fund 13 of 24 New Positions

The Service's Partners for Fish and Wildlife Program has partnered with the Natural Resources Conservation Service (NRCS) Sage Grouse Initiative (SGI) to provide matching funds to hire 24 new range conservationists and wildlife biologists, strategically located in areas of high sage-grouse abundance or core areas; where technical assistance was limiting conservation implementation.

Totaling $12.9 million, NRCS increased technical assistance to accelerate Initiative delivery and success by combining NRCS resources with the Intermountain West Joint Venture (IWJV) and those of 34 other conservation partners. The IWJV orchestrated and now manages this massive partnership in cooperation with partners including state fish and wildlife agencies, non-governmental organizations, BLM and Forest Service, corporations, conservation districts, and the Partners Program. New positions are supervised by non-federal partners and housed in USDA service centers for 5 years.

- BLM's Resource Management Plans (RMP) for each field office
- BLM's National Greater Sage-Grouse Planning Strategy which will revise and modify multiple RMPs;
- U.S. Forest Service's Forest Management Plan for each ranger district;
- Individual State wildlife action plan or specific sage-grouse conservation plan;
- The Western Association of Fish and Wildlife Agencies' Comprehensive Conservation Strategy (Stiver et al. 2006);

The Natural Resources Conservation Service recently began a rangewide Sage-Grouse Initiative designed to assist private landowners rangewide. Refuge managers, along with the Service's Partners for Fish and Wildlife Program should take a proactive approach to assist the Natural Resources Conservation Service and private landowners with conservation plans and action items of their own that can benefit sage-grouse.

Research will also continue to play an important role for sage-grouse conservation and refuge managers are encouraged to continue partnering with universities and other research entities to learn more about sage-grouse ecology, habitat requirements, responses to habitat treatments, and impacts from anthropogenic features on the landscape.

Predator Management

Management for sage-grouse by directly removing predators is generally viewed as proactive measure, especially by the general public. Predator control began with the expansion of livestock grazing with operators attempting to protect their herds by removing coyotes, red foxes and bobcats. Predator control via trapping, hunting, poisoning, or non-lethal means can provide some immediate short-term reprieve for sage-grouse, and may protect recently trans-located populations (Hagen 2011). However, sage-grouse have many different predators (>15) ranging from snakes, carnivores, felines, corvids, and raptors; none of which are solely dependent upon sage-grouse. Indirect interactions from predator control may also negatively impact sage-grouse and it has been shown that poor habitat conditions generally lead to increased predation (Mezquida et al. 2006; Bui et al. 2010). Sage-grouse have evolved with predators and are cryptic in color to aid in predator avoidance. Although sage-grouse have lower reproductive rates than other gallinaceous birds, their high annual survival suggests that they are well adapted to a wide range of predators (USFWS 2010). Therefore; predator management is typically not needed and can become intensive and fiscally exhaustive to manage with many of the predators re-occupying sites within two to three years after removal ceases (Hagen 2011).

To help maintain a correct balance of necessary predators in the ecosystem, refuge managers are encouraged to manage for healthy landscapes with few, to no, anthropogenic features. This can be accomplished by reducing habitat fragmentation caused by roads, fences, powerlines, pipelines, and any other habitat alterations (USFWS 2010). These features not only provide corridors for predators, but also perch points that can provide an advantage for avian predators.

Hunting

Hunting of sage-grouse has been a long and historic tradition gradually shifting from hunting out of necessity to trophy hunting with many hunters now simply hunting for taxidermy quality mounts (Reese and Connelly 2011). Similarly, the paradigm has gradually been shifting from the thought that hunting mortality of sage-grouse was compensatory in nature, to a view that hunting is a source of additive mortality and that more conservative hunting regulations may be required (Reese and Connelly 2011). The Service did not identify hunting as a factor to the population level decline, but cautioned that the present and threatened habitat loss coupled with disease outbreaks, such as West Nile virus, will require increased monitoring to assess hunting seasons on an annual basis and may require season closure if necessary (USFWS 2010). From 2001 to 2007 rangewide sage-grouse harvest varied from roughly 21,000 to 38,000 sage-grouse harvested annually (Reese and Connelly 2011). Currently 9 of 11 state wildlife agencies allow sage-grouse hunting; North Dakota and Washington do not have seasons. North Dakota closed its season in 2008 due to declining populations and it is currently still closed (Reese and Connelly 2011). Washington, which closed its season in 1988, has continued to experience a decline in sage-grouse populations. However, sage-grouse in Washington are highly dependent on altered sagebrush habitats (Conservation Reserve Program lands) which may provide insight into why their populations have continued to decline (Reese and Connelly 2011). Approximately half of refuges with populations of sage-grouse allow public hunting. Hunting is considered one the “big six” forms of wildlife dependent recreation under the National Wildlife Refuge System Improvement Act of 1997 and may be allowed where compatible (Service Policy 603 FW 2).

Hunting of sage-grouse on refuges must first be determined compatible under Service Policy 603 FW 2. If compatible, refuge managers should carefully consider if hunting of sage-grouse can occur, without negative impacts to sage-grouse at the population level. During the annual review of hunting plans for each refuge, habitat conditions impacting the population must be considered. Coordination with the respective state wildlife management on habitat conditions and population assessments will assist in these planning efforts. Directed research toward understanding that impact may be necessary. If sage-grouse hunting is allowed, season lengths and bag limits must protect sage-grouse populations which are generally done through conservative regulations and strict enforcement of those regulations. Hunting may also be

temporarily suspended at any time based on unusual or critical conditions of wildlife populations or habitat (50 CFR 32.1).

Disease

Sage-grouse are prone to various diseases with vectors including mallophaga, acarina, diptera, helminthes, parasites, bacteria, fungi, viruses, and nonparasitic diseases (see Christiansen and Tate, 2011 for an extensive list). There has been minimal research on diseases in sage-grouse [with the exception of the West Nile virus (WNv)]. It is believed that disease is not responsible for population level declines (USFWS 2010). However, monitoring of sage-grouse populations will need to continue to determine if outbreaks of these diseases (other than WNv) have, or are occurring (Christiansen and Tate 2011).

Most recently concern for sage-grouse has risen due to outbreaks of the WNv (Christiansen and Tate 2011; Walker and Naugle 2011). WNv generally results in acute mortality of sage-grouse with low resistance to the disease being documented (Walker and Naugle 2011). WNv is vector driven, transmitted by mosquitos (*Culex* spp.). These mosquitos occur throughout sage-grouse range and prefer to breed in sites with submerged vegetation, standing water, ephemeral puddles, vegetated pond edges, and hoofprints (Walker and Naugle 2011). Refuge managers should be aware of conditions that are conducive to breeding by WNv transmitting mosquitos and where possible, eliminate that potential.

Translocation

Translocation is generally viewed as experimental and not considered a viable strategy to restore extirpated populations of sage-grouse (Reese 1997). However in cases of translocating sage-grouse from one area to another for population supplementation, this could be accomplished in accordance with a specific and detailed plan developed in coordination with state wildlife agencies and health officials. This plan could take into account Service guidance (7 RM 12) for propagation and stocking. In addition, the area to receive trans-located sage-grouse must have habitat conditions at a landscape level that are conducive for sage-grouse, a capture and release plan to reduce impacts from predators, and a clear monitoring and assessment plan to determine success. Translocations that have been successful involved areas with suitable habitat conditions, were conducted during the breeding season, and before target populations have been extirpated (Baxter et al. 2008)

Restoration

With much of the sagebrush ecosystem being altered in some regard, restoration of habitats will be a critical component to the recovery and maintenance of sage-grouse populations. Pyke (2011) provides a very comprehensive overview of how to restore or rehabilitate sagebrush habitats and outlines five components for a successful restoration plan: 1) prioritizing sites at a landscape level; 2) verifying soil characteristics and implications of soil features; 3) comparing existing conditions to potential habitat conditions; 4) determining the current successional status of the site using state and transition models to guide management techniques; and 5) implementation of a monitoring plan. When developing a restoration plan, refuge managers could consider the context of the refuge in relationship to existing conditions and management actions by other management entities within the MZ. While the NWRS only accounts for 1% of the sage-grouse range, management actions and habitat conditions on refuge lands may have a substantial impact to local sage-grouse populations. Restoration and rehabilitation of habitats will play an important role in maintaining and improving conditions for sage-grouse.

Energy Development Best Management Practices

Energy development and associated infrastructure (powerlines, pipelines, etc.) are considered a significant risk to sage-grouse, particularly in eastern portion of their range (USFWS 2010). While there are currently numerous private holdings of mineral rights and energy leases with valid existing rights to development on refuge, the Service's mission and organic legislation, directs the agency to manage purposely for wildlife conservation. Refuges are not multiple use lands managed pursuant to the Multiple Use and Sustained Yield Act (1960), or the Federal Land Policy and Management Act (1976). Furthermore, federal regulations (43 CFR 3101.2) state "…*direct offers for oil and gas leases covering refuge lands shall be accepted and no leases covering such lands shall be issued except as provided in subsection 3100.2 (drainage) of this title. There shall be no drilling or prospecting under any lease heretofore or hereafter issued on lands within a wildlife refuge except with the consent and approval of the Secretary with the concurrence of the Service as to the time, place and nature of such operations in order to give complete protection to wildlife populations and wildlife habitat on the areas leased, and all such operations shall be conducted in accordance with the stipulations of the Bureau on a form approved by the Director*…" Under this premise, refuge managers should strive to manage strictly for wildlife species as described under each refuge's enabling legislation

and endangered, threatened, or candidate species such as sage-grouse. Working in coordination the Service's realty division and the BLM, withdrawal of outstanding, un-developed leases could be pursued to the extent possible.

In situations where a developer has existing legal rights to develop energy resources (oil, gas, or other minerals) in a refuge, it is Service policy to protect project resources to the maximum extent possible without infringing upon the rights of the sub-surface owner (Service Policy 612 FW 2). Each state has a regulatory oil and gas commission that regulates the development of mineral resources in that state. Proposals for development could be developed in coordination with the state oil and gas commission along with the BLM (where applicable). The Service recently completed a comprehensive environmental assessment on the Baca National Wildlife Refuge in south-central Colorado that provides an extensive list of protective measures required for oil and gas exploration that would be useful for refuge managers (USFWS 2011b). Some protective measures specific to sage-grouse could include, but are not limited to:

- reduce surface disturbance to extent possible by consolidating drill sites (e.g., directional and horizontal drilling) and access roads;
- use existing roads and well pads where plausible, or use oak matting for road and well pad construction to eliminate the need for new construction;
- use remote telemetry for well production to reduce physical operational visits by the producer;
- use surface pipelines to reduce surface disturbance;
- decontaminate and wash all vehicles before arriving to the site and on a regular basis to reduce the potential for introduction of invasive plant species;
- conduct soil testing before soil disturbing activities and require similar soil characteristics during reclamation;
- avoid crucial nesting, brood-rearing, or wintering habitats to the extent possible;
- use closed-loop drilling systems to minimize impacts to surrounding habitats and reduce other avian mortality caused by drowning;
- conduct drilling and maintenance operations during timeframes when sage-grouse are the least impacted or not occupying the site;
- restrict drilling operations to the smallest crew possible and prohibit littering, fires, overnight quarters, hunting, and excessive speeds by the operational crew;

- monitor and reduce lighting and sound levels to lowest level allowable; and
- protect groundwater from contamination by casing the essential aquifer.

Development of renewable energy (wind, solar, and geothermal) and associated infrastructure (powerlines and roads), which require a special use permit (SUP), has generally been considered incompatible with refuge management (Service Policy 603 FW 2). In addition, the effects of renewable energy development are likely similar to those of nonrenewable energy as similar types of infrastructure are required (USFWS 2010). Refuge managers are encouraged to work proactively with wind energy developers to identify sites off-refuge that will have the least impacts to all wildlife and plant species.

Monitoring and Assessment

Monitoring of sage-grouse populations should be accomplished with standardized protocols designed specifically for sage grouse (Reese and Bowyer 2007). Particularly, lek counts should be accomplished in coordination with the state wildlife agency's monitoring plan for sage-grouse. This should at minimum consist of counting leks 1) from one-half hour before to one hour after sunrise; 2) during conditions of light (<15km/hr) to no wind, in partly cloudy to clear conditions; 3) from early March to early May; 4) at least 3 times during a single visit, with 1-2 minutes between counts; and 5) with peak counts of males and females recorded separately (Reese and Bowyer 2007). Effort could also be placed in locating new or undiscovered leks as they may identify unknown areas of nesting habitat and affect other management actions. Identification and mapping of seasonal habitats on refuges and their relationship to off-refuge habitats will be an important component when developing a CCP and subsequent habitat management plan (Stiver et al. 2006).

Conclusion

The National Wildlife Refuge System is uniquely positioned to provide high quality sage-grouse habitats throughout the range by using the toolbox outlined above. Refuges should be at the forefront of sage-grouse and sagebrush conservation by managing for over landscape health and by providing an example to other land managers. Coordination and regular communications with stakeholders and other land managers will be crucial to maintaining viable populations. Refuge managers must continue to engage the Service's Partners for Fish and Wildlife Program and Ecological Services to continue to play a role in working with private landowners and other agencies throughout the range.

Supplemental Material

The supplemental material section contains references and Service policy statements we felt could be of particular interest and value to refuge managers. These could be used for more extensive research and guidance into sage-grouse ecology and management.

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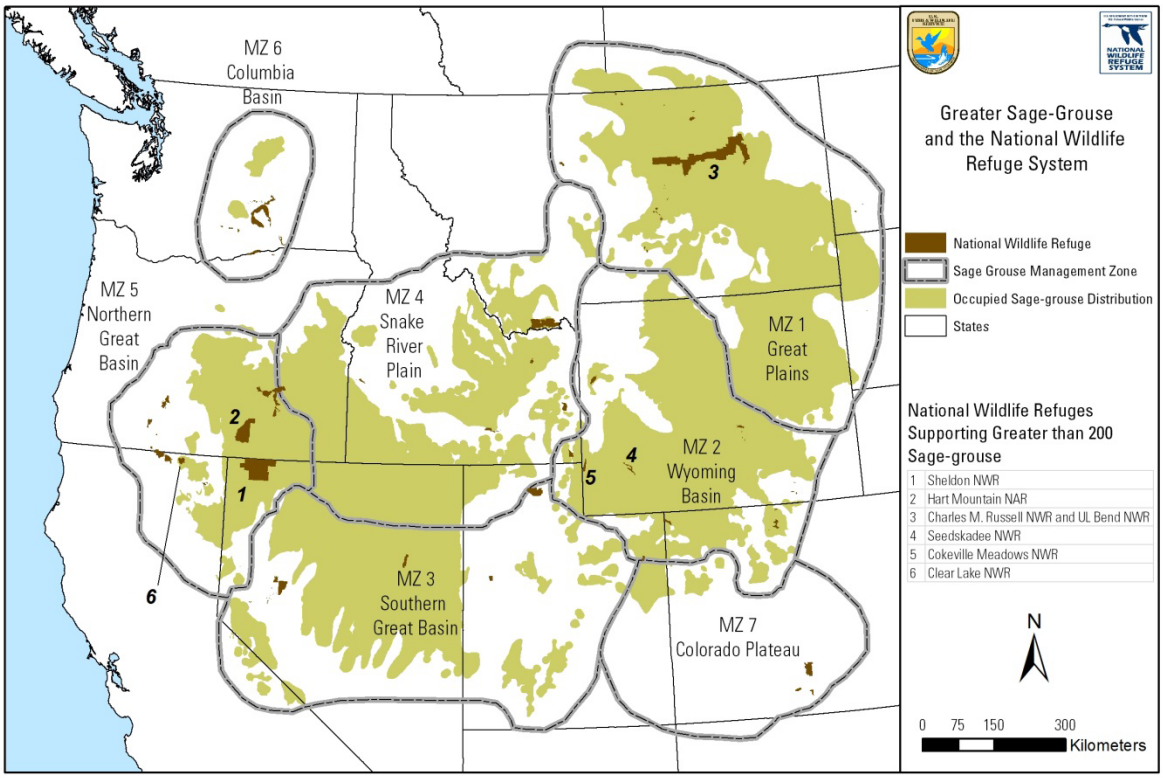
Table 1. List of National Wildlife Refuges containing sage-grouse habitats and their location.

Refuge	USFWS Region	State	Sage-grouse Present	Greater than 200 sage-grouse
Arapaho National Wildlife Refuge	6	CO	Yes	
Bear Lake National Wildlife Refuge	1	ID	No	
Black Coulee National Wildlife Refuge	6	MT	No	
Bowdoin National Wildlife Refuge	6	MT	Yes	
Browns Park National Wildlife Refuge	6	CO	No	
Camas National Wildlife Refuge	1	ID	Yes	
Charles M. Russell National Wildlife Refuge	6	MT	Yes	X
Clear Lake National Wildlife Refuge	8	CA	Yes	X
Cokeville Meadows National Wildlife Refuge	6	WY	Yes	X
Columbia National Wildlife Refuge	1	WA	No	
Creedman Coulee National Wildlife Refuge	6	MT	No	
Grays Lake National Wildlife Refuge	1	ID	No	
Halfbreed Lake National Wildlife Refuge	6	MT	Yes	
Hanford Reach National Monument	1	WA	No	
Hart Mountain National Antelope Refuge	1	OR	Yes	X
Hewitt Lake National Wildlife Refuge	6	MT	Yes	
Lake Mason National Wildlife Refuge	6	MT	Yes	
Lake Thibadeau National Wildlife Refuge	6	MT	No	
Malheur National Wildlife Refuge	1	OR	Yes	
Minidoka National Wildlife Refuge	1	ID	No	
Modoc National Wildlife Refuge	8	CA	No	
National Elk Refuge	6	WY	Yes	
Ouray National Wildlife Refuge	6	UT	No	
Pathfinder National Wildlife Refuge	6	WY	Yes	
Red Rock Lakes National Wildlife Refuge	6	MT	Yes	
Ruby Lake National Wildlife Refuge	8	OR	Yes	
Saddle Mountain National Wildlife Refuge	1	WA	No	
Seedskadee National Wildlife Refuge	6	WY	Yes	X
Sheldon National Wildlife Refuge	1	OR	Yes	X
UL Bend National Wildlife Refuge	6	MT	Yes	X
War Horse National Wildlife Refuge	6	MT	Yes	

Table 2. Demographic information on the six National Wildlife Refuges in relation to sage-grouse.

Refuge	Population Estimate	Seasonal Habitats Present	Grazing by Domestic Livestock	Hunting of sage-grouse	Open to Mineral Entry	Sage-grouse a Focal Species in CCP
Sheldon NWR	3,000	All	No	Yes	A portion	Yes
Hart Mountain National Antelope Refuge	2,000	All	No	No	No	Yes
Charles M. Russell and UL Bend NWRs	1,000	All	Yes	Yes	No	Yes
Seedskadee NWR	500-1,000	Primarily brood-rearing and early winter	No	Yes	Where leased	Yes
Cokeville Meadows NWR	200-300	Nesting, brood-rearing, and early winter	No	No	Mineral leases primarily privately owned	Yes
Clear Lake NWR	200	All	Yes	No	No known valuable mineral interest	Yes

Figure 1. Locations of National Wildlife Refuges in relation to occupied sage-grouse range (Schroeder et al. 2004) and management zones (Stiver et al. 2006). Refuges supporting more than 200 sage-grouse are identified.



Supplemental Material

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