

Final

Candidate Conservation Agreement with Assurances

for

Sagebrush Steppe Assemblage

Greater Sage-grouse (*Centrocercus urophasianus*)

Sagebrush Sparrow (*Artemisiospiza nevadensis*)

Brewer's Sparrow (*Spizella breweri*)

Sage Thrasher (*Oreoscoptes montanus*)

and

Shortgrass Prairie Assemblage

Black-tailed Prairie Dog (*Cynomys ludovicianus*)

Mountain Plover (*Charadrius montanus*)

Burrowing Owl (*Athene cunicularia*)

Ferruginous Hawk (*Buteo regalis*)

with integrated

Candidate Conservation Agreement

and

Conservation Agreement

Developed in partnership by

Thunder Basin Grasslands Prairie Ecosystem Association
U.S. Fish and Wildlife Service

February 8, 2017

Executive Summary

The Thunder Basin Grasslands Prairie Ecosystem Association (Association) provides private landowner leadership to develop responsible, science-based approaches to long-term management of member's lands. Established in 1999, the Association began proactively implementing Conservation Measures in 2001¹ and was incorporated as a non-profit organization in 2002. At present, there are 24 ranch, 1 oil and gas, and 14 coal members that encompass almost 1.2 million acres of lands to be prospectively enrolled.

The Association has developed a Conservation Strategy (Strategy) intended to purposefully place conservation effort within the Coverage Area where it is most likely to achieve durable conservation benefit. In addition to Conservation Measures consistent with the US Fish & Wildlife approved *Greater Sage-grouse Umbrella CCAA for Wyoming Ranch Management* (Statewide CCAA), the Strategy also addresses the multiple threats, including energy development, identified in the final report of the Greater Sage-grouse Conservation Objectives Team (COT). In contrast to the Statewide CCAA, the Strategy incentivizes measures of greatest conservation value; placing those conservation measures in the Coverage Area regardless of surface ownership. Recognizing threats associated with multiple land uses, including split estate mineral rights, the Strategy goes beyond grazing management to explicitly address the likelihood of energy development within the Coverage Area. The Association believes that this comprehensive ecosystem-based approach represents the best opportunity to achieve conservation of at-risk species within the Coverage Area. The fee structure of the Association, and its ability to provide financial assistance, ensures the availability of funding to implement Conservation Measures into the future.

The Association proposes to address landscape conservation in the context of two primary ecotypes and their associated at-risk species. These species assemblages consist of the following: within the sagebrush steppe ecotype, the greater sage-grouse (*Centrocercus urophasianus*), sagebrush sparrow (*Artemisiospiza nevadensis*) (i.e., formerly the sage sparrow, *Amphispiza belli*), Brewer's sparrow (*Spizella breweri*), and the sage thrasher (*Oreoscoptes montanus*); and, within the shortgrass prairie ecotype, the black-tailed prairie dog (*Cynomys ludovicianus*), mountain plover (*Charadrius montanus*), burrowing owl (*Athene cunicularia*), and ferruginous hawk (*Buteo regalis*).

Implementation of the Strategy is directed by three integrated conservation agreements consisting of this Candidate Conservation Agreement with Assurances (CCAA) for private property with no federal actions; a Candidate Conservation Agreement (CCA) for property where Covered Activities will be carried out that require a federal permit or other authorization; and a Conservation Agreement (CA) which addresses conservation efforts and Covered Activities associated with foreseeable energy development within the Coverage Area that may in the future involve a federal permit or other authorization. This Coverage Area encompasses five northeastern Wyoming counties and a 10-mile wide area to the west and south of: Campbell, Converse, Crook, Niobrara, and Weston along with two peripheral properties as identified by the Association prior to January 31, 2013. An interagency Memorandum of Understanding (Interagency MOU) among the federal, state, and private participants communicates the Strategy and defines their respective responsibilities.

Sagebrush and shortgrass prairie habitats are becoming increasingly degraded and fragmented due to the impacts of multiple threats. Within the Powder River Basin area, the COT report identified the following threats as present and widespread: non-native invasive plants, nonrenewable and renewable energy development, inappropriate grazing management, infrastructure (roads, power lines, etc.), and recreation. Many of these threats could be exacerbated

¹ See Table 1, Section 1.5 for an inventory of conservation actions already implemented.

by effects of climate change, which may influence long-term habitat trends.

Through addressing the threats identified in the COT report as well as other threats of local importance, the Strategy intends to achieve demonstrable conservation of sagebrush steppe and shortgrass prairie ecosystems and the sensitive species dependent on these habitats. It is the goal of the Association to provide for the conservation of these habitats and species in the landscape context of on-going energy development, grazing, and range management. The Strategy explicitly addresses the possibility of Changed Circumstances (e.g., landscape fire, drought, disease, etc.). Procedures to address these circumstances are detailed in Section 10. It should be emphasized that property enrollment and subsequent conservation efforts are commitments that are entered into entirely on a voluntary basis.

Ranching and energy development dominate land use and local economies within the 13.2 million acre Coverage Area. Approximately 85 percent, or 11.2 million acres, of the land within the Coverage Area is held in private or state ownership while 15 percent, or 2.0 million acres, of the surface lands are held by federal agencies. Approximately 90 percent, or 11.9 million acres, of the area is used for agriculture with about 87 percent, or 11.5 million acres, used as rangeland and the remaining 3 percent, or 0.4 million acres, used for crop production. Estimated total agricultural revenue² in 2012 was \$252 million.

The Coverage Area contains substantial reserves of coal, oil, and natural gas. During 2011, the coal mines in the five-county area produced over 426 million tons of coal (approximately 39 percent of coal mined in the United States), while employing over 6,160 people. Estimates as of 2008 suggest that the Gillette Coalfield may encompass 77 billion tons of recoverable coal. In 2011, coal-based revenue contributed approximately \$1.97 billion to federal, state, and local governments. As of 2009, the US Geological Survey estimated Powder River Basin oil and non-coal bed natural gas resources to consist of 639 million barrels of oil, 16.6 trillion cubic feet of natural gas, and 131 million barrels of natural gas liquids. Uranium, bentonite, and clinker are also mined within the Coverage Area. Though active mining occurs within the Coverage Area, at present less than 1% of the Coverage Area (and less than 10% of the potential enrolled area) is unavailable for wildlife habitat due to mining operations.

Recognition of the rangewide loss and fragmentation of sagebrush steppe habitats has resulted in numerous concurrent efforts³ by local, state, and federal agencies to address the associated decline of greater sage-grouse populations. Consistent with the “sage-grouse core area strategy” communicated within the State of Wyoming Governor’s Executive Order (Wyoming EO 2015-4), and the Land and Resource Management Plans of the federal agencies, the Association has crafted the Strategy anticipating the inevitability of future energy development within the Coverage Area. The Strategy provides for the enrollment of properties where future occurrence of energy development is reasonably foreseeable, by allowing conservation efforts to be placed within the Coverage Area where they are most likely to achieve conservation benefits. Conservation efforts may thus be implemented off the enrolled property to achieve the desired conservation benefits.

Conservation emphasis will be placed on Conservation Priority Areas (CPA) within the Coverage Area (Appendix E). The Interagency MOU (Appendix H) establishes a Conservation Advisory Committee that will work collaboratively to

² Revenue is provided for Campbell, Converse, Crook, Niobrara, and Weston counties as available; sub-county economic information is not available.

³ Sage-grouse National Technical Team, Sage-grouse Conservation Objectives Team, State of Wyoming core area strategy, Greater Sage-grouse Umbrella CCAA for Wyoming Ranch Management, Wyoming 9-plan Land and Resource Management Plan amendments, NRCS Working Lands for Wildlife and Sage-grouse Initiative, among others.

identify these CPAs. These areas may extend across jurisdictional boundaries. The CPA for sagebrush steppe habitats is expected to include the six designated sage-grouse core areas and one connectivity corridor, as well as other suitable habitats in proximity to these areas where meaningful long-term conservation benefit is likely to be achieved. For shortgrass prairie habitats, these areas will likely consist of designated habitats occupied by the species or providing required habitat features within the Coverage Area.

The Strategy also provides details on how Conservation Measures will be apportioned relative to the CPA, land ownership, mineral estate, and likelihood of subsequent development of the mineral estate (Appendix E). For example, in the case where an enrolled property is within sage-grouse core area habitat, Conservation Measures would be implemented on the enrolled property with the intent of maintaining or improving long-term conservation value of those lands. Where an enrolled property is outside a CPA and where development of the federal mineral estate may occur, some pre-reclamation Conservation Measures (e.g., treatment of cheatgrass) may be appropriate for the enrolled property, but until reclamation is underway, conservation emphasis would be directed to other enrolled properties within or in proximity to CPA.

The Conservation Strategy utilizes a point system to value the benefit of the Conservation Measures that specifically address the identified threats to the Covered Species. Input on the Conservation Measures was obtained from various state and federal agencies, environmental NGOs, local experts, and the Association. The participants were asked to rank the value of each Conservation Measure to the applicable species and the likelihood that Participating Members would choose that Conservation Measure. The final point value or range of values was confirmed for each Conservation Measure by consensus of the group (see Appendix E, Section 2 for more details).

Considering available habitat and threats identified on each member's property, the Association will encourage each member to provide for a balance between the Sagebrush Steppe and Shortgrass Prairie Assemblages where possible (Appendix E, Section 4.4). The Association, with input from the Conservation Advisory Committee, will work with each Participating Member to select Conservation Measures. Participating members enrolling over 40 acres are required to implement Conservation Measures totaling at least 30 points per 50,000 enrolled Acres (or portion thereof - see Appendix E, Section 3.5, Table 2) for each CI or CI/CP (e.g., an enrollee may choose to treat invasive cheatgrass, remove infrastructure, mark fences, etc.). Twenty of those 30 points must address habitat fragmentation and destruction. Participating members enrolling 40 acres or less (Small Acreage Owners) are required to implement Conservation Measures totaling at least 30 points, with a minimum of 12 points addressing habitat fragmentation and destruction. A more complete example of how the point system would be implemented on a typical property can be found in Appendix F. Each member will implement at least five Conservation Measures which address the identified threats on their enrolled acres. In order to address the primary threat of fragmentation, all Participating Members must select a majority of their points from the Conservation Measures identified as addressing habitat fragmentation and destruction (see Appendix E, Section 4).

The Association has crafted the integrated CCA anticipating future energy development within the Coverage Area. While substantial privately held mineral estate does occur within the Coverage Area, 60 percent, or 7.9 million acres, of the sub-surface estate is held by the Bureau of Land Management (BLM). Based on the nature of surface and sub-surface ownership of this area, effective implementation of Conservation Measures will require consistent and compatible management across federal, private, and state properties. The integrated documents facilitate appropriate management across all land ownerships.

The Strategy offers an opportunity for property owners, including livestock/agricultural producers, energy companies, government and state agencies, and additional partners to voluntarily identify and implement

coordinated and collaborative Conservation Measures within the commingled surface and sub-surface landscape of northeastern Wyoming. For example, a member of the Association with private lands and a federal grazing lease would implement consistent Conservation Measures contained in a CCAA and CCA. Similarly, an energy company that is a member of the Association would be able to integrate management across both private lands and federal leases. While energy companies will implement Conservation Measures on lands they control, their effort will also be directed to offsite properties used primarily for livestock grazing. The off-property cooperative Conservation Measures implemented by energy companies will provide long-term benefits for the Covered Species in addition to those provided by impact minimization and habitat reclamation associated with the energy development process.

Where valid and existing rights to the mineral estate are currently in-place, this Strategy allows conservation benefit to be achieved where it otherwise would not. Voluntary participation by existing lease holders that are members of the Association may allow for the continued development of these existing leases while providing for conservation where it is most likely to achieve lasting benefit. Conservation effort may thus be implemented off the enrolled property to achieve the desired conservation benefit.

Where mineral development may occur in the future, the Association has crafted an integrated CA anticipating the inevitability of future energy development within the Coverage Area. The CA provides for the proactive implementation of Conservation Measures irrespective of acquisition of any future mineral lease. Conservation efforts will be implemented where they are most likely to achieve conservation benefit and will provide for consistent management of foreseeable future energy development.

All member coal companies are currently engaged in active mining in the area and participate in ongoing conservation efforts. Active mining includes lands being contemporaneously reclaimed; reclamation efforts correspond with fluctuations in mine production. In addition, these companies will continue to support voluntary, collaborative conservation efforts in advance of prospective mineral lease acquisition within the Potential Coal Development Area. Likewise, oil & gas companies will facilitate voluntary, collaborative Conservation Measures in anticipation of mineral lease acquisition within a comparable area.

Most of the lands included in the Potential Coal Development Area have already been highly fragmented by extensive coal bed natural gas (CBNG) development and historic conversion of sagebrush/grasslands to row crop production (see Figure 3 on page 19). After coal mining, required reclamation, and voluntary implementation of Conservation Measures, these previously disturbed lands will provide extensive, contiguous blocks of improved habitat for wildlife and livestock grazing. The Strategy will incentivize reclamation above and beyond the permit requirements and will result in additional conservation benefit that would not otherwise have occurred.

The proactive off-property Conservation Measures implemented by the CA participants will provide long-term benefits and may allow for the continued development of future leases. In addition, after a successful lease within the Potential Mineral Development Areas, these lands will be enrolled under the member's CCA coverage and additional Conservation Measures will be implemented. These proactive Conservation Measures have already been substantive and have preceded final signing of this Strategy. Over \$2.7 million has been invested by the Association and its members from 2003 to 2013 to protect or enhance existing habitat. For example, the Association has cumulatively treated over 35,000 acres for cheatgrass (*Bromus tectorum*) within sagebrush steppe habitats, on lands prospectively to be enrolled in the Strategy.

Consequently, participants to the Strategy will realize a significant degree of certainty that the Conservation Measures agreed to in the Certificate of Inclusion/Certificate of Participation and considered in the related US Fish

and Wildlife Conference Opinion, will substantially reduce the likelihood of additional land use restrictions and ensure, to the greatest degree possible, the continuity of existing operations in the event of a listing decision for any of the Covered Species under the ESA. With respect to the land management agencies, participation should:

- advance implementation of land management plan direction related to conservation of at-risk species
- allow for participation of the land management agencies in prioritizing conservation effort within the Coverage Area;
- Facilitate broad collaborative monitoring of landscape condition and sensitive species status.

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Dedication

In Memory of Betty Pellatz 1930-2013

“The Thunder Basin Grasslands Prairie Ecosystem Association Board of Directors hereby dedicates this CCAA/CCA/CA and its future implementation to our Chairman Betty Pellatz. It is truly a testament to her courage, strength of purpose, persistence and irrepressible spirit. We are humbled and honored to have served under her leadership and have been guided by her faith. Her vision is the beacon we follow as we look to the future.”

NOTE: All capitalized terms used in this CCAA are defined in Appendix I of this Strategy.

1 INTRODUCTION

1.1 Landscape Context

The Thunder Basin Grasslands Prairie Ecosystem Association (Association) is a non-profit organization which provides private landowner leadership in developing a responsible, science-based approach to long-term management of member's lands. Established in 1999, the Association was incorporated as a non-profit organization in 2002. Each member of the Association seeking coverage under this Strategy must be a Non-federal Property Owner within the five northeastern Wyoming counties of Campbell, Converse, Crook, Niobrara, and Weston. The area where coverage will be provided is outlined on the map shown in Figure 1.

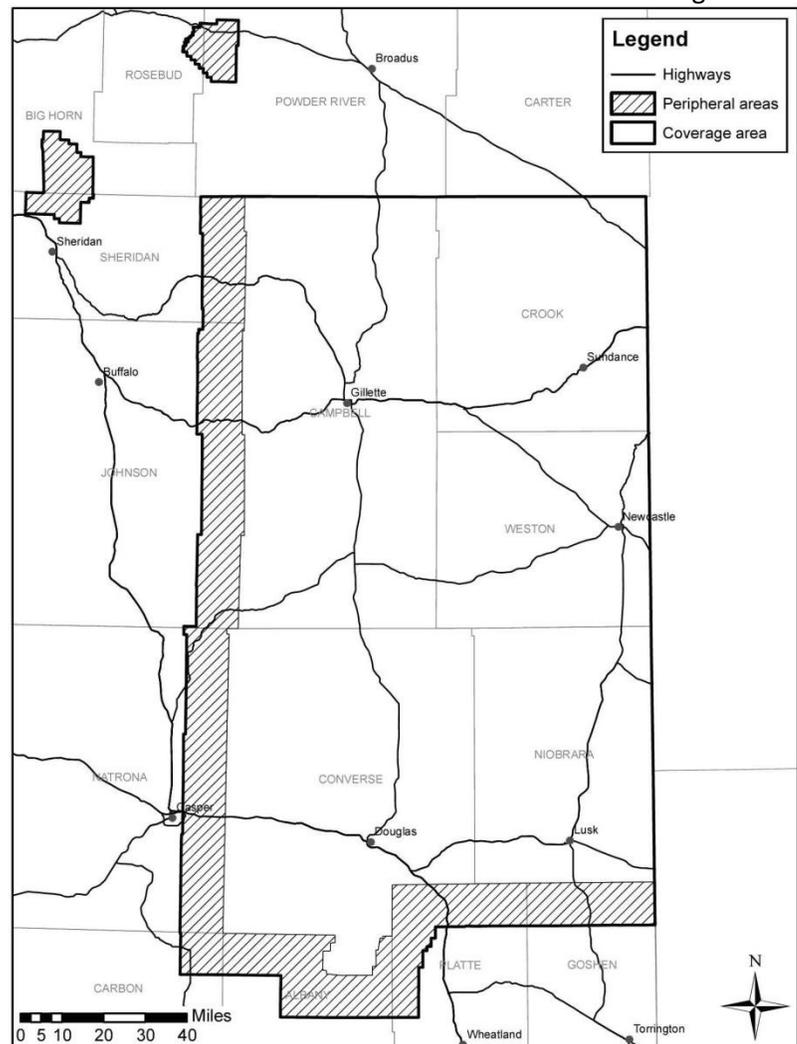
Ranching and energy development dominate land use and regional economies in the Coverage Area; approximately 85 percent of the land is held in private or state ownership. Current membership includes 24 livestock/agricultural producers and 15 energy companies (see Appendix G). All 15 energy companies have private land holdings within the Coverage Area and are currently engaged in production and reclamation activities.

The Association recognizes the need for consistent and compatible land management across all of the federal, private and state land ownerships within the Coverage Area. Acknowledging both the inter-relationships among private, state, and federal lands, and existing gaps in information, the Association has entered into an interagency MOU with the FWS, USFS, BLM, and WGFD which communicates the Strategy and defines their respective responsibilities (see Appendix H).

1.2 Implementation Overview, Strategy, and Goals

The Association has developed an incentives-based Conservation Strategy (Strategy) intended to purposefully place conservation effort within the Coverage Area where it is most likely to achieve

Figure 1



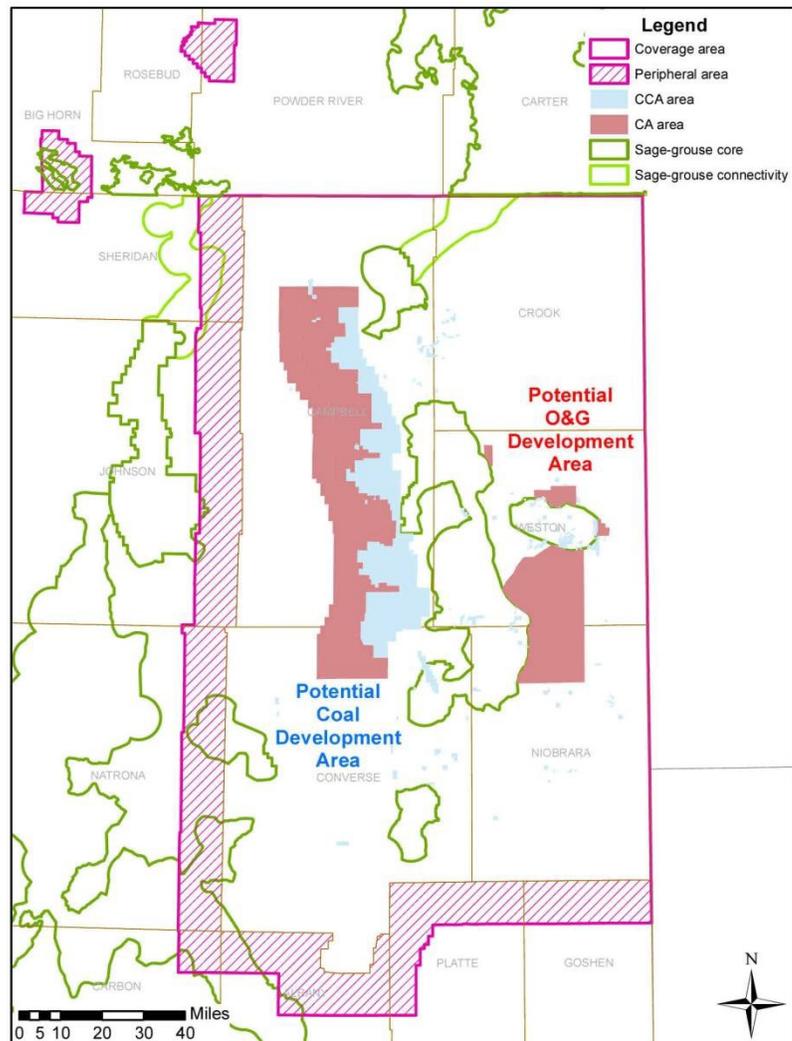
durable conservation benefit. Implementation of the Strategy is directed by integrated conservation agreements that follow. These consist of this Candidate Conservation Agreement with Assurances (CCAA) for private property, a Candidate Conservation Agreement (CCA; see Appendix A) for property that requires a federal permit or other authorization (surface or sub-surface), and a Conservation Agreement (CA; see Appendix B) that addresses conservation efforts associated with the foreseeable future development of energy resources that require a federal permit or other authorization within the Coverage Area. A map showing these areas, along with sage-grouse core and connectivity areas, is provided in Figure 2 (see Appendix B for more information about the Potential Coal and O&G Development areas).

Over the last ten years the Association has focused its efforts on addressing the habitat needs of species of concern within the Coverage Area in balance with the need for sustainable economic and social activities and preservation of cultural values. During the past six years, the Association has actively worked to facilitate and receive protection for its members through development of the Strategy with the U.S. Fish and Wildlife Service (FWS). Within this mixed ownership landscape, the Association proposes to address conservation in the context of two primary ecotypes and their associated at-risk species.

Eight species will be covered. Four are sagebrush obligates: greater sage-grouse (*Centrocercus urophasianus*; hereafter sage-grouse), sagebrush sparrow (*Artemisiospiza nevadensis*), Brewer's sparrow (*Spizella breweri*), sage thrasher (*Oreoscoptes montanus*); and four are shortgrass prairie species: black-tailed prairie dog (*Cynomys ludovicianus*), mountain plover (*Charadrius montanus*), burrowing owl (*Athene cunicularia*), and ferruginous hawk (*Buteo regalis*).

The primary objective of this Strategy is to achieve demonstrable conservation of these species and the ecosystems upon which they depend, in the landscape context of on-going energy development and range management. It should be emphasized that property enrollment and subsequent conservation efforts are commitments that are entered into entirely on a voluntary basis. A secondary objective is

Figure 2



for landowners to receive appropriate assurances against additional regulatory requirements should a Covered Species ever be listed under the Endangered Species Act of 1973, as amended (ESA).

The Conservation Strategy utilizes a point system to value the benefit of the Conservation Measures that specifically address the identified threats to the Covered Species. Input on the Conservation Measures was obtained from various state and federal agencies, environmental NGOs, local experts, and the Association. The participants were asked to rank the value of each Conservation Measure to the applicable species and the likelihood that Participating Members would choose that Conservation Measure. The final point value or range of values was confirmed for each Conservation Measure by consensus of the group (see Appendix E, Section 2 for more details).

Under this Strategy, the FWS would issue an Enhancement of Survival permit to the Association for the Covered Species and Covered Activities pursuant to Section 10(a)(1)(A) of the ESA to provide incidental take coverage if a Covered Species is listed to Non-federal Property Owners that conduct Covered Activities on their property that require no federal permit or other authorization. Subsequent Certificates of Inclusions (CI) or Certificates of Inclusion/Certificates of Participation (CI/CPs) will be issued by the Association to Participating Members contingent on the development of site-specific Conservation Measures. These individual voluntary agreements will be consistent with all activities and Conservation Measures identified in this Strategy and will describe each ownership and specific conservation practices that will be maintained or implemented on enrolled property to conserve, restore or enhance habitat for the species, as well as to reduce any unfavorable impacts to the species arising from the management and use of enrolled property.

1.3 CCAA Participation and Benefits

A CCAA is an agreement between the FWS and a participating Non-federal Property Owner who conducts Covered Activities on their land and voluntarily agrees to manage their lands to remove or reduce threats to species at risk of becoming listed as threatened or endangered under the ESA. In return, the Federal Government provides assurances by agreeing that, during the term of the permit or CI, it will not impose further commitments of resources or additional Conservation Measures from the participating Non-federal Property Owner if any of the Covered Species are ever listed under the ESA (“Assurances” further described in Section 9 of this document). CIs will be issued by the Association to members who voluntarily implement agreed-upon Conservation Measures for enrolled private lands where no federal nexus exists. For more information on how the Association will administer the CIs, see Appendix E.

The Participating Member will benefit from voluntarily enrolling in the CCAA in several ways:

- In the event a Covered Species becomes listed under the ESA, the Participating Member would receive assurances that implemented Conservation Measures and its Covered Activities would not change, ensuring continuity of operations.
- Participants will receive incidental take coverage for Covered Activities should any of the Covered Species become listed.
- The Participating Member may gain public relations benefits from their contribution toward conservation of the Covered Species.
- The Participant may benefit from the ability to consistently manage across federal and non-federal lands.

1.4 Advantages of a Landscape Scale, Multi-species Strategy

The efforts of the Association's livestock/agricultural producers and energy companies are inextricably linked and particularly well-suited to implement Conservation Measures across northeastern Wyoming. Either through direct ownership or arrangements of long-term leases, Association Members control an extensive land area that facilitates management on a landscape scale. The combination of members focused on livestock grazing and those members representing energy companies provide a unique synergy for implementing cooperative Conservation Measures to achieve enhanced habitat conditions for the Covered Species. While energy companies will implement Conservation Measures on lands they control, their effort will also be directed to offsite properties used primarily for livestock grazing. The off-property cooperative Conservation Measures implemented by energy companies will provide long-term benefits for the Covered Species in addition to those provided by impact minimization and habitat reclamation associated with the energy development process. The system of Conservation Measures included in this Strategy has been structured to provide incentives and mechanisms to facilitate these cooperative efforts and ensure these Conservation Measures are successful. This process encourages voluntary, cooperative Conservation Measures occurring on enrolled property across the landscape for the benefit of the Covered Species.

By working on a landscape scale, the Association seeks to maintain and enhance sustainable populations and associated habitat of the Covered Species in a manner that would remove the need to list the species as threatened or endangered.

Creating an environment in which existing livestock/agricultural producers, energy companies, and other participants are encouraged to continue their current operations and conserve habitat for the Covered Species is important to the long-term conservation of Covered Species populations and associated habitats. This approach offers an opportunity for property owners, including energy companies, government and state agencies, and additional partners to work together voluntarily to identify and implement Conservation Measures to preserve Covered Species populations and their habitats within the Coverage Area.

The area covered by this Strategy is home to eight species of concern including sage-grouse, Brewer's sparrow, sagebrush sparrow, sage thrasher, black-tailed prairie dog, mountain plover, burrowing owl, and ferruginous hawk. Recognizing the landscape-scale habitat needs of the sage-grouse in particular, the Association has created a strategic partnership among property owners in northeastern Wyoming. This partnership leverages livestock/agricultural producer and energy company resources by securing and enhancing Covered Species populations and appropriate habitats within a wide landscape (the Coverage Area covers approximately 17,000 square miles) through the enrollment of individual Non-federal Property Owners and CCA Participants who agree to meet the Strategy's conservation standards. In the future, the Association could expand this strategy to cover additional species of concern within this landscape. Additional species may be added after species-specific threats have been identified and appropriate conservation measures have been developed and formalized.

For the sagebrush steppe species, the Strategy builds upon the local and state-wide work done by the Northeast Wyoming Sage-grouse Working Group in 2006 which was later incorporated by the Sage-grouse Implementation Team into the Governor's Executive Order 2015-4 for Greater Sage-grouse Core Area Protection. In addition, range-wide conservation issues identified by the FWS 2010 listing

decision, Sage-grouse National Technical Team⁴ and the Sage-grouse Conservation Objectives Team⁵ were also addressed. These efforts provided the foundational guidelines for sage-grouse and sagebrush habitat conservation. For the shortgrass prairie species, pertinent listing decisions and species of concern documentation provided a basis for foundational guidelines. In addition to allowing for consistent and orderly implementation of a single set of Conservation Measures across all surface ownerships, the strength of this Strategy comes from identification and prospective implementation of Conservation Measures that not only incorporate the above guidelines but also include numerous Conservation Measures that are above and beyond those envisioned in these foundational documents. The Conservation Measures contained in this Strategy were developed after a thorough analysis involving both local and regional technical and scientific experts and are intended to meet the CCAA Standard for the Covered Species in northeastern Wyoming.

1.5 Previous Conservation Efforts

Since 2001, the Association and its members have undertaken a series of steps to remove or reduce the need for listing any of the Covered Species in northeastern Wyoming. These steps included conducting an in-depth assessment of current habitat conditions and wildlife populations in a 1 million acre pilot area which provided baseline information. The initial assessment was followed up with extensive vegetation monitoring and wildlife monitoring in selected locales to provide additional baseline information and support Adaptive Management strategies. The Association has also conducted a series of research studies to determine the relative benefits of fire, inter-seeding, selected grazing practices, and annual brome (cheatgrass) control—both independently and in various combinations—as management tools for northeastern Wyoming. In addition, the Association has successfully treated over 35,000 acres for cheatgrass control. Most of these efforts have been focused on protecting or enhancing occupied sagebrush habitat.

While all of the Association-sourced efforts have been designed to protect or enhance existing habitat of the Covered Species, points for these efforts have not been included in the Conservation Measure point system except for a few members who may choose to include projects initiated after January 1, 2006 as part of their Conservation Measures. If members choose to use post-2006 projects as part of their Conservation Measures, those projects must be the same as current Conservation Measures described in Appendices C and D. Points for previous conservation projects will be given based on the current performance monitoring criteria described in Appendices C and D. No points will be given for post-2006 conservation projects that are not identical to the Conservation Measures identified in Appendices C and D. In total, the Association has invested nearly \$2.8 million from 2001 to 2013 to protect or enhance existing habitat. To develop funding for these projects, the Association has worked with a wide range of partners including the Natural Resource Conservation Service, State of Wyoming, WGFD, National Fish and Wildlife Foundation, FWS, Sand County Foundation, Sonoran Institute, The Nature Conservancy, Wyoming Wildlife and Natural Resource Trust, BLM, USFS, Peabody Energy, Cloud Peak Energy Resources LLC, and Buckskin Mining Company among others.

In addition, all of the Association's members engaged in energy development have contributed to on-going research studies, habitat conservation projects, evaluation of habitat, and support of the Association's

⁴ Sage-grouse National Technical Team (2011)

⁵ US Fish and Wildlife Service (2013)

mission.

Table 1. Conservation Spending from 2001 to 2013

COT Threat Areas	
1 - Agricultural conversion	
2 - Conifer encroachment	
3 - Energy development	
4 - Fire	
5 - Free roaming equids	
6 - Grazing / range management	\$1,414,221.82
7 - Infrastructure	\$32,509.00
8 - Isolated / small population size *	\$362,749.92
9 - Mining	
0 - Noxious weed / Annual grasses	\$690,090.68
1 - Recreation	
2 - Sagebrush elimination	\$271,604.50
3 - Urbanization	
TOTAL through 2013	\$2,771,175.92

*denotes wildlife monitoring and sage-grouse collaring efforts to better understand species populations and habitat use.

1.6 Physical Landscape Setting

Located primarily in northeastern Wyoming, the Coverage Area is recognized as an ecologically significant landscape containing mixed and short-grass prairies and sagebrush ecosystems that supports numerous grassland and sagebrush obligate and associated species of concern. This area falls within Bailey's Temperate Steppe Division of the Dry Domain ecoregion⁶. Ecoregions are comprised of large areas of similar climate where ecosystems are present in predictable patterns. The defining characteristic of a dry climate is that annual losses of water through evaporation at the earth's surface exceed annual water gains from precipitation. As a result of this overall water deficiency, few permanent streams originate in dry climate zones. Dry climates are the most extensive ecosystem in the world, and occupy one-quarter or more of the earth's land surface.

Climate is typical of a semi-arid, high plains steppe environment with relatively large seasonal and diurnal variations in temperature. Recurring periods of extended drought, sometimes lasting several years, are not unusual. Summers are relatively short and warm, while winters are longer and cold. Away from the mountains, the mean maximum temperature in July ranges from 85 to 95° F⁷. January is typically the coldest month, with mean minimum temperatures ranging from 5 to 10° F. Freezes can occur early in the fall and late in the spring, producing a generally short (average 125 day) growing season. Sunshine dominates approximately 60 percent of winter days and about 75 percent of summer days. Spring and summer are the wettest months, although rainfall amounts are highly variable and can be very localized. Relative humidity ranges from 5 to 75 percent, depending on the season, with an average of 25 to 30 percent on the warmer summer days. The area is quite windy, with frequent periods of sustained winds from 30 to 40 miles per hour (mph) and regular gusts exceeding 60 mph.

⁶ Bailey (1998)

⁷ National Oceanic and Atmospheric Administration (2013)

Snow typically falls from November through May, with periodic accumulations of more than 10 feet in the mountains and more moderate levels of snowfall and accumulation at lower elevations. The low relative humidity, high percentage of sunshine, and high average winds all contribute to a high rate of evaporation across the area.

Precipitation occurs predominantly during the spring and fall, with approximately 10 percent in the form of snow. The average annual precipitation measured at the Gillette 4SE National Oceanic and Atmospheric Administration meteorological station located in the west-central portion of the Coverage Area was 15.67 inches⁸. May (2.67 inches) and June (2.69 inches) are the wettest months, while January (0.57 inch) and February (0.56 inch) are the driest. Snowfall averages 56.4 inches per year at the Gillette station, with the highest monthly averages occurring in March (10.4 inches) and April (8.4 inches). As is expected in a dry climate, average evapotranspiration of approximately 31 inches of water per year greatly exceeds annual precipitation⁹.

The majority of the Coverage Area is comprised of high plains and is part of the unglaciated Missouri Plateau subregion of the Great Plains province. The area includes most of the Powder River Basin which is both a geologic structural and a topographic drainage basin. The structural basin is an elongated, asymmetrical syncline approximately 120 miles east to west and 200 miles north to south. It is bounded by the Black Hills on the east; the Casper arch, Bighorn Mountains, and Hardin platform on the west; and the Hartville uplift, and Laramie Range on the south. The northern extent of the structural basin is the Miles City arch, Porcupine dome, and Bull Mountains in Montana¹⁰. The axis of the structural basin trends from the southeast to the northwest near the western margin of the syncline. The majority of the Coverage Area is located on the gently dipping eastern limb of the structural basin, with the geological strata in that area dipping gently to the west at 1 to 2 degrees toward the axis of the basin.

The Powder River Basin is drained by its namesake, the Powder River, although it is also drained by other major rivers. The Coverage Area is located in the headwaters of the Belle Fourche River (Middle and Upper Belle Fourche sub-basins), Cheyenne River (Angostura Reservoir, Antelope, Beaver, Dry Fork Cheyenne, Hat, Lance, Lightning, and Upper Cheyenne sub-basins), Little Missouri River (Upper Little Missouri sub-basin), Glendo Reservoir and Middle North Platte-Casper sub-basins), and Powder River (Little, Middle, and Upper Powder sub-basins) basins.

Broad plains, rolling hills, and tablelands dominate the landscape within the Coverage Area. Internally drained playas are common in the basin, as are buttes and plateaus capped by sandstone or porcelanite clinker (baked and fused rock resulting from in-place burning of coal deposits during the prehistoric era). Elevations throughout the area range from less than 3,200 feet to more than 6,400 feet above mean sea level. The major river valleys have wide, flat floors and broad floodplains. The drainages bisecting the basin are incised and typically are intermittent (do not flow year-round) or ephemeral (respond only to rainfall or snowmelt events) and, thus, do not provide year-round water sources.

The area is characterized by open high hills and sagebrush-grassland tablelands having intermittent

⁸ Ibid.

⁹ National Oceanic and Atmospheric Administration (1982)

¹⁰ Anna (2009)

escarpments. Many hills are bisected by drainages that create moderate variations in local relief. The overall topographic trend of hills is roughly northwest to southeast. Covered Species are generally found throughout the area except in the forested regions of the Black Hills.

1.7 Ownership and Control

Surface ownership of the Coverage Area includes 8.5 million acres in private ownership (79 percent), 841,000 acres owned by the State of Wyoming (8 percent) and 1.4 million acres owned by the Federal Government (13 percent). For the Federal Government, 799,000 acres are managed by the Forest Service (7 percent), 646,000 acres are managed by the BLM (6 percent), the Bureau of Reclamation (BOR) manages 19,000 acres, the National Park Service (NPS) manages 1,300 acres, and the Corps of Engineers (COE) manages 1,000 acres¹¹. Approximately 14 percent of the private land subject to this Strategy is adjacent to and often managed concurrently with federal lands within the Thunder Basin National Grassland. These federal lands are administered by the Spring Creek, Inyan Kara, and Thunder Basin Grazing Associations, acting as agents for the USFS. The subsurface estate is of mixed ownership as well including 4.8 million acres of private surface with federal mineral (45 percent), 3.7 million acres of private surface and private mineral (34 percent), 1.4 million acres of federal surface and federal mineral, 850,000 acres of state surface and mineral, and 24,000 acres of federal surface with private mineral.

1.8 Economic Base

Ranching and energy development (coal, oil and gas) dominate land use and local economies within the 13.2 million acre Coverage Area. Approximately 85 percent, or 11.2 million acres, of the land within the Coverage Area is held in private or state ownership, while 15 percent of the surface lands are held by federal agencies. Approximately 90 percent, or 11.9 million acres, of the area is used for agriculture with about 87 percent, or 11.5 million acres, used as rangeland and the remaining 3 percent, or 0.4 million acres, used for crop production. Estimated total agricultural revenue¹² for the Coverage Area in 2012 was \$252 million¹³. The ability to lease federal land for livestock grazing is important to this area economically and culturally, and in most cases is essential to the private ranchers.

The Coverage Area contains some of the largest surface coal mines in the world, primarily in the Gillette Coalfield, large reserves of oil, and natural gas (from both conventional reservoirs and coal beds). As of 2008, the United States Geological Survey (USGS) estimated that total recoverable coal resources in the Gillette Coalfield were about 77 billion short tons¹⁴. During 2011, the 12 mines in the area produced over 426 million tons of coal (approximately 39 percent of the coal mined in the United States) while employing over 6,160 people¹⁵. Wyoming coal production peaked in 2008. Powder River Basin production was 437 million tons in 2007 compared to 388 million tons in 2012. Workers employed by the coal industry earned \$81,700 on average (compared to the state-wide average of \$43,400) and coal-based revenue to federal state and local governments approximated \$1.97 billion.

¹¹ To date, no Association sponsored conservation projects have occurred on BOR, NPS, or COE lands.

¹² Revenue is provided for Campbell, Converse, Crook, Niobrara, and Weston counties as available; sub-county economic information is not available.

¹³ National Agricultural Statistics Service (2013)

¹⁴ Luppens et al. (2008)

¹⁵ Wyoming Mining Association (2012)

Bentonite, uranium, and clinker also are commercially produced in the Coverage Area¹⁶, though to a far lesser degree than the other resources discussed above. Layers of bentonite (weathered volcanic ash) of varying thickness are mined where they are near the surface, mostly along the eastern edges of the area. Most of the uranium resources currently in production or being developed are found in southwestern Campbell and northwestern Converse counties. Localized clinker deposits are mined throughout the area and are used for construction aggregate as well as a road treatment to provide traction during wet weather.

The Powder River structural basin is one of the richest petroleum provinces in the Rocky Mountain area. As of 2009, the USGS estimated the mean levels of undiscovered oil and non-CBNG resources in the Powder River Basin as 639 million barrels of oil, 16.6 trillion cubic feet of natural gas, and 131 million barrels of natural gas liquids¹⁷.

Conventional oil and natural gas (excluding CBNG) have been produced in the Powder River Basin for more than 100 years, with an estimated 500 fields producing oil or natural gas from oil-bearing strata during that period. Depths to conventional gas and oil-bearing strata generally range from 4,000 to 14,000 feet, although some early wells on the Basin margins were as shallow as 150 feet. CBNG wells are generally much shallower than conventional gas wells, typically less than 2,000 feet. CBNG is naturally occurring methane trapped by water pressure in the coal or by impermeable strata above it. In the Powder River Basin, this gas is primarily biogenic in origin and is generated by large, subsurface, naturally occurring microbial communities residing in the coal¹⁸.

1.9 Land Use

As indicated above, the Coverage Area supports the private enterprises of energy development and ranching. In addition, the general public uses the Thunder Basin National Grassland and Black Hills National Forest for a variety of recreational uses including, hunting, camping, off-highway travel, bird watching, photography, and rock hunting.

The Coverage Area contains approximately 20,600 square miles. Of this, approximately 2 percent is forest land which is not used by the Covered Species. Slightly less than 1 percent has been disturbed by coal mine development (note that these numbers do not include ancillary disturbances such as railroad tracks and access roads). However, due to contemporaneous reclamation techniques employed by the mines, almost half of the noted disturbance has been reclaimed or is in the reclamation process.

¹⁶ Wyoming State Geological Survey (2013)

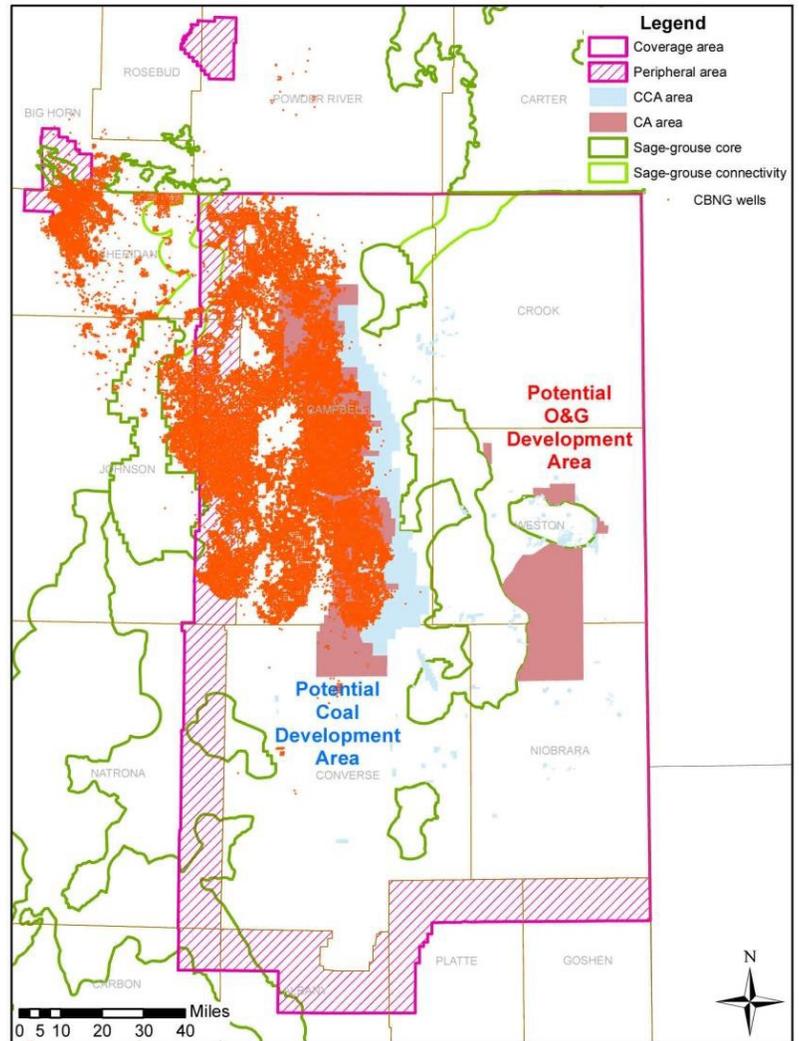
¹⁷ Anna (2009)

¹⁸ Ulrich and Bower (2008)

Extensive oil and gas development can be found throughout the Coverage Area, particularly in those areas where CBNG development has occurred. For example, most of the lands included in the Potential Coal Development Area have already been highly fragmented by CBNG development (CBNG wells are shown in orange on Figure 3). The Strategy will incentivize reclamation above permit requirements so that after coal mining, required reclamation, and voluntary implementation of Conservation Measures, these previously disturbed lands will provide extensive, contiguous blocks of improved habitat for wildlife and livestock grazing.

In addition, sod was broken on small parcels of land during the homesteading era—primarily the first three decades of the 20th century. Most of these disturbances have returned to some level of native vegetation, although some fields were planted to non-native grasses, such as crested wheatgrass, when farming ceased.

Figure 3



2 LEGAL AUTHORITY AND PURPOSE

Sections 2, 7, and 10 of the Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 *et seq.*, authorize the FWS to enter into this Strategy. Section 2 of the ESA states that encouraging interested parties, through federal financial assistance and a system of incentives, to develop and maintain conservation programs is a key to safeguarding the Nation's heritage in fish, wildlife, and plants. Section 7 of the ESA requires the FWS to review programs that it administers and to utilize such programs in furtherance of the purposes of the ESA. By entering into this Strategy, the FWS is utilizing its Candidate Conservation Programs to further the conservation of the Nation's fish and wildlife. Lastly, section 10(a)(1)(A) of the ESA authorizes the issuance of permits to "enhance the survival" of a listed species.

Consistent with the FWS's "Candidate Conservation Agreement with Assurances Final Policy" (64 FR 32726), the conservation goal of this Strategy is to protect and enhance the sage-grouse, sagebrush sparrow, Brewer's sparrow, sage thrasher, black-tailed prairie dog, mountain plover, burrowing owl, and ferruginous hawk habitat and populations on non-federal lands within the historic range of the species in northeastern Wyoming. This conservation goal will be met by giving the participating

landowners incentives to implement Conservation Measures in association with Covered Activities in exchange for regulatory certainty concerning land use restrictions that might otherwise apply should these species become listed under the ESA. These measures will also help support the goals of the Northeast Wyoming sage-grouse working group relating to long-term conservation and enhancement of the sagebrush steppe/mixed grass prairie complex in Wyoming¹⁹.

The overarching purpose of this combined Strategy is for the FWS, BLM, USFS, and WGFD to join with the Association to implement Conservation Measures for the Covered Species by preserving and enhancing habitat for these species, while reducing threats that are controllable within the defined Coverage Area.

Primary objectives of the CCAA are to:

- coordinate and implement conservation actions to reduce or eliminate known threats to the Covered Species within the Coverage Area,
- identify CPAs within the Coverage Area with input from the Conservation Advisory Committee,
- implement Conservation Measures where they are most likely to achieve lasting conservation benefit,
- support ongoing efforts, especially those of WGFD to establish or re-establish and maintain viable populations of the Covered Species in both ‘occupied’ and ‘suitable, but unoccupied’ habitats,
- encourage development and protection of suitable Covered Species habitat by giving Participating Member incentives to implement specific Conservation Measures (as described in their CIs), and
- provide assurances that neither additional Conservation Measures nor additional land, water, or resource use restrictions, beyond those voluntarily agreed to in the CI, will be required as long as members are in good standing (see Appendix E, Section 3.5).

For additional information on the purpose and objectives of the associated CCA and CA, see Appendices A and B, respectively.

3 RESPONSIBILITIES OF THE PARTIES

3.1 Participating Members

To obtain CCAA coverage, interested Non-federal Property Owners must be a member of the Association and must enroll their property by working with the Association to complete and submit a CI (see application process in Appendix E, Implementation Plan; see example CI/CP in Appendix F), which will address threats identified on a member’s property and include specific Conservation Measures that the member commits to implementing. An approved CI will provide regulatory certainty that the Covered Activities addressed under the Enhancement of Survival Permit associated with the CCAA could continue to be implemented if the species is listed, as long as the Conservation Measures in the CI are

¹⁹ Northeast Wyoming Sage-Grouse Conservation Plan (2006)

being implemented.

If a member who has enrolled in the CCAA so desires, they can also become a CCA or CA Participant by completing and submitting a Certificate of Participation (for more information see Appendices A, B, and F), which will include the specific Conservation Measures that the member commits to implementing. It is not possible to have only CCA or CA coverage.

Conservation Measures will increase the existing habitat value of the Coverage Area through the enhancement of habitat conditions and addressing threats to the Covered Species. This includes efforts to control invasive species, shrub and understory vegetation management, grazing management, and water resource management, among other measures (see all Conservation Measures in Appendices C and D). With respect to both federal and non-federal properties, the Participating Member agrees to implement Conservation Measures either on or off these properties as provided in the CI or CI/CP, consistent with the Conservation Strategy.

The Participating Member will:

- 1) Comply with the requirements of the CCAA as documented in the CI or CI/CP
- 2) Implement all Conservation Measures identified in the CI or CI/CP
- 3) Monitor as described in their CI or CI/CP
- 4) Report results of monitoring annually to the Association as described in their CI or CI/CP
- 5) Notify the Association of incidental take of Covered Species as described in Section 8.5

3.2 Association

Implement and administer this Strategy by:

- 1) Encouraging property owners within the Coverage Area to join the Association and participate in appropriate conservation efforts.
- 2) Encouraging Association Members to enroll their property in the CCAA through CIs when the property is occupied by or contains potentially suitable habitat for the Covered Species.
- 3) Encouraging Association Members to participate in the CCA through CI/CPs when areas they hold under a lease, license, or permit with a federal agency are occupied by or contain potentially suitable habitat for the Covered Species.
- 4) Encouraging Association Members to participate in the CA through CI/CPs when areas they may obtain under a lease, license, or permit with a federal agency within the reasonably foreseeable future, are occupied by or contain potentially suitable habitat for the Covered Species.
- 5) Working with appropriate land management / wildlife professionals and researchers to ensure that Conservation Measures remain current and incorporate appropriate best management practices.
- 6) Working with Participating Members to ensure CIs and CI/CPs include appropriate Conservation Measures. All applicable CIs and CI/CPs will include conservation strategies to ensure that rangeland health is maintained, especially during drought.
- 7) Continuing to support the management of lands as set forth in the Grazing Management Plans of the Participating Members.
- 8) Approving and signing CIs and CI/CPs utilizing the Conservation Measures detailed in Appendix C for sagebrush obligates and Appendix D for shortgrass prairie species. All CIs and CI/CPs will be available to the FWS and summarized in the annual monitoring report.

- 9) Being the primary party responsible for conducting monitoring activities as specified in this Strategy. (see Section 12, 13, and 14 in the CCAA and monitoring provisions in Appendices C and D).
- 10) Working with landowner members to ensure appropriate implementation of the provisions of their individual CIs and CI/CPs, including best management practices to avoid impacts to migratory birds.
- 11) Submitting an annual report to the FWS by March 15 of the following year that documents activities implemented under this Strategy, their effects on Covered Species, and effects of activities undertaken in prior years that require multi-year monitoring on Covered Species.

3.3 FWS

The FWS agrees to provide the following administrative and technical assistance to aid the Association in implementing the Conservation Measures, subject to authorization and availability of appropriated funds:

- 1) If the FWS determines that the CCAA meets issuance criteria, FWS would issue a permit to the Association, under section 10(a)(1)(A) of the ESA.
- 2) Review monitoring and other reports submitted by the Association to the FWS for compliance with the terms of the Strategy and associated CIs and CI/CPs.
- 3) Serve on the Conservation Advisory Committee (see Appendix E, Section 6.1 for membership), provide expertise on the management and conservation of the Covered Species, help to determine CPAs, provide assistance in developing and implementing CIs and CI/CPs, evaluate and process modifications or amendments (see Section 17), and provide assistance in coordinating implementation of this Strategy.
- 4) Conduct effectiveness and/or compliance monitoring when appropriate.
- 5) Help seek funding, if available, to achieve the Conservation Measures and implement monitoring and Adaptive Management activities outlined in the Conservation Measures given in Appendices C and D.
- 6) Provide technical assistance to the Association and Participating Members regarding migratory birds. This includes identifying potential impacts of the implementation of Conservation Measures during migratory bird nesting season and recommendations of best management practices to avoid impacts to migratory birds.

4 COVERAGE AREA AND COVERED ACTIVITIES

4.1 Coverage Area

The Coverage Area is the area defined within the Association's Conservation Strategy where Association Members may enroll their property. The Coverage Area will encompass approximately 13.2 million acres of private, state, and Federal property, spanning northeastern Wyoming and southeastern Montana. This Strategy applies to lands in the Coverage Area owned or beneficially managed by Participating Members or where Participating Members hold other property rights under a lease, license, permit, contract, or other instrument with a federal agency (e.g., grazing permit, oil & gas lease, coal lease, etc.). Association Members seeking coverage must be willing and able to conduct appropriate Conservation Measures on properties which lie within the Coverage Area.

Association members with energy development projects seeking coverage under this Strategy will be encouraged to conduct Conservation Measures on reclaimed areas either owned or under their

management control through the term of the Strategy and/or on those lands they own but are not scheduled for energy development. All Participating Members are encouraged to conduct or facilitate cooperative Conservation Measures in partnership with other member on properties within the Coverage Area.

Members engaged in livestock grazing and members developing energy resources provide a unique synergy for implementing cooperative Conservation Measures to achieve enhanced habitat conditions for the Covered Species. The system of Conservation Measures included in this Strategy has been structured to provide incentives and mechanisms to facilitate these cooperative efforts and ensure these Conservation Measures are successful. This process encourages voluntary, cooperative Conservation Measures occurring on properties across the landscape for the benefit of the Covered Species. When cooperative Conservation Measures occur, points credited to participating CI or CI/CP holders will be proportional to the resources provided by each partner. These particular areas and associated acres will be defined in signed agreements between the individual participant(s) and the Association and included as an attachment to the relevant CI(s) and/or CI/CP(s).

4.1.1 Qualifying Peripheral Enrolled Property

In addition, the Coverage Area includes two qualifying peripheral properties within portions of three counties in southeastern Montana, and additional qualifying peripheral properties within a 10-mile wide area spanning portions of seven additional counties located immediately west and south of the five-county block in Wyoming.

When the Association began determining the Coverage Area, Association Members desiring coverage outside northeastern Wyoming had to identify potential peripheral property by January 31, 2013. These properties had to be within 50 miles of the five-county area and had to have characteristics commensurate with those found within the five-county area, as demonstrated through vegetation and/or habitat baseline assessments. The Association and members conducted on-site visits and made initial determination of the similarity of peripheral acreage to the five-county area prior to June 15, 2013. To facilitate off-property conservation, the member with peripheral property has arranged for or ensured contemporaneous collaboration with agricultural property(s) in the general vicinity.

After February 1, 2013, only property within Wyoming, within 10 miles of the five-county area, and with minimal impact (e.g., ranch properties with appropriate grazing management) will be considered for peripheral enrollment.

4.2 Covered Activities

Covered Activities will be specified in each CI or CI/CP, as applicable. Covered Activities include the items set forth below and operations reasonably associated with the Covered Activities:

- 1) *General farm operations*: Cultivation of fields; planting, cultivation and harvesting small grain, seed and/or hay crops; irrigation by flooding or sprinklers; construction and placement of watering sources; installation, maintenance, and reconstruction of access roads, fences, and power lines; leasing of fee minerals; agricultural equipment operation; weed control; and construction and maintenance of farm houses (no subdivisions), outbuildings, fences and corrals.
- 2) *General ranching operations*: Grazing of forage; feeding hay and dietary supplements in feedlots and in pastures; calving and branding operations, including temporary penning of animals;

disposal of dead animals; construction and placement of watering sources; installation of access roads, fences, and power lines; gathering and shipping livestock; general stewardship and animal husbandry practices; leasing of fee minerals; and construction and maintenance of ranch houses (no subdivisions), outbuildings, fences and corrals.

- 3) *Recreation*: Participating Members' lands provide numerous recreational benefits for family members and guests, some of whom pay for recreational services by leasing hunting rights or through other mechanisms. For the purposes of this Strategy, the following land use, management and recreational activities are defined as "Covered Activities:" legal hunting and fishing, use of recreational vehicles both on and off established roads consistent with Conservation Measures agreed to in the member's CI or CI/CP, horseback riding, camping, and hiking.
- 4) *Oil and gas production operations*: Exploration, construction, operation and maintenance of oil and gas wells, including production facilities, gathering systems, waste water reservoirs, access roads, fences, power lines, and other ancillary activities necessary to produce oil and gas from federal, state and fee mineral leases.
- 5) *Surface/in-situ mining operations*: Exploration, leasing, construction, operation and maintenance of a surface or in-situ mine. This would include activities such as establishment and utilization of mine facilities; overstripping operations (including drilling and blasting); stockpiling overburden and topsoil; mineral removal (including drilling and blasting); backfilling; grading; establishment and utilization of drainage diversions, sedimentation ponds, waste water reservoirs, haul roads, fences, power lines, and railroads; environmental monitoring activities, reclamation of mined lands including animal husbandry, and other ancillary activities necessary to mine minerals from federal, state and fee leases and reclaim associated mined lands. For example, surface coal mining involves progressive sequencing of topsoil salvage, overburden removal, coal removal, backfilling and recontouring, topsoil reapplication, seedbed preparation and reseeding, and animal husbandry. The active mining process moves progressively through this sequence. Active mining includes lands being contemporaneously reclaimed utilizing direct haul of topsoil and fill material along with material from stockpiles. Reclamation efforts correspond with fluctuations in mine production.

5 SAGEBRUSH STEPPE ASSEMBLAGE

The parties to this Strategy recognized that an ecosystem assessment of the designated planning landscape was needed to ensure the most current knowledge of existing conditions across the landscape was available before they determined needed Conservation Measures. Data for the Thunder Basin Grasslands assessment was collected in 2003 through 2005, and the final report was published in 2008 by the Ecosystem Management Research Institute. This assessment has been supplemented and modified by additional wildlife and vegetation data collected by the Association in 2006 through 2012 and by information contained in the Northeast Wyoming Sage-Grouse Conservation Plan.

Data developed during this phase include GIS maps of the landscape including ecological sites, existing ecological communities, human infrastructure, and political and management boundaries and attribute data and characteristics of each ecological community. To the extent possible, the data, maps and

knowledge were acquired from existing sources. Where necessary data, maps and/or knowledge were insufficient, they were generated through research, sampling, or other sources. Knowledge of ecological relationships, historical disturbances and the status of species were developed using an open process initiated and managed by the Association and involving scientists and natural resource managers.

5.1 Sage-grouse as an Umbrella Species

The Association has developed and is implementing a landscape Conservation Strategy focused on sagebrush and grassland ecosystems and corresponding wildlife habitat. Specific emphasis on conservation efforts in sagebrush ecosystems is being placed in areas within and adjacent to the sage-grouse core habitat management areas that were recently designated by the State of Wyoming and lie within the Coverage Area. In addition, other areas located outside the core areas on member-owned lands within the Coverage Area that include potential habitat or sign of sage-grouse use in the recent past may be included in efforts to maintain or enhance habitat conditions for this species.

The Association's landscape-wide plan to maintain and restore sagebrush habitat to meet the needs of sage-grouse will also meet the needs of the other three sagebrush obligate species within this Strategy. These species—including sage-grouse, sagebrush sparrow, Brewer's sparrow, and sage thrasher—are native to the Thunder Basin area and are listed as "species of concern" by the Wyoming Game and Fish Department. The Association proposes that coverage for all these species under the sage-grouse umbrella approach is supported by the premises and conclusions of the study entitled "Greater sage-grouse as an umbrella species for sagebrush-associated vertebrates"²⁰. Specifically, this study states:

"Sage-grouse have been advanced as an indicator or umbrella species for other sagebrush-associated species and the sagebrush ecosystem (Dobkin, 1995; Rich and Altman, 2001; Rich et al., 2005). The umbrella species concept is used in conservation planning to protect biodiversity of typically lesser-known taxa (Simberloff, 1998; Caro and O'Doherty, 1999; Andelman and Fagan, 2000; Fleishman et al., 2000, 2001). Roberge and Angelstam (2004, 77) defined an umbrella species as one "whose conservation confers protection to a large number of naturally co-occurring species." The most common criterion in selecting an umbrella species is a broad geographic range, and thus presumed co-occurrence with a large number of other species (Fleury et al., 1998; Simerloff, 1998; Caro and O'Doherty, 1999; Andelman and Fagan, 2000). How well a species or group of species functions as an umbrella depends largely on the objective of the umbrella application. If the objective is to benefit multiple species through improvement of habitats for the umbrella species, criteria in addition to co-occurrence must be considered. First, resource requirements of the umbrella species must overlap with those of other targets of protection. Species with similar geographic distributions but dissimilar land-cover associations may not benefit from habitat management for the umbrella species. Second, management prescriptions appropriate for the umbrella species must also benefit other targeted species. Other criteria used to select umbrella species include a moderate level of prevalence and high sensitivity to human disturbance (Fleishman et al., 2000), sound knowledge of the species' biology and life history (Caro and O'Doherty, 1999), and legal protection (Rubinoff, 2001).

²⁰ Rowland et al. (2006)

Based on these criteria, greater sage-grouse hold promise as an umbrella species because they are: (1) closely associated with sagebrush communities across their wide range, and thus co-occur with a host of other shrubland species (Paige and Ritter, 1999; Connelly et al., 2004; Rich et al., 2005); (2) currently neither rare nor ubiquitous (Connelly et al., 2004; Schroeder et al., 2004); (3) sensitive to anthropogenic disturbances (Lyon and Anderson 2003; Aldridge, 2005); and (4) better-studied than most species associated with sagebrush (Rowland and Wisdom, 2002; Connelly et al., 2004). In addition, explicit guidelines for managing habitat for sage-grouse (Connelly et al., 2000) and monitoring their populations (Connelly et al., 2003) have been published.

Rowland²¹ found that these species shared substantial habitat with sage-grouse: sage thrasher (mean $\phi = 0.57$), sage sparrow (mean $\phi = 0.55$), and Brewer's sparrow (mean $\phi = 0.50$) where mean ϕ values from 0.85 to 0.30 indicated sharing of substantial habitat. With this in mind, the following Conservation Measures are designed to positively impact sagebrush habitat in ways that will be beneficial to the four sagebrush-obligate Covered Species. In addition, Conservation Measures that apply specifically to one or more of these four species are clearly identified.

5.2 Status, Existing Conditions, and Factors Affecting the Species

Sagebrush habitats are becoming increasingly degraded and fragmented due to the impacts of multiple threats, including direct habitat conversion, urbanization, inappropriately sited infrastructure (roads, power lines, etc.), inappropriate grazing practices, wildfire and the change in wildfire frequency, incursion of invasive plants, and nonrenewable and renewable energy development. Many of these threat factors could be exacerbated by effects of climate change, which may influence long-term habitat trends. For sagebrush obligates such as the sage-grouse, Brewer's sparrow, sagebrush sparrow, and sage thrasher (species covered by this Strategy), the dramatic decline in sagebrush habitat is of critical concern.

5.2.1 Sage-grouse

In 2010, the FWS determined that the greater sage-grouse was warranted for protection under the ESA due to the loss and fragmentation of habitat and a lack of adequate regulatory mechanisms to stem habitat loss. The FWS did not propose a listing rule at the time due to the need to address higher priority listing actions. When the FWS made the warranted but precluded finding in 2010, the sage-grouse became a candidate species. After evaluating the best available scientific and commercial information regarding the greater sage-grouse, in September 2015, the FWS determined that protection for the greater sage-grouse under the Endangered Species Act (ESA) is no longer warranted and is withdrawing the species from the candidate species list (80 FR 59858).

The Wyoming Game and Fish Department²² identifies the sage-grouse on its list of Species of Greatest Conservation Need because populations have declined and critical sagebrush habitats have declined in both quantity and quality. In-depth information on sage-grouse habitat requirements and key aspects of life-history stages are presented in the Wyoming Greater Sage-Grouse Conservation Plan (July 2003), the Northeast Wyoming Sage-Grouse Conservation Plan (August 2006), and Sage-Grouse Habitat Management Guidelines for Wyoming (July 2007). Information provided below is primarily from these

²¹ Rowland et al. (2006)

²² Wyoming Game and Fish Department (2010)

documents.

5.2.1.1 Sage-grouse Natural History

Limited research of sage-grouse habitat parameters (structure, cover, etc.) in eastern Wyoming has been conducted to understand what might be appropriate in the region. Therefore, local parameters detailed below are drawn from a research study conducted by Brown and Clayton²³ and information gathered by the Association (see Tables 1-3 for local seasonal habitat parameters). More general, in-depth information on sage-grouse habitat requirements and key aspects of life-history stages is presented in the Wyoming Greater Sage-Grouse Conservation Plan (July 2003), the Northeast Wyoming Sage-Grouse Conservation Plan (August 2006), and Sage-Grouse Habitat Management Guidelines for Wyoming (July 2007).

Table 1. Suitable nesting and early brood-rearing habitat characteristics

Habitat Feature	Habitat Use	Minimum Productive Site Characteristics
Sagebrush canopy cover	Nesting Cover	16 percent ²³
Sagebrush height	Nesting Cover	12 inches ^{23,24}
Sagebrush growth form	Nesting Cover	Spreading with few dead branches ²⁴
Perennial grass and forb height	Nesting Cover	6 inches ²³
Perennial grass and forb cover	Nesting Cover and food	35 percent ²³
Forb abundance and variety	Food	High ²⁴

Table 2. Suitable late brood-rearing habitat characteristics

Habitat Feature	Habitat Use	Minimum Productive Site Characteristics
Sagebrush canopy cover	Cover	13 percent canopy cover ²³
Sagebrush height	Cover	14 inches ²³
Proximity of sagebrush cover	Cover	Sagebrush cover is adjacent(<100 yards) to brood-rearing area(s) ²⁴
Perennial grass and forb canopy cover	Cover and food	35 percent canopy cover ²³
Riparian and wet meadow plant community	Food	Wetland plant species dominate wet meadow or riparian area ²⁴
Riparian and wet meadow stability	Cover and food	Some bare ground maybe evident but vegetative cover dominates the site ²⁴
Forb availability in uplands and wetland areas	Food	Succulent forbs are readily available in terms of distribution and plant structure ²⁴

Table 3. Suitable fall and winter habitat characteristics

Habitat Feature	Habitat Use	Minimum Productive Site Characteristics
Sagebrush canopy cover	Cover and food	14 percent canopy cover ²³
Sagebrush height	Cover and food	11 inches ²³

²³ Brown and Clayton (2004)

²⁴ Greater Sage-grouse Umbrella CCAA for Wyoming Ranch Management

Final characteristics will be reviewed and revised as necessary by the Association and Conservation Advisory Committee based on the results of a joint research project being conducted by Yellowstone Ecological Research Center and Wildlife Management Research Support, which is scheduled for completion in the fall of 2016.

Sage-grouse are a landscape-scale, sagebrush obligate species, requiring large, interconnected blocks of sagebrush habitat for survival²⁵. Sagebrush is used as cover and is an important component in their diet throughout the year²⁶. Both quantity and quality—varying sagebrush canopy covers, densities and heights, age classes, patch sizes, and moisture availability—of the sagebrush habitat determines suitability for, and productivity of, sage-grouse. Suitable habitat consists of plant communities dominated by sagebrush with a diverse native grass and forb (flowering herbaceous plants) understory²⁷. The composition of shrubs, grasses and forbs varies with the subspecies of sagebrush, the management history, and range site potential.

In eastern Wyoming, most sage-grouse habitat occurs in Wyoming big sagebrush (*Artemisia tridentata wyomingensis*) dominated plant communities. Western wheatgrass (*Pascopyrum smithii*) and needle and thread (*Hesperostipa comata*) are the dominant grass species and the area supports a variety of forbs which are important to sage-grouse survival including common yarrow (*Achillea millefolium*), milkvetch (*Astragalus spp.*), littlepod false flax (*Camelina microcarpa*), fleabane (*Erigeron spp.*), buckwheat (*Eriogonum spp.*), curlycup gumweed (*Grindelia squarrosa*), prickly lettuce (*Lactuca serriola*), common pepperweed (*Lepidium densiflorum*), desert biscuitroot (*Lomatium spp.*), phlox (*Phlox spp.*), common dandelion (*Taraxacum officinale*), yellow salsify (*Tragopogon dubius*), and American vetch (*Vicia americana*)²⁸.

For sage-grouse populations to survive, appropriate seasonal habitat must be available depending on life cycle needs. Research has found that nest success and early brood survival are some of the most significant vital rates influencing population dynamics of sage-grouse²⁹. Sage-grouse generally have lower reproductive rates and higher annual survival rates than other species of upland game birds³⁰. They also live longer than most upland game bird species; individual birds four to five years old are common. Annual survival rates for yearling and adult female sage-grouse range from 35 to 85 percent. Male survival rates range from 38 to 54 percent³¹ which may be related to higher lek predation rates and increased physiological demands due to sexual dimorphism³².

Seasonal habitats occur in a patchwork or mosaic across the landscape. The amount of each seasonal habitat, the vegetative condition, and spatial arrangement determine the landscape's potential for sage-grouse. Throughout the range of sage-grouse, spatial arrangement of these habitats can be an

²⁵ Patterson (1952)

²⁶ Connelly et al. (2011b)

²⁷ Connelly et al. (2004)

²⁸ Peterson (1970), Barnett (1992), Barnett and Crawford (1994), Drut et al. (1994)

²⁹ Connelly et al. (2011a)

³⁰ Connelly and Braun (1997)

³¹ Connelly et al. (1994), Zablan et al. (2003)

³² Swenson (1986)

important factor in determining if a population is migratory or non-migratory in nature. In eastern Wyoming, where close interspersed wintering, nesting, and brood rearing habitat rarely requires large seasonal movements, sage-grouse are essentially non-migratory and may spend the entire year within an area of 10 mi² or less³³.

Seasonal movements are likely influenced by site fidelity³⁴ and vegetation requirements. Sage-grouse exhibit a high degree of site fidelity to nesting and early brood rearing habitat, while movement through late summer and early fall habitat appears related to availability of herbaceous vegetation. There is reduced fidelity to winter habitats, but this appears to be related to the availability of sagebrush under a variety of snow depths³⁵. The following seasonal habitats are necessary for survival of sage-grouse.

Most breeding occurs on strutting grounds (leks) during March and April, although reneating hens can return to the lek in May. Leks are generally situated on sites having minimal sagebrush with lower herbaceous height and less shrub cover than surrounding areas. Surrounding stands of sagebrush are used extensively by sage-grouse for foraging, loafing, escape, and protection from predators³⁶. Leks are generally located close to nesting habitat and may occur on broad ridge tops, old lake beds or playas, areas farmed during the Great Depression or other areas of low sagebrush flats, and disturbed sites such as burns, abandoned well locations, airstrips or roads³⁷. For non-migratory populations the lek may be an approximate center of their annual range³⁸. Adult females may select suitable nesting habitat prior to breeding, drawing males to the general vicinity, thus creating leks in close proximity to the nesting habitat³⁹. Adult females return to the same area to nest each year⁴⁰ and may nest within 660 feet of the previous year's nest⁴¹. Juvenile birds follow hens during their first summer and fall and generally return to these seasonal ranges in subsequent years⁴², and males return to leks where they have achieved stature in the breeding hierarchy.

On average, most nests are located within 3.9 miles of the lek. However, nests have been found more than 12.4 miles away from the lek⁴³. Slater (2003) found that 75 to 87 percent of nests were located within 3.2 miles of the lek in his two study areas in southwest Wyoming. In an analysis of sage-grouse studies conducted in seven areas in Wyoming since the mid-1990s, Holloran and Anderson (2005) found that 45 percent of nests were located within 2 miles of the lek where the hen was bred, and 64 percent of the nests were within 3 miles of the lek. A collaring study in the Thunder Basin National Grassland area found that nest locations ranged from 330 feet to 17.6 miles from the lek and slightly over 87 percent of the nests were within 2 miles of the lek⁴⁴. Sage-grouse typically nest under sagebrush⁴⁵, but

³³ Brown and Clayton (2004)

³⁴ Fischer et al. (1993)

³⁵ Hupp and Braun (1989), Robertson (1991)

³⁶ Patterson (1952), Gill (1965)

³⁷ Connelly et al. (1981), Gates (1983)

³⁸ Eng and Schladweiler (1972), Wallestad and Pyrah (1974), Wallestad and Schladweiler (1974)

³⁹ Connelly et al. (2011a), Thacker (2010)

⁴⁰ Fischer et al. (1993), Holloran (2005)

⁴¹ Gates (1983)

⁴² Schroeder et al. (1999)

⁴³ Hanf et al. (1994), Wakkinen et al. (1992), Lyon (2000), Holloran and Anderson (2005)

⁴⁴ Brown and Clayton (2004)

may use other large shrubs as well⁴⁶. In Wyoming, sagebrush in nesting areas ranged from 8 to 14 inches in height with a canopy cover from 6 to 26 percent⁴⁷. Wyoming studies indicate sage-grouse select nesting sites where total shrub and dead sagebrush canopy cover and residual grass cover are higher than surrounding areas⁴⁸. Selected sagebrush stands have sagebrush of varying heights with good residual grass under the sagebrush canopy. Areas between the sagebrush have good forb cover while maintaining some grass and litter cover. Live grass heights measured immediately after hatch range from 4 to 9 inches with residual grass heights from 2 to 6 inches⁴⁹. Raw data collected by the Association in the Coverage Area indicates sagebrush in nesting areas is 6 to 19 inches tall with a canopy cover from 6 to 27 percent.

Early brood-rearing habitats are used during the chick's first month of life from June to early July. Hens move their brood immediately upon hatching from the nest site to brood-rearing areas. Early brood-rearing areas are generally within 1.5 miles of the nest site, and sage-grouse will stay in these locations for the first 14 to 21 days after hatching⁵⁰. The majority of chick mortality occurs during this period⁵¹. After the first three weeks, broods may have dispersed five or more miles from the nest. Denser patches of sagebrush in the habitat are used for nesting and the smaller openings and patches of sagebrush with a relatively sparse canopy and a good herbaceous understory are used as feeding sites. Optimum early brood habitat consists of sagebrush stands that are 11 to 32 inches tall with a canopy cover of 10 to 25 percent and an herbaceous understory of 15 percent grass canopy and 10 percent forb canopy⁵². Insects are crucial during the first ten days post-hatch and can make up to 60 percent of chick diets during this time, remaining an important source of protein throughout the summer⁵³. Brood-rearing habitats having a wide diversity of plant species tend to also provide an equivalent diversity of insects that are important chick foods. Raw data collected by the Association indicates sagebrush in early brood-rearing areas is 5 to 19 inches tall with a canopy cover from 0 to 27 percent.

As summer progresses (mid-July through mid-September) and sagebrush habitats dry and herbaceous plants mature, sage-grouse move to moister areas still supporting succulent herbaceous vegetation⁵⁴. In eastern Wyoming, these areas are generally riparian or moister habitats along streams and draw bottoms: native meadows or irrigated hay and alfalfa meadows adjacent to sagebrush habitats⁵⁵ are used where available. Sage-grouse continue to rely on adjacent sagebrush for protection from weather and predators, and for roosting and loafing. In years with good summer precipitation, hens with broods tend to remain dispersed in the upland sagebrush communities where succulent forbs are available until late summer⁵⁶. In more arid years wet meadows, springs and streams are the primary sites that

⁴⁵ Patterson (1952), Gill (1965), Wallestad and Pyrah (1974), Schroeder et al. (1999)

⁴⁶ Connelly et al. (1991)

⁴⁷ Patterson (1952), Holloran (1999), Lyon (2000)

⁴⁸ Holloran (1999), Lyon (2000), Slater (2003), Holloran et al. (2005)

⁴⁹ Holloran (1999), Lyon (2000), Slater (2003)

⁵⁰ Berry and Eng (1985)

⁵¹ Patterson (1952)

⁵² Sveum et al. (1998)

⁵³ Peterson (1970)

⁵⁴ Gill (1965), Klebenow (1969), Savage (1969), Connelly and Markham (1983), Gates (1983), Connelly et al. (1988), Fischer and Reese (1996)

⁵⁵ Martin (1970), Connelly and Markham (1983), Connelly et al. (1988)

⁵⁶ Martin (1970), Wallestad (1971), Fischer and Reese (1996), Holloran (1999)

produce forbs and insects necessary for juvenile birds, whose diet shifts from insects to forbs as summer progresses⁵⁷.

Fall movements to winter ranges are slow and meandering and occur from mid-September to the first major snowfall⁵⁸. Time spent in transitional fall habitat is highly dependent upon weather conditions. As fall precipitation increases and temperatures decrease, sage-grouse move into mixed sagebrush-grassland habitats in moist upland and mid-slope draws where fall green-up of cool-season grasses and some forbs occur. As these areas dry and frost kills grasses and forbs, sagebrush consumption increases⁵⁹. With major snowfall accumulation, sage-grouse move onto winter range.

During winter, sage-grouse feed almost exclusively on sagebrush leaves and buds⁶⁰ and will select relatively tall and large expanses of dense sagebrush. Typical wintering sites have sagebrush 10 to 14 inches above the snow, with above snow canopy covers from 10 to 30 percent. Data collected by the Association indicates sagebrush in winter areas is 7 to 24 inches tall with a canopy cover from 10 to 26 percent. Sage-grouse generally return to traditional wintering areas before heavy snowfall. Foraging areas tend to be gentle southwest facing slopes and windswept ridges. On clear, calm nights sage-grouse will roost in open, low sagebrush sites, but during windy periods or snowstorms sage-grouse seek taller shrubs with greater canopy cover. Doherty et al. (2008) identified landscape-scale habitat features that influence sage-grouse winter habitat selection in the Powder River Basin of Wyoming. Sage-grouse selected for large expanses of intact sagebrush in relatively flat terrain and avoided areas with conifer habitat and more rugged terrain.

5.2.1.2 Sage-grouse Distribution

Sage-grouse are native to the sagebrush steppe/mixed grassland complex of western North America and historically occurred in parts of sixteen states and three provinces^{61,65}. Today, the species is present in eleven states (California, Colorado, Idaho, Montana, Nevada, North Dakota, South Dakota, Oregon, Utah, Washington, and Wyoming) and two provinces (Alberta and Saskatchewan.) Sage-grouse have been eliminated from small historic ranges in Arizona, Kansas, Nebraska, Oklahoma, and British Columbia and from a larger historic range in New Mexico. Range contractions have occurred throughout the species' range, most notably in Montana, North Dakota, South Dakota, Utah, and Washington⁶².

5.2.1.3 Factors Affecting Sage-grouse

Many factors influence the ability of sage-grouse to survive across their range. In 2015 the FWS issued a finding⁶³ on a petition to list the sage-grouse as threatened or endangered under the ESA. The FWS evaluated individual impact of potential threats to the sage-grouse, including nonrenewable energy development, infrastructure, agricultural conversion, wildfire and invasive plants, improper grazing, free-roaming equids, conifer encroachment, mining, renewable energy, predation, disease,

⁵⁷ Patterson (1952), Klebenow (1969), Peterson (1970), Drut et al. (1994)

⁵⁸ Connelly et al. (1988)

⁵⁹ Patterson (1952)

⁶⁰ Patterson (1952), Connelly and Markham (1983), Connelly et al. (1988)

⁶¹ Connelly and Braun (1997)

⁶² Schroeder et al. (2004)

⁶³ Federal Register 80:59858-59942

urbanization, recreation, climate change, drought, hunting, scientific and educational use, contaminants, military activities, small populations, and inadequacy of existing regulatory mechanisms. Based on new information and effective regulatory mechanisms implemented since the 2010 finding, the FWS determined that none of these impacts were substantial threats to the sage-grouse individually or cumulatively to warrant listing under the ESA.

However, factors that may negatively affect sage-grouse negatively have been identified by the sage-grouse Conservation Objectives Team, convened by the FWS, which released a report in 2013⁶⁴. The Conservation Objectives Team Report discussed impacts and potential conservation measures associated with fire, non-native invasive plant species, energy development, sagebrush removal, grazing, range management structures, free-roaming equids, pinyon-juniper expansion, agricultural expansion, mining, recreation, ex-urban development, infrastructure, and fences.

Ranch and livestock management can have positive or negative impacts on sage-grouse, depending on the management techniques employed. Some benefits of livestock management may include:

- Maintenance of large tracts of unfragmented and undeveloped land;
- Increased rangeland plant diversity, including perennial grasses and forbs;
- Weed and invasive species management; and
- Maintenance of productive springs and seeps (Beck and Mitchell 2000, Connelly et al. 2004, Crawford et al. 2004, Cagney et al. 2009).

However, some livestock and ranch management activities can also have negative impacts to sage-grouse by:

- Compacting soils and increasing bare ground, thus increasing the risk of establishing invasive species;
- Installation of water developments in inappropriate locations, which may degrade nesting and brood-rearing habitat or increase the risk of West Nile virus;
- Removing sagebrush to increase forage for livestock, resulting in loss of sage-grouse habitat;
- Over-grazing, decreasing residual cover and beneficial grasses and forbs in nesting and brood-rearing habitat; and
- Installation of fences in certain locations, causing direct mortality to sage-grouse and increasing fragmentation of habitats (Beck and Mitchell 2000, Connelly et al. 2004, Crawford et al. 2004, Cagney et al. 2009).

During their study of sage-grouse in eastern Wyoming, the Northeast Wyoming Sage-Grouse Working Group identified the top five threats in decreasing order of importance as: 1) oil, gas and CBNG development, 2) weather, 3) vegetation management, 4) invasive plants, 5) parasites and diseases. At the local level, the Association identified the following five threats in decreasing order of importance: 1) invasive species, 2) drought and climate change, 3) inappropriate grazing management, 4) energy development, and 5) predation.

Nest success and early brood survival rates are the most significant vital rates influencing population dynamics of sage-grouse⁶⁵. Up to 90 percent of chick mortality occurs within the first month after

⁶⁴ US Fish & Wildlife Service (2013)

⁶⁵ Connelly et al. (2011a)

hatching⁶⁶, a period which extends from late May to late June. Invasive species, drought and climate change directly impact the quantity and quality of nesting and brood-rearing habitat by displacing perennial grasses and beneficial forbs which are used for screening cover and forage. Cheatgrass (*Bromus tectorum*) is especially detrimental as it not only destroys habitat by displacing forbs and perennial grasses, but also increases the risk of wildfires by providing a highly flammable fuel source leading to larger, hotter, and more common fires. As mentioned earlier, sagebrush is necessary for forage and cover. Wyoming big sagebrush, the most common sagebrush found in the Coverage Area, is easily destroyed by fire with reestablishment time frames in excess of 50 years⁶⁷. Depending on the extent and intensity of the fire, significant areas of habitat can be fragmented or rendered unsuitable either through direct habitat destruction or by making the burned area more prone to subsequent invasion by cheatgrass⁶⁸.

5.2.2 Brewer's Sparrow

Brewer's sparrows are often the most abundant bird species in appropriate sagebrush habitats. However, they have experienced significant decline throughout their range during the last 10 to 20 years⁶⁹. North American Breeding Bird Survey⁷⁰ data for 1966 to 2011 indicates non-significant survey-wide declines averaging 0.4 percent per year (n = 673 survey routes.) Significant declines are evident in California, Colorado, and Oregon, with the steepest significant decline in Nebraska (11.7 percent average per year, n = 5.) Idaho, Montana, Washington, and Wyoming experienced lesser, non-significant declines. These negative trends appear to be consistent throughout the 45-year survey period. New Mexico experienced a significant increase in population and Arizona, Nevada, and Utah show a non-significant, apparently stable to increasing population. Christmas Bird Count data for the U.S. for the period 1959 to 1988 indicates a stable survey-wide trend (0.2 percent annual increase, n =116 survey circles) and a significantly positive trend in Texas (6.7 percent average annual increase, n =33.)

The Brewer's sparrow is considered a regionally sensitive species by the USFS and the Wyoming State Office of the BLM. The WGFD (2010) identifies the Brewer's sparrow on its list of species of greatest conservation need as a Native Species of Special Concern and states that populations are stable but vulnerable to impacts from increased industrialization in preferred habitat. In depth information regarding the background and status of the Brewer's sparrow can be found in two recent documents: a conservation assessment prepared by Holmes and Johnson (2005a) and a species assessment prepared by Hansley and Beauvais (2004a).

5.2.2.1 Brewer's Sparrow Natural History

Brewer's sparrows are small, slim sparrows approximately 5 to 6 inches in length with long, notched tails. Their coloring is subtle with a brown crown, tan/brown back and rump, brown wings, and undersides that are dull white with grayish flanks. Juveniles are similar to the adults but duller in color. Breeding begins in mid-April in the south to May or early June in the north. Clutch size is typically 3 to 4. Reproductive success has been correlated with climatic variation and clutch size, with success

⁶⁶ Crawford et al. (2004)

⁶⁷ Lesica et al. (2008)

⁶⁸ Brooks (2004)

⁶⁹ Rotenberry et al. (1999)

⁷⁰ Sauer et al. (2012)

increasing in wetter years⁷¹.

Nests are low (from essentially ground level to about 39 inches above the ground) in sagebrush (preferred) or other shrubs and occasionally cactus. Nests are often higher in taller sagebrush⁷². In southeastern Idaho, nests were found between 8 to 20 inches above ground in the most dense portion of the shrub and placement may increase in height with progression of season⁷³. Reynolds (1981) reported average nest shrub height of 25 inches, average nest height of 10 inches, and average nest to crown distance of 14 inches. Similar values were reported by Rich (1980): 26 inch average shrub height, 11 inch average nest height, and 15 inch average height of cover above nest. In California, nests are sometimes found in vineyards. Brewer's sparrows most often perch in live sagebrush shrubs that are taller and denser than neighboring shrubs⁷⁴.

Rotenberry et al. (1999) noted that Brewer's sparrows select shrublands with a shrub canopy height less than 59 inches for breeding habitat. That work noted that shrubs specifically chosen for nesting sites were less than 39 inches in height and had the characteristic of being mostly or entirely alive. Walker (2004) has indicated the species shows a preference for nesting habitat in northern Wyoming that contains areas of dense sagebrush averaging 27 percent (range 8 to 60 percent) of ground cover. In Montana, Brewer's sparrows were observed utilizing habitat with as little as 13 percent ground cover from shrubs⁷⁵. Knick and Rotenberry (1995) observed that habitat selection by Brewer's sparrow in Idaho was negatively correlated to Russian thistle coverage, among other factors. That same study indicated habitat preference for larger shrub patches and relatively low proportion of edge between shrubland and grasslands.

5.2.2.2 Brewer's Sparrow Distribution

Brewer's sparrows winter from the southwest through Baja and Central Mexico⁷⁶ often in large, mixed flocks. The northernmost populations move farthest south with southern populations being non-migratory in some areas of the southwestern United States⁷⁷.

Brewer's sparrows can be abundant in sagebrush habitat and will breed in high densities (Great Basin and Pacific slopes), but densities may vary greatly from year to year⁷⁸. In southeastern Oregon, reported density averaged 0.8 individuals per acre but ranged from 0.1 to 2.1 per acre⁷⁹. Dobler et al. (1996) reported densities of 0.2 to 0.3 individuals per acre in eastern Washington. In the Great Basin, density usually ranged from 0.6 to 1.2 per acre but sometimes exceeded 2 per acre⁸⁰. Medin (1990) reported breeding density of 0.03 to 0.04 individuals per acre in shadscale habitat in eastern Nevada. Breeding territory usually averages from 1.5 to 3.1 acres and will contract as densities of breeding birds

⁷¹ Rotenberry and Wiens (1989, 1991)

⁷² Rich (1980)

⁷³ Petersen and Best (1985)

⁷⁴ Castrale (1982)

⁷⁵ Bock and Bock (1987)

⁷⁶ Rotenberry et al. (1999)

⁷⁷ Small (1994), Rotenberry et al. (1999)

⁷⁸ Rotenberry et al. (1999)

⁷⁹ Rotenberry and Wiens (1980), Wiens and Rotenberry (1981a)

⁸⁰ Rotenberry and Wiens (1989)

increase⁸¹. Mean territory sizes reported by Rotenberry et al. (1999) varied from 0.2 to 5.8 acres.

5.2.2.3 Factors Affecting Brewer's Sparrow

The potential loss or fragmentation of sagebrush habitat is viewed as the principal threat to Brewer's sparrow based on conservation actions recommended by the Wyoming Game and Fish Department as well as regional and national observations by the USFS on several national forests in Colorado⁸² and the Audubon Society Watchlist. The Watchlist also identifies the invasion of exotic plants, especially cheatgrass, as contributing to the decline of sagebrush habitat important to Brewer's sparrow. Walker (2004) has also noted that identification and control of nonnative plants, particularly cheatgrass, as a key recommendation for reducing threats to Brewer's sparrow habitat relative to direct impacts of cheatgrass colonization and indirect effects of increased wildfire fuel and sagebrush impacts. The increasing frequency and intensity of range fires, in association with invasion by exotic annuals such as cheatgrass, pose a significant threat to Brewer's sparrow habitat. Additionally, uncontrolled burns or wildfires can destroy sagebrush and sagebrush habitat. Rotenberry et al. (1999) noted that predation by ground squirrels, loggerhead shrikes, ravens and magpies, among others, can represent a negative factor in the breeding success of Brewer's sparrows.

5.2.3 Sagebrush Sparrow

Sagebrush sparrows are a species of concern in the West due to population decline in some regions and the degradation and loss of breeding and wintering habitats. While still common throughout much of the sagebrush country, they are vulnerable to loss and fragmentation of sagebrush habitat and may require large patches for breeding. Sagebrush sparrows can likely persist wherever large areas of sagebrush and other preferred native shrubland exist for breeding and the integrity of native vegetation is maintained. They are likely to return to areas where sagebrush and other native vegetation have been restored.

According to the North American Breeding Bird Survey⁸³, sagebrush sparrows showed a significant decline of 4.8 percent average per year from 1966 to 1979 (n = 73) but a significant increase of 2.0 percent average per year from 1980 to 1996 (n = 154). Overall trend data for 1966 to 2011 indicates non-significant survey-wide declines averaging 0.1 percent per year (n = 374 survey routes). However, generally low sample sizes make trend estimates unreliable for most states and physiographic regions. Significant declines are evident in Idaho and Oregon with Colorado, New Mexico, and Utah experiencing lesser, non-significant declines. These negative trends appear to be consistent throughout the 45-year survey period. Washington and Wyoming experienced significant increases in population and Arizona and California show a non-significant stable or increasing population. The largest numbers of sagebrush sparrows occurred in Idaho, west-central Nevada, northeastern Utah, and southwest Wyoming. Christmas Bird Count data shows a significant decline of 2.1 percent average per year (n = 160 survey circles) survey-wide for the period from 1959 to 1988. The highest average birds per 100 party hours of Christmas Bird Counts from 1959 to 1988 occurred in California (3.30), Arizona (5.21), and New Mexico (11.23).

The sagebrush sparrow is considered a regionally sensitive species by the USFS and the Wyoming State

⁸¹ Wiens et al. (1985)

⁸² Vasquez (2005)

⁸³ Sauer et al. (2012)

Office of the Bureau of Land Management. The WGFD (2010) identifies the sagebrush sparrow on its list of species of greatest conservation need as a Native Species of Special Concern and states that populations are stable but vulnerable to impacts from increased industrialization in preferred habitat. In depth information regarding the background and status of the sagebrush sparrow can be found in two recent documents: a conservation assessment prepared by Holmes and Johnson (2005b) and a species assessment prepared by Hansley and Beauvais (2004b).

5.2.3.1 Sagebrush Sparrow Natural History

Sagebrush sparrows are small songbirds approximately 5 to 6 inches in length with a gray-brown head; back is buffy brown with dusky streaks; underparts are white, with a central dark spot and dusky streaks on the sides. Juveniles are duller and more heavily streaked. Clutch size usually is 3 to 4, sometimes 5 and incubation lasts about 13 days. Individual females produce 1 to 3 broods annually and reproductive success is greater in wetter years⁸⁴. Breeding territory size usually averages about 3.7 to 7.4 acres but varies with plants community composition and structure, increasing with horizontal patchiness⁸⁵. In the Great Basin, sagebrush sparrow density is usually 0.2 to 0.8 individual per acre⁸⁶.

Habitat structure (vertical structure, shrub density, and habitat patchiness) is important to habitat selection⁸⁷. The Audubon Watchlist notes that the sagebrush sparrows breed in large patches of brush, principally sagebrush, with a minimum requirement of about 320 acres of continuous habitat. Sagebrush sparrow habitat is positively correlated with big sagebrush, shrub cover, bare ground, above-average shrub height, and horizontal patchiness; and negatively correlated with grass cover⁸⁸. Sagebrush sparrows prefer semi-open habitats with shrubs 39 to 78 inches tall⁸⁹. Nests are found on the ground or in a shrub, up to about 39 inches above ground level⁹⁰. The New Mexico Partners in Flight indicates that prime nesting sites are sagebrush plants with more than 75 percent live material. In the Great Basin, sagebrush sparrows usually nest in living sagebrush—avoiding the southwestern side of the plant—where cover is sparse but shrubs are clumped⁹¹. Nest placement may be related to density of vegetative cover over the nest, as nests are found higher in taller shrubs⁹². Sagebrush sparrows feed on insects, spiders and seeds (especially in the winter) and will run along the ground stopping to pick up food.

5.2.3.2 Sagebrush Sparrow Distribution

Sagebrush sparrows are found from sea level to 6500 feet⁹³ and are strongly associated with sagebrush for breeding. They can also be found in salt-bush brushland, shadscale, antelope brush, rabbitbrush, black greasewood (Colorado), mesquite, and chaparral⁹⁴.

⁸⁴ Rotenberry and Wiens (1991)

⁸⁵ Wiens et al. (1985)

⁸⁶ Rotenberry and Wiens (1989)

⁸⁷ Martin and Carlson (1998)

⁸⁸ Rotenberry and Wiens (1980), Wiens and Rotenberry (1981b), Larson and Bock (1984)

⁸⁹ Martin and Carlson (1998)

⁹⁰ Terres (1980)

⁹¹ Petersen and Best (1985)

⁹² Rich (1980)

⁹³ Rising and Beadle (1996)

⁹⁴ Green and Smith (1981), Martin and Carlson (1998), Paige and Ritter (1999), Reynolds (1981)

Sagebrush sparrows form flocks of 25 to 50 individuals in the winter. Northern breeding populations are long- distance migrants, arriving in the northern part of the breeding range in February to March and vacating most or all of their breeding range for winter. Migrations are more localized in the southwestern part of the range. Populations from the foothills of the Coast Ranges and the western slope of the Sierra Nevada in California are essentially sedentary⁹⁵. Populations in the San Joaquin Valley and northern Mojave Desert are migratory. They migrate uphill in late spring after breeding and in late summer and fall they descend and spread southward and eastward to wintering grounds⁹⁶.

5.2.3.3 Factors Affecting Sagebrush Sparrow

As is true for most sagebrush obligates, the potential loss or fragmentation of sagebrush habitat is viewed as the principal threat. The Wyoming Game and Fish Department (2006) identified habitat fragmentation as a significant threat for sagebrush sparrow. Braun et al. (1976) identified a principal threat as habitat loss due to shrub clearing. The Audubon Watchlist website notes that when cheatgrass alters the landscape, sagebrush sparrows abandon traditional breeding sites. The increasing frequency and intensity of range fires, in association with invasion by exotic annuals such as cheatgrass, pose a significant threat to sagebrush sparrow habitat. Additionally, uncontrolled burns or wildfires can destroy sagebrush and sagebrush habitat.

5.2.4 Sage Thrasher

Sage thrashers appear to be stable or increasing throughout much of their range. However, they remain vulnerable where sagebrush habitats are severely degraded or converted to annual grasslands or to other land uses. There is a high probability of sustaining sage thrashers wherever native sagebrush habitats are maintained with high shrub vigor, tall shrubs, horizontal shrub patchiness, and an open understory of bare ground and native bunchgrasses and forbs.

North American Breeding Bird Survey⁹⁷ data shows a non-significant survey-wide decrease from 1966 to 2011 averaging 0.5 percent per year (n = 454 survey routes). Significant decreases were noted in Idaho and Utah with non-significant decreases in Colorado, Montana, Nevada, New Mexico, and Oregon. Non- significant increasing trends were observed in Arizona, California, Washington, and Wyoming. Centers of summer abundance occur in the Great Basin, especially in Nevada and southeastern Oregon, and in the Wyoming Basin. The Christmas Bird Count data is stable survey-wide from 1959 to 1988 (n = 161 survey circles), but indicates a significant decline in Texas (2.8 average per year, n = 59) and a significant increase in New Mexico (2.4 average per year, n = 19). Winter abundances are highest in west Texas and southeastern New Mexico.

The sage thrasher is considered a sensitive species by the Wyoming State Office of the BLM. The WGFD (2010) identifies the sagebrush sparrow on its list of species of greatest conservation need as a Native Species of Special Concern and states that populations are stable but vulnerable to impacts from increased industrialization in preferred habitat. In depth information regarding the background and status of the sagebrush sparrow can be found in a species assessment prepared by Buseck et al. (2004).

⁹⁵ Johnson and Marten (1992)

⁹⁶ Ibid.

⁹⁷ Sauer et al. (2012)

5.2.4.1 Sage Thrasher Natural History

The sage thrasher is a medium-sized songbird, approximately 8 to 9 inches in body length with a wingspan of 13 inches. Males and females have a brownish gray back with indistinct streaking—especially on the crown, a whitish underside with dark streaking, outer tail feathers tipped white, and wings with thin white wingbars. Clutch size ranges from 1 to 7 but is typically 4 to 5 with incubation averaging 15 days. Individual females produce 1 to 2 broods per season. In Oregon, reproductive parameters were not associated with climatic variation⁹⁸. Males are readily detectable during courtship as they sing loudly and conspicuously from the tops of shrubs, and will perform song flights low over shrubs. Otherwise, sage thrashers are relatively shy and will drop to the ground when approached. Singing drops off after eggs are laid⁹⁹.

Nests are usually within 39 inches of the ground in the fork of shrubs (almost always sagebrush) although nests are sometimes found on the ground¹⁰⁰. In southeastern Idaho, sage thrashers nested in clumps of tall big sagebrush with dense foliage overhead. Nests were generally 20 inches below the shrub crown and tended to be on the southeast side of the shrub¹⁰¹. Reynolds (1981) recorded mean nest shrub height of 35 inches, mean nest height of 7 inches, and mean distance between nest and shrub crown of 23 inches. For nests placed in shrubs (n = 114 nests), Rich (1980) observed mean nest shrub height of 33 inches, mean nest height of 9 inches, and mean distance between nest and shrub crown of 24 inches. The distance between the nest and the shrub crown is nearly always 23 inches whether the nest is placed on the ground or within the shrub, presumably for optimum shading and shelter¹⁰².

The New Mexico Partners in Flight website notes that areas of sagebrush grassland with dense stands of sagebrush present that are 27 inches or greater in height represents important habitat for the sage thrasher. Cannings (2000) has outlined that sagebrush stands with shrub cover greater than 15 percent, general shrub heights ranging from 12 to 24 inches, with larger individual shrubs more than 40 inches in height providing preferred nesting sites represents important sage thrasher habitat. Similarly, the Ministry of Environment for British Columbia¹⁰³ indicates that management areas for sage thrashers should be comprised of 25 to 250 acres of contiguous shrub-steppe habitat or 500 acres of discontinuous habitat. Those management areas should include a low amount of bare ground (10 to 20 percent), a moderate coverage of shrubs (10 to 30 percent) and contain clumps of multiple large sagebrush plants that exceed 40 inches in height. Castrale (1982) has identified the presence/absence of individual tall sagebrush plants as the most important breeding habitat quality and use factor for sage thrashers.

5.2.4.2 Sage Thrasher Distribution

The sage thrashers range in the United States is Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, New Mexico, Nevada, Oregon, South Dakota, Texas, Utah, Washington and Wyoming. Sage thrashers are positively correlated with the presence of Brewer's sparrow, probably due to similarities

⁹⁸ Rotenberry and Wiens (1989)

⁹⁹ Ryser (1985)

¹⁰⁰ Harrison (1978), Reynolds (1981), Rich(1980)

¹⁰¹ Petersen and Best (1991)

¹⁰² Reynolds (1981), Rich (1980)

¹⁰³ Gebauer (2004)

in habitat relations¹⁰⁴, but do not exhibit the steep and widespread declines evident for Brewer's sparrow¹⁰⁵.

5.2.4.3 Factors Affecting Sage Thrasher

Loss or fragmentation of sagebrush habitat is the principal threat to sage thrasher habitat. The Wyoming Game and Fish Department (2006) identified habitat fragmentation as a significant threat for sage thrasher. The New Mexico Partners in Flight website notes that habitat loss due to shrub clearing is a principal threat. Paige and Ritter (1999) have indicated that monotypic stands of cheatgrass comprising the sagebrush understory can interfere with sage thrasher feeding. Several authors have noted that cheatgrass invasions can convert sage thrasher breeding habitats into annual grasslands that are suboptimal at best for thrashers. Wiens and Rotenberry (1981a) and Reynolds et al. (1999) indicated that, in general, the abundance of breeding sage thrashers is positively correlated with sagebrush cover and negatively correlated with annual grass cover. Buseck et al. (2004) noted that for Wyoming, the invasion of nonnative grasses and forbs is most likely the largest threat to sagebrush steppe habitats and the biggest threat facing sage thrasher populations through reduction or elimination of vital breeding habitat. Although parasitism has been viewed as a threat, several authors, including Rich and Rothstein (1985), have noted that sage thrashers reject cowbirds eggs relatively quickly and are not significantly vulnerable to parasitism. Reynolds (1979) noted that predation by snakes and loggerhead shrikes can be a negative factor in the breeding success of sage thrashers.

5.3 Threats, Conservation Measures, Benefits and Monitoring

Sagebrush obligate threats and associated Conservation Measures are found in Appendix C. They are separated into each of the five threat factor areas—Factor A: The present or threatened destruction, modification, or curtailment of habitat or range; Factor B: Overutilization for commercial, recreational, scientific, or education purposes; Factor C: Disease and predation; Factor D: Inadequacy of existing regulatory mechanisms; and Factor E: Other natural or manmade factors affecting the species' continued existence. A listing ranked by point value and a detailed presentation of benefits and required monitoring can also be found in Appendix C.

6 SHORTGRASS PRAIRIE ASSEMBLAGE

As noted for the Sagebrush Steppe Assemblage, an ecosystem assessment of the designated pilot area was needed to ensure the most current knowledge of existing conditions across the landscape was available before needed Conservation Measures were determined. Data for the Thunder Basin Grasslands assessment was collected in 2003 through 2005, and the final report was published in 2008 by the Ecosystem Management Research Institute. This assessment has been supplemented and modified by additional wildlife and vegetation data collected by the Association in 2006 through 2012.

6.1 Status, Existing Conditions, and Factors Affecting the Species

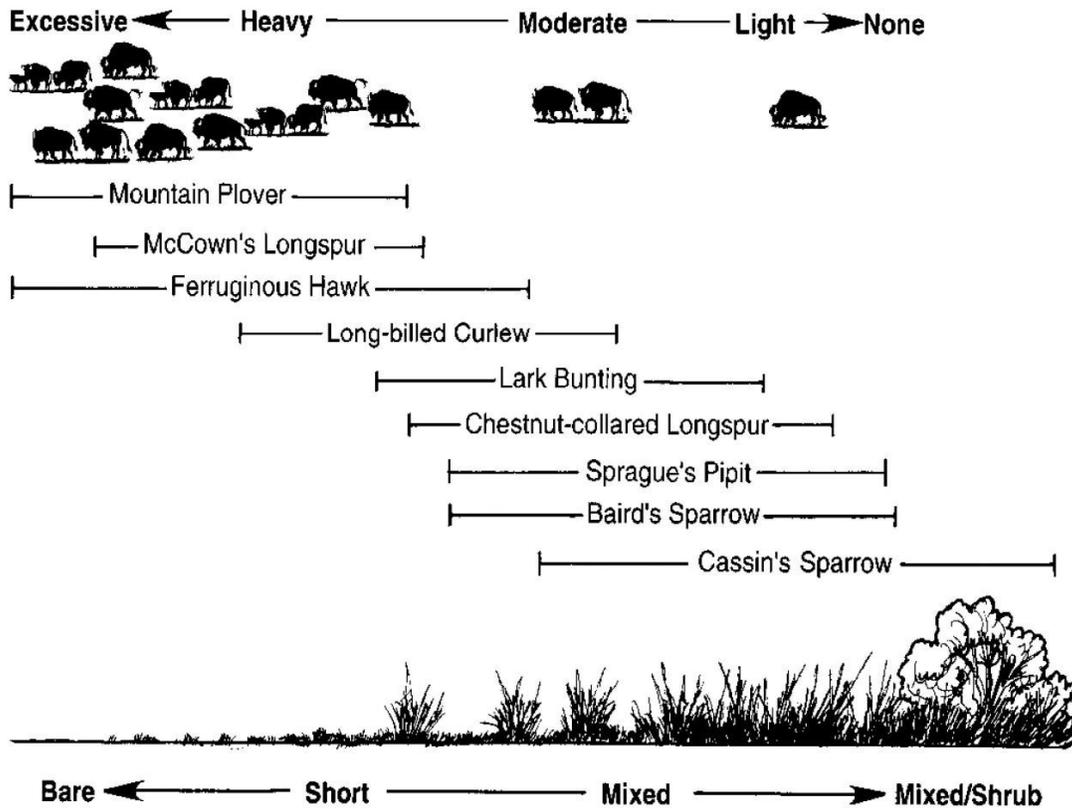
Shortgrass prairie habitats are becoming increasingly degraded and fragmented due to the impacts of multiple threats including urbanization, infrastructure (roads, power lines, etc.), wildfire and the change in wildfire frequency, incursion of invasive plants, and nonrenewable and renewable energy

¹⁰⁴ Wiens and Rotenberry (1981a)

¹⁰⁵ Sauer et al. (2012)

development. Many of these threat factors could be exacerbated by effects of climate change, which may influence long-term habitat trends.

Endemic bird species of the Great Plains require grazing regimes that encompass a broad continuum from light utilization (mixed grass/shrub environments) to heavy utilization (short grass/bare ground environments) as the following diagram from Knopf indicates.



(from Knopf, F.L. *Prairie Legacies: Birds*. Pages 135-148 in F.B. Samson and F.L.Knopf [eds.]. *Prairie Conservation*. Island Press. Covelo, California. 1996)

It is the intent of the Association to provide for this heterogeneity on a landscape level while supporting local homogeneity in specific sites across the Coverage Area.

6.1.1 Black-tailed Prairie Dog

The black-tailed prairie dog became a candidate for listing in 2000. In August 2004, the FWS determined the black-tailed prairie dog was no longer warranted candidate status. However, the black-tailed prairie dog is classified as a regionally sensitive species by the USFS and the Wyoming State Office of the Bureau of Land Management. The Wyoming Game and Fish Department (2010) identifies the black-tailed prairie dog on its list of Species of Greatest Conservation Need because populations have declined and its habitat is vulnerable. However, there is no identified ongoing significant habitat loss in Wyoming. The black-tailed prairie dog is designated as vulnerable by the Committee on the Status of Endangered Wildlife in Canada and threatened by the Lista de las Especies Amerzadas, the official threatened and endangered species list of the Mexican Government. In-depth information regarding the background and status of the black-tailed prairie dog is presented in the FWS's finding for the

resubmitted petition to list the black-tailed prairie dog as threatened¹⁰⁶, and the subsequent 90-day finding¹⁰⁷. Information provided below is primarily from the petition and the FWS's finding.

6.1.1.1 Black-tailed Prairie Dog Natural History

The black-tailed prairie dog is one of five species of prairie dog, all of which occur only in North America. It is a small rodent that exhibits a colonial lifestyle, living in burrow systems within generally large, dense colonies. This lifestyle may represent the most complex social organization of all rodents and likely offers an effective defense mechanism against predators and increases reproductive success, though facilitating the transmission of disease.

Black-tailed prairie dogs are associated with grasslands and shrub-grasslands and, in Wyoming, appear most abundant on shortgrass prairies. Towns, or colonies, are loosely defined as aggregations of prairie dogs, while colonies are further organized into "coterie" made up of 2 to 40 members¹⁰⁸. Coterie members defend their group territory against intrusion by members of adjacent coterie. Biggins et al. (1993) define prairie dog complexes as prairie dog colonies within a 4.3 mile radius of other prairie dog colonies. Typical dispersal between established colonies is 3 miles or less. Black-tailed prairie dog densities vary depending upon season, region, and climatic conditions, but typically range from 2 to 18 individuals per acre.

Black-tailed prairie dogs are active above ground year round. Prairie dogs consume both grasses and forbs, and a majority of their diet may include plant species having value as livestock forage, such as western wheatgrass (*Pascopyrum smithii*), blue grama (*Bouteloua gracilis*), and needle-and-thread (*Hesperostipa comata*). Utilization of vegetation by prairie dogs in newly established colonies has been estimated at 18 to 37 percent. Most utilization affects grasses and can reach as high as 80 percent by mid-August. In some cases, particularly during periods of drought, utilization may approach 100 percent.

A female may produce up to 20 offspring during its lifetime, producing a single litter of 4 to 5 pups per year over a lifetime of 3 to 4 years. While not prolific in comparison to many other rodents, the species is capable of rapid population increases subsequent to substantial reductions.

Black-tailed prairie dogs are very sensitive to plague, and mortality frequently reaches 100 percent¹⁰⁹. Two patterns of die-offs are typically described for black-tailed prairie dogs: 1) a rapid and nearly 100 percent die-off with incomplete recovery, such as has occurred at the Rocky Mountain Arsenal and the Comanche National Grassland in Colorado¹¹⁰; and 2), a partial die-off resulting in smaller, but stable, populations and smaller, more dispersed colonies, such as has occurred at the Cimarron National Grassland¹¹¹. Several researchers have suggested that the response of black-tailed prairie dogs to plague may vary based on population density or degree of colony isolation¹¹².

¹⁰⁶ 69 FR 51217, August 18, 2004

¹⁰⁷ 73 FR 73211-73219, December 2, 2008

¹⁰⁸ Hoogland (2006)

¹⁰⁹ Barnes (1993)

¹¹⁰ Cully and Williams (2001)

¹¹¹ Ibid.

¹¹² Cully (1989), Cully and Williams (2001), Lomolino and Smith (2003)

Some studies have documented the development of antibodies in black-tailed prairie dogs surviving a plague epizootic. In one Colorado site, over 50 percent of survivors developed antibodies¹¹³. Recent laboratory research indicates that, at low levels of exposure, a small percentage of black-tailed prairie dogs show some immune response and consequently some resistance to plague, indicating that it may be possible to develop a plague vaccine in the future¹¹⁴. Preliminary work has demonstrated significantly higher antibody titers and survival rates in vaccinated black-tailed prairie dogs that were challenged with the plague bacterium¹¹⁵. Oral vaccination may be effective for managing plague epizootics in free-ranging prairie dog populations by reducing mortality in exposed individuals¹¹⁶.

6.1.1.2 Black-tailed Prairie Dog Distribution

The historic range of the black-tailed prairie dog included portions of 11 states, Canada, and Mexico. Today, the range occurs from extreme south-central Canada to northeastern Mexico and from approximately the 98th meridian west to the Rocky Mountains. The species is currently present in 10 states (Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, and Wyoming), but has been extirpated from Arizona. Range contractions have occurred in the southwestern portion of the species' range in Arizona, western New Mexico, and western Texas; and in the eastern portion of the species' range in Kansas, Nebraska, Oklahoma, South Dakota and Texas. These range contractions are largely due to habitat loss through cropland development in the east¹¹⁷ and through conversion of grasslands to desert shrub lands in the southwest¹¹⁸.

The black-tailed prairie dog appears to be widely distributed throughout its historic range in Wyoming, generally in disconnected populations across the shortgrass prairie in the eastern half of the state. Luce (2003) estimated 125,000 acres of black-tailed prairie dog occupied habitat statewide in 2003. Estimates in 2006 by the Wyoming Game and Fish Department indicate 213,174 acres of black-tailed prairie dog colonies are present in Wyoming. Of that, 102,725 acres are part of black-tailed prairie dog colonies classified as healthy (>50 percent active)¹¹⁹. Sylvatic plague, caused by a bacterium (*Yersinia pestis*), has resulted in notable declines in the State's largest identified complex at the Thunder Basin National Grassland. Even with these declines, the Wyoming population was estimated at 229,607 acres in 2007¹²⁰.

6.1.1.3 Factors Affecting Black-tailed Prairie Dog

Historically, as many as 100,000,000 acres of occupied black-tailed prairie dog habitat occurred across a landscape of approximately 400,000,000 acres of potential habitat, forming several large metapopulations in the United States. At present, there are an estimated 2,100,000 acres¹²¹ of occupied habitat in the United States. When the amount of current occupied habitat is contrasted with the amount of remaining rangeland it is evident that sufficient potential habitat still occurs in each of the 11 States within the historic range of the species to accommodate large expansions of black-tailed

¹¹³ Pauli (2005)

¹¹⁴ Creekmore et al. (2002)

¹¹⁵ Mencher et al. (2004)

¹¹⁶ Ibid.

¹¹⁷ Luce (2003)

¹¹⁸ Pidgeon et al. (2001)

¹¹⁹ Wyoming Game & Fish Department (2006)

¹²⁰ Van Pelt (2007)

¹²¹ Van Pelt (2007), Kempema (2007)

prairie dog populations.

Recreational shooting can reduce black-tailed prairie dog population densities at specific sites, and there is a possibility that extirpation may have occurred in isolated circumstances, but interest in recreational shooting is generally not high where populations are at low levels. Black-tailed prairie dog populations can recover following intensive recreational shooting¹²². Although recreational shooting has been implicated in affecting reproductive output in the short-term¹²³, there are no long-term studies that indicate that reproductive output will permanently reduce local populations.

Although plague is likely the most important factor adversely influencing black-tailed prairie dog population dynamics, recent information indicates populations are responsive, re-populating plague-impacted colonies. Cully and Williams (2001) indicate that 1) high exposure doses of plague bacilli may be necessary for disease contraction in some individuals, 2) limited immune response has been observed in some individuals, 3) a population dynamic may have developed in low-density, isolated populations that contributes to the persistence of these populations, and 4) the apparent ability of some sites to recover to pre-plague levels after a plague epizootic. The black-tailed prairie dog remains a relatively abundant species despite plague.

6.1.2 Mountain Plover

The mountain plover was proposed for listing as a threatened species in 1999. In September 2003, the FWS withdrew the proposal, because new information indicated that the threats to the species included in the proposed listing were not as significant as earlier believed. In June 2010 as part of a settlement agreement, the proposed December 2002 rule listing the mountain plover as threatened was reinstated. On May 12, 2011, the withdrawal of proposed rule was published in the Federal Register (76 FR 27756).

The mountain plover is classified as a regionally sensitive species by the USFS and the Wyoming State Office of the BLM. The WGFD (2010) identifies the mountain plover on its list of species of greatest conservation need as a Native Species of Special Concern based on 1) unknown, but suspected stable, population status and trends, 2) habitat vulnerability, and 3) sensitivity to human disturbance. In depth information regarding the background and status of the mountain plover is presented in the FWS's withdrawal of the proposed rule to list the mountain plover as threatened¹²⁴.

The following is a summary of information provided primarily from the FWS's withdrawal.

6.1.2.1 Mountain Plover Natural History

The mountain plover is a small bird approximately 8 inches in body length, similar in size and appearance to a killdeer, but lacking the contrasting dark breast belt common to most plovers including the killdeer. Individuals can live up to 8 years of age, but the mean life span is approximately 1.9 years¹²⁵. Mountain plovers are insectivorous with beetles, grasshoppers, crickets, and ants as their principal food items.

¹²² Reeve and Vosburgh (2006)

¹²³ Pauli and Buskirk (2007)

¹²⁴ 68 FR 53083, September 9, 2003

¹²⁵ Dinsmore (2001)

The mountain plover is a migratory species of the shortgrass prairie and shrub-steppe eco-regions of the West. On the breeding range, the plover historically occurred on nearly denuded prairie dog colonies and in areas of major bison concentrations where vegetation was clipped short. Mountain plovers are usually associated with sites that are modified by grazing and digging mammals, even on the wintering grounds. Breeding adults, nests, and chicks have been observed on cultivated lands in several states including Wyoming. The majority of mountain plovers winter in California, where they are found mostly on cultivated fields.

Nests are usually placed in areas where vegetation is less than 4 inches tall and the amount of bare ground exceeds 30 percent. Knopf and Wunder (2006) identified that in shortgrass prairie habitat, vegetation associated with the nest sites includes blue grama, buffalo grass (*Buchloe dactyloides*), and prickly pear cactus (*Opuntia spp.*). Topography is typically flat or gently rolling¹²⁶. In areas where mountain plovers are associated with prairie dog colonies, size of the colony is important. In Montana mountain plover densities were highest on colonies of 15 to 124 acres, while colonies less than 25 acres were considered marginal habitat¹²⁷. However in the Powder River Basin of Wyoming, Parrish et al. (1993) found that mountain plovers did not have a strong affinity to prairie dog towns with only 1 of 15 nests occurring on a town. In another Wyoming study, Plumb et al. (2005) found that black-tailed prairie dogs were present at 53 percent of the nesting sites across the State.

Mountain plovers leave their wintering grounds in Mexico and Southern California by mid-February or March and arrive on the breeding grounds in Wyoming in late March or early April. They lay their eggs in June, and their young are on their own by July of the same year. Fledging rates appear low with 0.26 to 1.4 chicks per successful nesting attempt¹²⁸. Due to predation, only 0.17 to 0.74 chicks per nesting attempt live to migrate from the breeding grounds¹²⁹. The adults usually begin leaving for the wintering grounds in early August, arriving during mid-September to November. During migration, they can form flocks of hundreds of birds.

6.1.2.2 Mountain Plover Distribution

Mountain plovers nest in the Rocky Mountains and Great Plains states from Montana south to Nuevo Leon, Mexico. Most breed in Montana, Wyoming, and Colorado. In Wyoming, breeding mountain plovers are known or suspected across the State, with nesting documented in the Thunder Basin in most years during surveys conducted between 1992 and 2002. The Breeding Bird Survey did not detect a trend for the mountain plover in Wyoming during 1966 to 2002; however, these data are uncertain given weaknesses in the BBS in monitoring species that occur at low densities, such as the mountain plover¹³⁰. The majority of mountain plovers winter in California, although there are some reports of wintering birds in Arizona, Texas, and Mexico.

6.1.2.3 Factors Affecting Mountain Plover

Historically, the conversion of grassland to cropland likely contributed to the decline of the mountain plover. Livestock grazing occurs throughout the nesting habitat of the mountain plover and often

¹²⁶ Parrish (1988)

¹²⁷ Dechant et al. (2003b)

¹²⁸ Knopf and Wunder (2006)

¹²⁹ Ibid.

¹³⁰ Wyoming Game and Fish Department (2006)

favors uniform cover, unlike historical grazing regimes that provided a mosaic of grasses, forbs, and bare ground for the species. Although much of the natural habitat in the mountain plover's wintering range has been lost (largely in California), the habitat loss does not seem to have limited plover populations. Therefore, the FWS has found that habitat loss does not pose a significant threat to the mountain plover.

Predation influences the productivity of all ground-nesting birds, including the mountain plover. Mountain plover eggs and chicks are the most vulnerable to terrestrial and avian predation. Although nesting success may be affected locally in some years, it is not a persistent factor throughout the species' range.

Because mountain plovers congregate in large flocks on the wintering grounds, they may be more vulnerable to local catastrophic events there, although the likelihood of such an event is small. Control of grasshoppers and other pests on private lands may also pose a threat to the mountain plover. Additionally, mountain plovers may be exposed to pesticides and other chemicals while they occupy winter habitat in California. However, a review of exposure to various chemicals showed that concentrations were below thresholds that cause population-level effects.

6.1.3 Burrowing Owl

From 1994 until 1996 when the category was eliminated, the western burrowing owl was listed by the FWS as a category 2 candidate species, indicating that more information was necessary to determine whether the species status was declining, stable, or improving. Although the burrowing owl is not a candidate species at this time, it is considered a bird of conservation concern at the national level by the FWS¹³¹ and is classified as a regionally sensitive species by USFS and the Wyoming State Office of the BLM, and as a Species of Concern by wildlife agencies of several states. The WGFD (2010) identifies the burrowing owl on its list of species of greatest conservation need as a Native Species of Special Concern based on 1) unknown population status and trends, 2) habitat vulnerability, and 3) sensitivity to human disturbance. In depth information regarding the background and status of the burrowing owl is presented in two recent documents: a status assessment and conservation plan prepared by Klute et al. (2003) and a conservation assessment prepared by McDonald et al. (2004).

6.1.3.1 Burrowing Owl Natural History

The burrowing owl is a small, ground-dwelling owl with long legs, a round head with an oval facial ruff, and no ear tufts¹³². The species is semi-colonial and uses open, treeless areas for nesting. Because short vegetative structure is important in allowing for detection of predators, burrowing owls are commonly found in association with cattle, prairie dogs, and other grazers¹³³.

The species often nests in prairie dog burrows, as well as burrows dug by other animals such as badgers or foxes. Burrowing owls will use active and relatively inactive prairie dog colonies, but have been shown to experience lower rates of nest depredation and have higher rates of nesting success on larger, denser prairie dog colonies¹³⁴. In northeastern Colorado, density of burrowing owls was correlated with

¹³¹ US Fish & Wildlife Service (2008)

¹³² Poulin et al. (2011)

¹³³ McDonald et al. (2004)

¹³⁴ Dechant et al. (2003c)

active burrow density. In 26 of 27 colonies occupied by burrowing owls, at least 50 percent of the prairie dog burrows were active¹³⁵. In southeastern Colorado, burrowing owls occupied prairie dog colonies with 43 percent active burrows¹³⁶. Habitat selection by burrowing owls was correlated with burrow length, high burrow density, low shrub cover, prairie dog activity, and closeness to water in the Thunder Basin¹³⁷.

Burrowing owls are opportunist feeders, consuming insects, small mammals (mice and voles), birds and other prey¹³⁸. Burrowing owls appear to prefer a vegetation mosaic with nesting habitat interspersed with taller vegetation for hunting¹³⁹.

Those burrowing owls that nest in Canada and the northern Great Plains typically leave their wintering grounds in March and April, arriving on the northern breeding grounds as late as May. Wyoming burrowing owls typically arrive on the breeding grounds in late April¹⁴⁰. Burrowing owls begin laying eggs in late March in the southern part of the range (northern Arizona and New Mexico), and mid-May in the north (southern Canada). In the Thunder Basin, nest initiation dates are typically between April 15 and June 1¹⁴¹. They produce only one brood per season with 7 to 9 eggs in an average clutch and between 1.6 and 4.9 young fledged per nest attempt¹⁴². In Wyoming, an average of 3 young fledge per nest¹⁴³. Northern birds leave for their wintering grounds by mid-October, while more southern birds remain year-round¹⁴⁴.

6.1.3.2 Burrowing Owl Distribution

The historical breeding range of the burrowing owl includes portions of southwestern Canada south through the non-forested portions of the western United States (as far east as western Minnesota) and into central Mexico. The breeding range has contracted primarily on the eastern and northern edges, particularly in Manitoba, North and South Dakota, Nebraska, Kansas, Oklahoma, and Texas. Burrowing owls generally winter from Mexico to El Salvador, but have been noted in lesser abundance in Arizona, California, Kansas, New Mexico, Oklahoma, Oregon, and Texas. Wyoming forms part of the core of the burrowing owl's breeding range, with owls widespread in grassland and shrub-steppe habitats and often associated with prairie dog colonies¹⁴⁵. In Wyoming, burrowing owls are at highest concentrations in the south and east, although the species has been documented in all of the State's latilongs, with confirmed or probable breeding in 24 of the 28 latilongs¹⁴⁶. However, the Thunder Basin National Grasslands had a relatively low percentage of black-tailed prairie dog colonies occupied by burrowing owls during surveys conducted during 1998, with only 16 percent occupied as compared to

¹³⁵ Klute et al. (2003)

¹³⁶ Dechant et al. (2003c)

¹³⁷ Lantz (2005)

¹³⁸ Poulin et al. 2011

¹³⁹ McDonald et al. (2004)

¹⁴⁰ Ibid.

¹⁴¹ Lantz (2005)

¹⁴² Poulin et al. (2011)

¹⁴³ McDonald et al. (2004)

¹⁴⁴ Gillihan et al. (2001)

¹⁴⁵ Beauvais (2000a)

¹⁴⁶ Wyoming Game and Fish Department (2006)

55 percent occupied across all national grasslands included in the study¹⁴⁷. The Breeding Bird Survey detected significant declines of burrowing owls in Wyoming during 1966-2002; however, these data are uncertain given weaknesses in the BBS in monitoring species that occur at low densities, such as the burrowing owl¹⁴⁸.

6.1.3.3 Factors Affecting Burrowing Owl

Habitat loss and degradation is the single most important threat to persistence, mostly due to declines in prairie dog colonies and to land conversion for urban and agricultural uses¹⁴⁹. Elimination of burrowing rodents through control programs has also been identified as the primary factor in the recent and historical decline of burrowing owl populations¹⁵⁰.

Loss to predation in fragmented and/or urban landscapes where edge-loving and domestic predator densities are high has been identified as a threat to burrowing owls¹⁵¹. Additionally, indirect effects of sylvatic plague on burrowing owls that use prairie dog colonies has the potential to significantly affect burrowing owls through loss of habitat and food sources¹⁵².

Insecticides and rodenticides can directly kill or reduce the growth and reproductive rates of owls in agricultural areas¹⁵³. Incidental shooting of burrowing owls as a byproduct of recreational shooting of prairie dogs has been documented, although it is not likely a significant threat¹⁵⁴. Because burrowing owls do not appear to scavenge prairie dog carcasses, ingestion of lead fragments is not considered to be a threat to burrowing owls¹⁵⁵. Collision with vehicles has been cited as a source of mortality, but the significance of this mortality is not known¹⁵⁶.

6.1.4 Ferruginous Hawk

From 1982 until 1996 when the category was eliminated, the ferruginous hawk was listed by the FWS as a category 2 candidate species. The FWS was petitioned to list the ferruginous hawk in 1991 and found listing was not warranted in 1992¹⁵⁷. Although the ferruginous hawk is not a candidate species at this time, the ferruginous hawk is considered a bird of conservation concern at the national level by the FWS¹⁵⁸ and is classified as a regionally sensitive species by the USFS and the Wyoming State Office of the BLM. The WGFD (2010) identifies the ferruginous hawk on its list of species of greatest conservation need as a Native Species of Special Concern based on 1) wide distribution, 2) unknown population status and trends, 3) ongoing significant loss of habitat, and 4) sensitivity to human disturbance.

¹⁴⁷ Sidle et al. (2001)

¹⁴⁸ Wyoming Game and Fish Department (2006)

¹⁴⁹ McDonald et al. (2004)

¹⁵⁰ Deschant et al. (2001), Klute et al. (2003), McDonald et al. (2004)

¹⁵¹ Klute et al. (2003), McDonald et al. (2004)

¹⁵² Ibid.

¹⁵³ Deschant et al. (2001), Klute et al. (2003), McDonald et al. (2004)

¹⁵⁴ McDonald et al. (2004)

¹⁵⁵ Klute et al. (2003), McDonald et al. (2004)

¹⁵⁶ Klute et al. (2003)

¹⁵⁷ 57 FR 37507, July 20, 1995

¹⁵⁸ US Fish & Wildlife Service (2008)

6.1.4.1 Ferruginous Hawk Natural History

The ferruginous hawk is a large, broad-winged hawk that nests in flat or rolling terrain in pinyon-juniper, shrublands, and grasslands of the western United States, but rarely nests in forests. Landscapes with less than 50 percent coverage of cropland and hayland are used for nesting and foraging¹⁵⁹. Ferruginous hawks use a variety of nesting substrates, most commonly trees and large shrubs, followed by cliffs, utility structures, dirt outcrops, and relatively flat ground¹⁶⁰. Historically, ground nesting was common¹⁶¹. They typically build large nests of sticks, twigs and debris and often reuse nests for many years¹⁶². In northeastern Wyoming, ferruginous hawks are opportunistic nesters, often selecting nest sites away from golden eagle nests¹⁶³. Territory and nest site re-occupancy is common for ferruginous hawks and territories often contain multiple alternate nests¹⁶⁴.

Most breeding ferruginous hawks arrive in Wyoming in April and leave by September¹⁶⁵. Ferruginous hawks are easily disturbed during the breeding season, particularly during the early stages of nesting, and sensitivity to disturbance may be heightened during years of low prey abundance¹⁶⁶. Average annual clutch size of ferruginous hawks varies from 2 to 4 eggs, but can range from 1 to 8 depending upon prey abundance. The mean number of fledglings produced by a breeding pair each year ranges from 1.3 to 3.2¹⁶⁷. Young typically leave the nest at 38 to 50 days of age, but remain dependent upon the parents for several weeks after fledging¹⁶⁸.

Ferruginous hawks eat primarily mammals, including rabbits, ground squirrels, prairie dogs, and pocket gophers. Generally, to the east of the Continental Divide the primary prey is prairie dogs and other ground squirrels¹⁶⁹. In southern Wyoming, MacLaren et al. (1988) found ferruginous hawks had the most diverse diet when compared to prairie falcons, golden eagles, and red tailed hawks. Ferruginous hawks took 37 percent ground squirrels, 22 percent prairie dogs, and 20 percent leporids. However, leporids actually contributed 48 percent of the biomass consumed as compared to 22 percent from prairie dogs and 16 percent from ground squirrels. Although ferruginous hawks may shift to other prey when their principal prey species declines, productivity is affected by densities of major prey species¹⁷⁰.

6.1.4.2 Ferruginous Hawk Distribution

The ferruginous hawk breeding habitat includes western North America from southern Canada between the Great Plains and Rocky Mountains south to northern Arizona and New Mexico. Nesting generally occurs as far east as western South Dakota and western Nebraska and as far west as the Great Basin and Columbia River Basin regions. Wintering range includes primarily grassland and shrub-steppe habitats in northern California through portions of the southwest into northern Texas, New Mexico,

¹⁵⁹ Dechant et al. (2003a)

¹⁶⁰ Olendorff (1993), Bechard and Schmutz (1995), Dechant (2003a)

¹⁶¹ Commission for Environmental Cooperation (2005)

¹⁶² Bechard and Schmutz (1995)

¹⁶³ Phillips and Beske (1990)

¹⁶⁴ Dechant et al. (2003a)

¹⁶⁵ Beauvais (2000b)

¹⁶⁶ Dechant et al. (2003a)

¹⁶⁷ Bechard and Schmutz (1995)

¹⁶⁸ Ibid.

¹⁶⁹ Ibid.

¹⁷⁰ Olendorff (1993)

Arizona, and portions of Colorado¹⁷¹. In Wyoming, the ferruginous hawk is found statewide excluding the mountainous areas. It has been documented in all of the State's 28 latilongs, with confirmed or probable breeding in 25 of them¹⁷². The Breeding Bird Survey did not detect a trend for the ferruginous hawk in Wyoming during 1966-2002; however, these data are uncertain given weaknesses in the BBS in monitoring species that occur at low densities, such as the ferruginous hawk¹⁷³.

6.1.4.3 Factors Affecting Ferruginous Hawk

Population declines have been attributed to loss of habitat to cultivation, urbanization, grazing, control of small mammals, mining, and fire management, with cultivation the most significant¹⁷⁴. Several of the habitat effects are related to prey availability. For example, cultivation leads to replacement of short grasses by taller crops that conceal prey items more effectively. Additionally, nest tree availability is adversely affected by cultivation and some grazing regimes. Olendorff (1993) asserted that grazing with improper stocking levels could also lead to adverse effects to prey items. However, in the Thunder Basin grazing benefits ferruginous hawks by reducing vegetative cover and making prey more visible¹⁷⁵.

There is no evidence that overutilization is a factor affecting the species. Eggs were once valuable to collectors, but most collecting occurred during the early 1900s, was not likely a key factor in declines, and no longer appears to be a threat¹⁷⁶. Collection for use in falconry is not a threat as ferruginous hawks are rarely used in falconry¹⁷⁷.

There is no indication that disease is a factor affecting this species. There are few documented instances of nest predation, although ground predators such as coyotes and badgers may pose a threat to ground- nesting ferruginous hawks¹⁷⁸.

Poisoning and control of prey items (including prairie dogs) can produce local food shortages leading to interruptions in breeding, decreased productivity, and increased susceptibility of breeding ferruginous hawks to human disturbance¹⁷⁹. Poisoning, with rodenticides such as zinc phosphide, is used to control rodent populations with minimal impacts to secondary consumers¹⁸⁰. However, there is considerable risk of secondary poisoning to non-target avian and mammalian predators and scavengers from the recently approved use of anticoagulant rodenticides such as Rozol™ and Kaput™ for prairie dog control. Bechard and Schmutz (1995) and Olendorff (1993) report reduced productivity of nests near active oil and gas wells, although Dechant et al. (2003a) cites a study from Montana that reported no negative impacts on productivity as a result of petroleum development. Collisions with power lines and electrocutions result in occasional mortality of ferruginous hawks, but do not appear to pose a

¹⁷¹ Bechard and Schmutz (1995)

¹⁷² Wyoming Game & Fish Department (2006)

¹⁷³ Ibid.

¹⁷⁴ Olendorff (1993), Bechard and Schmutz (1995), Dechant et al. (2003a)

¹⁷⁵ Kantrud and Kologiski (1983), Konrad and Gilmer (1986)

¹⁷⁶ Bechard and Schmutz (1995)

¹⁷⁷ Commission for Environmental Cooperation (2005)

¹⁷⁸ Bechard and Schmutz (1995)

¹⁷⁹ Olendorff (1993)

¹⁸⁰ Andelt (2006)

significant threat to the population¹⁸¹.

A recent study of lead shot retention in recreationally shot prairie dogs in the Thunder Basin found that 87 percent of prairie dogs shot with soft point (expanding) bullets contained detectable amounts of bullet fragments¹⁸². Although the estimates were variable, on average 228 mg of the lead bullet core remained in the carcass. Seventy-three percent of the lead fragments in the carcasses were small, each weighing less than 25 mg, which have potentially important implications for lead assimilation in secondary consumers, such as ferruginous hawks.

Predator-prey interactions often result in predators expending the least amount of effort for the maximum amount of forage (e.g., large prey such as lagomorph versus small prey such as prairie dogs). Olendorff (1993) reported that while the frequency of consumption of prairie dogs and ground squirrels is over 44 percent, the actual biomass consumed by ferruginous hawks is greater than 65 percent lagomorph. Considering the diversity and availability of prey items in this area, the large areas the hawks cover in their home ranges, the actual risk from lead ingestion and poisoning is likely minimal.

6.2 Threats, Conservation Measures, Benefits, and Monitoring

For ease of reference, shortgrass prairie threats and associated Conservation Measures are found in Appendix D. They are listed by each of the five threat factor areas—Factor A: The present or threatened destruction, modification, or curtailment of habitat or range; Factor B: Overutilization for commercial, recreational, scientific, or education purposes; Factor C: Disease and predation; Factor D: Inadequacy of existing regulatory mechanisms; and Factor E: Other natural or manmade factors affecting the species' continued existence. A listing ranked by point value and a detailed presentation of benefits and required monitoring can also be found in Appendix D.

7 EXPECTED BENEFITS

Implementation of this Strategy is intended to reduce threats to the Covered Species under each of the five threat factors which will be considered in any future listing decision by the FWS. The Conservation Measures identified in this Strategy are expected to benefit the Covered Species by maintaining, enhancing, and restoring Covered Species' populations and their habitats as well as reducing the threats of direct mortality. Specific benefits of each Conservation Measure are listed in Appendices C and D. Since non-federal landowners control lands that are important habitats for the Covered Species, conservation of these species will be enhanced by encouraging the implementation of Conservation Measures by the Participating Members in a landscape scale setting.

All Participating Members in this Strategy will implement Conservation Measures specifically identified as addressing habitat fragmentation and destruction on their enrolled acreage. Along with decreasing fragmentation, these Conservation Measures will help maintain resiliency and increase heterogeneity. Through the implementation of the point system discussed in Appendix E, participating CI and CI/CP holders will choose additional Conservation Measures which will contribute to this ecosystem based approach. The suite of available Conservation Measures is designed to reduce or prevent habitat

¹⁸¹ Olendorff (1993), Bechard and Schmutz (1995)

¹⁸² Pauli and Buskirk (2007)

fragmentation, maintain or enhance habitat, and avoid or minimize incidental take of Covered Species while implementing the Covered Activities. Should all landowners within the Coverage Area participate and provide Conservation Measures as outlined in this Strategy, threats would be reduced within the Coverage Area. Therefore, a substantial conservation benefit would be realized for the Covered Species. In addition, the Strategy provides Participating Members the ability to collaboratively implement or fund Conservation Measures where durable conservation benefit would be achieved. The Strategy will advance the recovery of the Covered Species and is expected to result in a larger number and more widely distributed populations of each of the Covered Species as required by the CCAA Standard.

8 DIRECT/INCIDENTAL TAKE

Specific authorization of direct and incidental take is provided as part of the Enhancement of Survival permit that may be issued by the FWS. Should any of the Covered Species become listed under the ESA, authorization for incidental take under the Enhancement of Survival permit is limited to the Covered Activities of the Participating Landowners as set forth in the Strategy and individual CIs or CI/CPs. Section 9 of the ESA and federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Under the ESA, take is defined in 50 CFR § 17.3 as: “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct.” Harass is defined by the FWS as “any intentional or negligent act, or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering”. Harm is defined by the FWS to mean “an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.” Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2) of the ESA, taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA, provided that such taking is in compliance with the terms and conditions of the incidental take statement.

Habitat loss and fragmentation have been identified as the primary causes of declines for the Covered Species. Therefore, the protection of existing habitat as well as the restoration of degraded habitat is crucial to the continued existence of the Covered Species. The Conservation Measures identified in this Strategy are expected to maintain and enhance habitat on enrolled lands and limit adverse impacts that the Covered Activities may have on the Covered Species.

There is no take prohibition of Covered Species under the ESA until such time as they become listed. However, six of the Covered Species, sagebrush sparrow, Brewer’s sparrow, sage thrasher, mountain plover, burrowing owl, and ferruginous hawk, are covered under the Migratory Bird Treaty Act, regardless of the species status under the ESA. Conservation Measures were designed to avoid and minimize impacts to migratory birds.

8.1 Level of Direct Take

The Section 10(a)(1)(A) permit would authorize the direct take of black-tailed prairie dogs under the

authority of regulations pertaining to enhancement-of-survival permits for species federally listed as endangered (50 CFR 17.22(a)) or for species federally listed as threatened (50 CFR 17.32 (a)).

The permit would include conditions for each type of take. Direct take of black-tailed prairie dogs is limited to the following actions:

- Implementation of Conservation Measures for Shortgrass Prairie (Appendix D) A4A, B1B, C1A, and C1B allowing for ½ mile boundary control of black-tailed prairie dog colonies, as described in approved CIs or CI/CPs. These Conservation Measures may require direct take of black-tailed prairie dogs but benefit the species as management of a discontinuous, moderately dense prairie dog population may limit the spread of plague and other disease.
- Control of black-tailed prairie dogs for human health and safety purposes. Due to implementation of Conservation Measures benefiting the black-tailed prairie dog, a Participating Member may experience increases in prairie dog numbers that could detrimentally impact the cooperator's ongoing ranching and farming activities. Thus, control measures, including poisoning and shooting, resulting in take of black-tailed prairie dogs would be authorized in areas within enrolled property identified as areas of control within approved CI/CPs. Participating Members would identify where black-tailed prairie dogs could detrimentally impact the participants' ongoing ranching and farming activities, or where they have the potential to adversely affect human health and safety (i.e., within ½ mile of structures such as homes, barns, or dams). These areas must be identified in the CI or CI/CP.

The Association estimates that a maximum of 10% of Participating Members would implement control measures resulting in direct take of black-tailed prairie dogs. It is anticipated that given fluctuating prairie dog population numbers, this amount of control would infrequently be necessary and only applicable in the years of high expansion of prairie dog numbers. Using this estimate, the FWS's estimate of direct take of black-tailed prairie dog due to the proposed action is up to 1,460 prairie dogs annually. This annual take allowance equates to approximately 0.1 percent of the estimated 1.36 million prairie dogs within the Coverage Area.

8.2 Level of Incidental Take

The Association anticipates that the incidental take of the Covered Species will be difficult to predict and detect. Scientific data that quantify the effects of the proposed actions on the eight species, and on individuals of each species, is very limited. Thus, there is uncertainty in generating specific metrics for anticipated level of incidental take, such as number of expected mortalities of individuals, or numbers of habitat acres temporarily or permanently lost or temporarily affected. A complex range of factors will influence the response or fate of the individuals of a species to impacts. Factors contributing to this uncertainty include, but are not limited to: 1) inability to accurately predict the location, frequency, timing, duration, etc. of proposed projects; 2) inability to accurately measure the nature or extent of potential effects; 3) limited ability to pinpoint the source, or combined sources, of effects; 4) the uncertainty of population numbers of the Covered Species within the Coverage Area; 5) seasonal fluctuations in environmental conditions and natural fluctuations in population numbers; 6) accounting for confounding or stochastic events such as drought or wildfire; and 7) sources of risk that emerge outside private lands covered under the CCAA. Due to the landscape scale of this Strategy, the Association cannot quantify the exact amount of enrolled acres and the conservation commitment at

this time but preliminary estimates indicate approximately 1.2 million acres are ready for enrollment and therefore anticipates that Covered Activities and Conservation Measures may be implemented on that amount of land.

Estimated incidental take is based primarily on the risk to the species from harassment, and the likelihood of their injury, mortality. Risk is evaluated by estimating the potential exposure and likely response of individuals to ongoing ranching and energy development activities (Covered Activities). Importantly, not all individuals of each species exposed to a particular disturbance will respond negatively such that effects reach the level of take. In other words, adverse effects may occur, such as flushing of birds during livestock management activities, but may be insignificant such that vital rates (reproductive success, survival, etc.) are not affected.

We recognize that the estimates provided below are based on a number of assumptions. For instance, we assume that individuals of each species are evenly distributed across the habitat type and that all individuals, of all age classes, have an equal probability of being exposed to Covered Activities. We believe that our assumptions have been selected such that they are very likely to over-estimate the number of individuals affected and subject to adverse effects including mortality, rather than underestimate the effects. Additionally, we anticipate that Conservation Measures in Appendices C and D will minimize adverse effects including the injury or death of individuals. For some actions, we assume that incidental take may be reduced by as much as 95 percent (i.e., the rate of mortality or injury would be 5 percent). As noted above, we also expect that Conservation Measures including offsite conservation actions will minimize adverse effects including the injury and death of individuals.

Based on the FWS assessment of the adverse effects or potential risks to the species and their habitats from implementation of the CCAA, their estimate of incidental take in the form of harm or harassment caused by the Covered Activities is expected to involve up to 30 greater sage-grouse, 5 sagebrush sparrow, 2,800 Brewer's sparrow, 15 sage thrasher, 455 black-tailed prairie dog, 5 mountain plover, 5 burrowing owl and 10 ferruginous hawk taken over each 5 year period of the 30 year CCAA, under full participation across the Coverage Area.

8.3 Type of Take

Incidental take could occur as a result from Covered Activities. Based on the FWS's analysis of potential threats related to the Covered Activities, and the suite of Conservation Measures identified to address those threats, we believe that most impacts to sagebrush and short-grass prairie habitats and take of sagebrush obligate or short-grass prairie individuals will be avoided to the extent practicable. However, it is likely that all impacts to habitats and individuals cannot be avoided and some adverse effects, including the direct take of black-tailed prairie dogs and the unintentional take of the eight species will occur on participant's lands. We anticipate that the threats and associated effects described above can be grouped into five categories which may result in take of sagebrush obligate or short-grass prairie species, and thus require direct take and incidental take coverage if the species is listed. These categories include:

- 1) Habitat Fragmentation and Destruction, which includes coal mines, oil and gas development, conversion of suitable habitat and infrastructure in sagebrush habitats;
- 2) Management of Vegetation which includes invasive and non-native plants, woodland encroachment, restoration of disturbed habitats and sagebrush management;

- 3) Livestock Management and Agricultural Production;
- 4) Disease Management; and
- 5) Direct take of black-tailed prairie dogs from poisoning and managed shooting.

The implementation of the Strategy is intended to avoid and minimize the sources of incidental take from Covered Activities and reduce the impacts to the Covered Species. Incidental take could occur as a result of management practices that modify suitable habitat to an extent that successful reproductive and recruitment activities by the Covered Species are impaired or eliminated (e.g., fragmentation, conversion or loss of existing habitat through inappropriate siting of roads, fences, pipelines, energy facilities, and subdivisions; inappropriate reclamation; inadequate control of invasive species and of wildfire in sagebrush habitat; inappropriate livestock grazing and wildlife management; etc.). Incidental take could also occur through direct mortality (e.g., stock tanks with no wildlife escape ramps; collisions with barbed-wire fences and power lines; machinery operations associated with haying, topsoil stripping, drilling, blasting, etc.; collisions with vehicles (both on- and off-road); trampling of nests by livestock; etc.).

8.4 Impact of Take

The Conservation Measures included in this Strategy are intended to address all potential sources of take related to habitat loss or degradation associated with the Covered Species. The minor negative effects of the Strategy are unlikely to result in an appreciable reduction in the likelihood of survival and recovery of any of the eight species across their entire range. The Conservation Measures implemented through participation of this CCAA will facilitate avoidance, minimization, and off-setting of threats across approximately 23 percent of sagebrush habitat and approximately 40 percent of the shortgrass prairie habitat in Wyoming, depending upon participation, providing a long-term, net benefit for sagebrush obligate and shortgrass prairie species on a landscape scale. The beneficial effects from implementation of this Strategy are expected to accrue over time.

Most of the off-property cooperative Conservation Measures implemented by energy companies will provide long-term benefits for the Covered Species in addition to those provided by impact minimization and habitat reclamation associated with energy development, thus multiplying conserved habitat. Implementation of the proposed Conservation Measures will advance the recovery of these species and result in a net increase in available habitat to these species over the long-term. Conservation benefits for the Covered Species under this Strategy will thus accrue well beyond the duration of the conservation period. This should result in reduced impacts and incidental take of these species. Incidental take by Participating Members and the resulting effects to the Covered Species are expected to be sporadic in nature and minimal when considered across both the landscape and temporal scales of the Strategy.

In order for Participating Members to agree to ensure the long-term conservation of the black-tailed prairie dog, the populations must be managed to decrease detrimental impacts on ongoing ranching and farming activities. Impacts of control of black-tailed prairie dogs resulting in direct take are significantly outweighed by conservation benefits associated with the implementation of Conservation Measures for the shortgrass ecotype that directly benefits prairie dogs by increasing populations and improving habitat.

8.5 Notification of Take

This Strategy does not require that a Participating Member notify the Association or FWS prior to any expected incidental take of the Covered Species that might be associated with Covered Activities, as we anticipate incidental take may not be anticipated in advance.

If incidental take occurs, the Participating Member shall notify the Association within 30 days. The Association will notify the FWS if levels of anticipated future take may exceed permitted levels. Incidental take that has occurred over the prior year will be included in the Association's annual report.

9 ASSURANCES PROVIDED FOR NON-FEDERAL PROPERTY

In return for committing to implement Conservation Measures, as specified in their CI, to improve the status of the Covered Species, the FWS provides Participating Members with regulatory assurances, as set forth at CFR 50 17.22(d)(5), that the Covered Activities can continue without interruption if any of the Covered Species were to be listed under the ESA. More specifically, upon the approval and execution of a CI under this CCAA, the FWS will provide the Participating Member with assurances that no additional Conservation Measures or additional land, water, or resource use restrictions, beyond those voluntarily agreed to and described in the CCAA and/or CI, will be imposed on enrolled properties should the Covered Species become listed as a threatened or endangered species, provided that the CI is being implemented as agreed upon. These assurances, set forth in the enhancement of survival permit that will be issued to the Association, will be authorized with the approval of each CI. This is consistent with the CCAA Final Policy (64 FR 32726) and the regulations implementing the policy (69 FR 24084).

10 CHANGED OR UNFORESEEN CIRCUMSTANCES

10.1 Changed Circumstances Provided for in the Strategy

Changed circumstances are those that affect the Covered Species or their habitat within the Covered Area by altering an expected outcome of the Conservation Measures in a CI. As used in this section, Changed Circumstances include only such circumstances that can be reasonably anticipated and for which the FWS, Participating Members, and the Association can plan responses (see Section 10.3 below regarding Unforeseen Circumstances). This CCAA has identified mineral ownership and energy development, wildfire, drought, West Nile virus, plague, and climatic variations (including catastrophic flooding) as potential Changed Circumstances that are reasonably anticipated to occur over the term of this CCAA.

The contingency responses to the identified Changed Circumstances, referred to as Changed Circumstances Conservation Measures (CCCMs) and described below, are considered part of this CCAA and each CI through which properties are enrolled in this Strategy. As a result, any incidental take of Covered Species resulting from implementation of the CCCMs provided for in this CCAA is authorized by this CCAA and the permit. The FWS will not impose any restrictions or conservation measures beyond those identified in this CCAA or CI without the consent of the Participating Member, provided the CI is being implemented as agreed.

Changed Circumstances affecting single or limited numbers of CIs will be handled on a case by case basis. The Association will discuss the Changed Circumstances with the affected Participating Member. Following this discussion, each member of the Conservation Advisory Committee (see Appendix E, Section 6.1 for membership information) will be given an electronic copy of the Changed Circumstances at issue and any proposed alternatives to review. Adequate review will require response from a simple majority of the then current Committee members. Recommendations from this Committee will be documented and presented to the Board, the affected Participating Member(s), and the FWS. Any modification to the member's CI/CP will occur through consultation and mutual agreement among the Association, the affected Participating Member(s), and FWS. Approved modifications will be incorporated into the Participating Member's CI.

However, if one or more circumstances occur that effectively eliminates a substantial amount of habitat (e.g., the ability to maintain the required assemblage point minimum of 33 percent is not possible within the time frame of the Strategy) the Association will notify the Conservation Advisory Committee within 30 days of that determination. Within 90 days of notification, the Association, the Conservation Advisory Committee, and the FWS will meet and evaluate the Conservation Measures, the monitoring data, and identify potential Conservation Measures, management practices, or other actions which could be employed to address the change in circumstances. The Adaptive Management framework will be used to make future adjustments as necessary. Approved modifications will be incorporated into the Participating Member's CI.

Mineral Ownership and Energy Development. In some instances the mineral ownership of lands in the Coverage Area differs from the surface ownership of the same parcel(s). There exists the potential that the surface owner has a CI under the CCAA, but the mineral owner does not. In those cases mineral development activities may occur on enrolled lands but outside the control of the surface owner holding the CI on those lands and contrary to the CI Conservation Measures applied to those lands. Impacts can include both direct loss of habitat and habitat fragmentation by roads, pipelines, power lines, wind turbines, and other infrastructure. CCCMs that could be considered for the CI holder include, but are not limited to:

- Inclusion of additional Conservation Measures from the following topic categories from Appendices C and D: energy development, split estate, facilities, roads, etc. The Participating Member also has the option to participate or fund off-property Conservation Measures in one of the designated CPAs.
- Reduction of Conservation Measure point values (see Appendix E, Section 4.5, Figure 2). If unanticipated development of these subsurface minerals occurs, the FWS will review those actions related to the development of the particular Covered Activity and will work with other agencies having jurisdiction to ensure that they are compatible with the conditions of the Strategy.

Wildfire. There is a potential for catastrophic fire throughout the Coverage Area. Fire can eliminate suitable habitat and increase the likelihood of invasive, noxious plants. The Association, Conservation Advisory Committee, FWS, and Participating Member will evaluate the potential for ecosystem conversion after a fire occurs (sagebrush steppe vs. shortgrass prairie in the context of CCAA conservation) and the need for rehabilitation or potential for natural recovery based on pre-fire plant

community health, fire intensity, and proximity to invasive annual species (e.g., cheatgrass). CCCMs that could be considered include, but are not limited to:

- Inclusion of additional Conservation Measures from the following topic categories from Appendices C and D: wildfires, invasive species, inappropriate livestock & wildlife grazing management, etc.
- Allowing for natural recovery where healthy pre-fire plant communities existed and observed fire intensity indicates natural recovery and proximity of invasive species are not a concern. Timing of livestock grazing following wildfire will depend on response of desirable vegetation. The Participating Member will identify and set quantifiable objectives for post-fire vegetation recovery based on pre-fire monitoring data, returning livestock grazing once objectives have been met.
- Participation in rehabilitation where natural recovery is unlikely, due to fire intensity and/or proximity to invasive annual species, and where feasible, practicable, and if adequate funding is available. The Association, Conservation Advisory Committee, and Participating Member will determine and implement appropriate measures to prevent or control invasive noxious vegetation. Post-treatment monitoring will be conducted to determine if rehabilitation techniques have been successful or if implementation changes are indicated.
- Replacement of fence or installation of temporary fence where needed to protect recovering habitat post-fire, and, where appropriate, mark these fences with anti-strike markers or other agreed upon visual markers as described in the relevant Conservation Measures of the CCAA.

Drought. Variation in precipitation amount is not an uncommon event within the Coverage Area. Annual monitoring and Conservation Measures applicable to the enrolled lands are expected to detect year to year variations in precipitation amounts and the effect on vegetation. However, prolonged or severe drought in important habitat areas in the Coverage Area may create conditions that reduce seasonally available habitat beyond normal annual variation and cause changes on the landscape. Prolonged periods are defined here as three years or more. CCCMs that could be considered include, but are not limited to:

- Inclusion of additional Conservation Measures from the following topic categories from Appendices C and D: loss of green vegetation and insects, invasive species, inappropriate livestock & wildlife grazing management, etc.
- Use of Adaptive Management to adjust levels and season of livestock grazing during drought conditions to maintain suitable habitat using the site specific conditions as determined by monitoring. These Adaptive Management measures may include one or more of the following, as mutually agreed upon:
 - a. Implement management changes, such as grazing rest, deferment, rotation, or other changes designed to maintain long term vegetation health for habitat.
 - b. Develop grass banks for use during drought conditions.
 - c. Develop additional water sources for livestock.

Disease Including West Nile Virus and Sylvatic Plague. The occurrence and effects of West Nile virus are largely unpredictable and outside the scope of control of FWS, the Association, or Participating

Members. Sylvatic plague outbreaks are also unpredictable and outside the scope of control of FWS, the Association, or Participating Members. The parties recognize that Changed Circumstances will apply to significant outbreaks as opposed to relatively small occurrences.

CCCMs for West Nile Virus that could be considered include, but are not limited to:

- Inclusion of additional Conservation Measures from the following topic categories from Appendices C and D: West Nile virus, loss of green vegetation and insects, lack of suitable water availability, etc.
- Reporting of observations of dead or sick sage-grouse or other bird deaths that could be attributed to disease or parasites to the Association within 48 hours of detection.

CCCMs for Sylvatic plague that could be considered include, but are not limited to:

- Inclusion of additional Conservation Measures from the following topic categories from Appendices C and D: plague, control of prey/food sources, use of insecticides, etc.
- Reporting of significant decreases in numbers of prairie dogs observed in established colonies that could be attributed to disease to the Association within 48 hours of detection.

Climatic Variations. Scientists predict that variations in climate will result in changes to temperatures and precipitation patterns in the Coverage Area¹⁸³. These effects are predicted to result in increased wildfire and invasive species interactions, and conditions that are suitable for West Nile virus transmission in sage-grouse populations¹⁸⁴. Although the current climate models are not available at a small scale (such as the lands covered by this Strategy) and their application and conclusions remain the subject of intense scientific debate, it is prudent to consider the potential impacts of climatic variations over the period of this Strategy. However, because the primary concerns are related to drought and fire, we believe appropriate actions to address Changed Circumstances associated with climate change impacts are sufficiently considered above.

Excessive runoff resulting from catastrophic hydrological events (e.g. rain on snow event) is associated with mass-wasting of hill slopes, damage to river banks, and downstream flooding. These events have the capability to drastically change stream hydrology and vegetative composition of riparian corridors. The FWS, the Association, and the Conservation Advisory Committee will evaluate the need for rehabilitation based on the degree of flood impact. CCCMs for drastic flood events that could be considered include, but are not limited to:

- Inclusion of additional Conservation Measures from the following topic categories from Appendices C and D: invasive species, loss of green vegetation and insects, West Nile virus, and damage to existing green areas.
- Adjustment of levels and season of livestock grazing to maintain and/or rehabilitate habitat for Covered Species.

10.2 Changed Circumstances not Provided for in the CCAA

If additional Conservation Measures are deemed necessary to respond to Changed Circumstances and such measures were not provided for in the Strategy's operating conservation program, the FWS will

¹⁸³ Global Climate Change Impacts in the United States (2009)

¹⁸⁴ Knick and Connelly, editors (2011)

not require any conservation and mitigation measures in addition to those provided for in the Strategy without the consent of the CI holders, provided the Strategy is being properly implemented.

10.3 Unforeseen Circumstances

Unforeseen Circumstances are those changes in circumstances affecting the Covered Species or their habitat in the Coverage Area that could not have been reasonably anticipated at the time of the CCAA's development, and that result in a substantial and adverse change in the status of the Covered Species. If additional Conservation Measures are necessary to respond to Unforeseen Circumstances with respect to a CI, the FWS will work with the Participating Member to determine what additional Conservation Measures or modifications would be appropriate to address the circumstance. However, implementation of additional Conservation Measures or modifications would be based solely upon willing agreement by the Participating Member. Additional Conservation Measures to respond to Unforeseen Circumstances will not require the commitment of additional land resources, water resources, financial compensation, or additional restrictions on the use of land, water, or other natural resources, beyond the level otherwise agreed upon in this CCAA and the relevant CI, without the consent of the Participating Member.

11 PROVISIONS FOR ADAPTIVE MANAGEMENT

An adaptive, outcome-based approach¹⁸⁵ will be used for allowing management flexibility, recognizing that Conservation Measures may need to be updated based on research results (see Appendix E for more information). Such an adaptive approach explicitly recognizes that multiple factors (e.g., environmental conditions, biological processes, etc.) affect Covered Species populations. Furthermore, the consequences of prescriptive Conservation Measures cannot be predicted with certainty, and therefore the Strategy provides a framework for making objective decisions in the face of that uncertainty. Thus, Adaptive Management relies on an iterative cycle of monitoring, assessment, and decision making to clarify the relationships among the Conservation Measures and response of habitat and ultimately, abundance of the Covered Species.

The Association will work with the Conservation Advisory Committee in the development and implementation of appropriate adaptive actions. Monitoring to determine habitat responses to the various treatment methods will continue. These monitoring results will be evaluated and used to define appropriate site-specific practices and to refine techniques. In addition, the Association will review reports and results from other regional projects involving Covered Species monitoring and/or habitat treatment to determine potential applicability to the Coverage Area. Appropriate adjustments will be considered and proposed to the signatory parties when these reviews note applicable refinements. This does not obligate the Association to commit additional land, water, or financial compensation or place additional restrictions on the use of land, water, or other natural resources beyond the level otherwise agreed upon for the species covered by the Strategy. These adjustments will be used in future CI or CI/CP development and current CI or CI/CP holders may adopt suggested changes if they so choose.

¹⁸⁵ Walters and Hilborn (1978)

12 MONITORING PROVISIONS

The Association, in conjunction with Participating Members and qualified consultants, will be responsible for monitoring as specified in each Conservation Measure (see Appendices C and D). Monitoring is based on established guidelines such as the those found in the Wyoming Rangeland Monitoring Guide, the Wyoming Game and Fish Department manuals, and peer-reviewed literature. In addition, members will be asked to report new energy development or reclaimed locations on their enrolled acres each year.

There are two components in the monitoring program: 1) compliance monitoring, which will include annual self-reporting by the Participating Member and compliance evaluations conducted by the Association, and 2) biological monitoring, which will include a baseline assessment by the Participating Member and the Association, and periodic habitat / wildlife monitoring conducted by the Association, qualified consultants, and Participating Member(s) that have been trained in appropriate monitoring protocols.

In addition to the monitoring associated with each Conservation Measure, the Association, in conjunction with Participating Members and qualified consultants, will gather the following information and store data in a database maintained by the Association:

- 1) Weekly and annual rainfall at 12 locations across the Coverage Area
- 2) Yearly monitoring of the sage-grouse leks assigned by the WGFD including currently identified and newly discovered leks
- 3) Determination of areal extent of selected black-tailed prairie dog colonies using GPS and GIS systems every other year to monitor expansion / contraction

The FWS, after reasonable prior notice to the Association, may enter the enrolled non-federal lands accompanied by Association representatives. Notice will be provided at least two weeks in advance of a visit by FWS staff conducting and/or assisting with monitoring.

Nothing in this section precludes the FWS from carrying out its duties as required and authorized by law, including law enforcement investigations.

Nothing in this Strategy supersedes existing access procedures and protocols required for industrial safety.

13 COMPLIANCE MONITORING

Each Participating Member will submit required annual reports to the Association by December 31 of each year or as specified in the CI or CI/CP. Additionally, the Association will provide a compiled annual report including any direct or incidental take, monitoring results and summaries of implementation status of approved CI and CI/CPs to the FWS by March 15 of the following year.

14 EFFECTIVENESS MONITORING

Effectiveness monitoring will be the responsibility of the Association with assistance from the Participating Member as agreed-upon in the relevant CI, and with Conservation Advisory Committee involvement as needed. The Association is responsible for evaluating effectiveness monitoring reports

submitted by the Participating Member. Appropriate monitoring is identified in each Conservation Measure (Appendices C and D) and may include monitoring such vegetation parameters as height, canopy cover, production, and species diversity or direct monitoring of such parameters as Covered Species numbers, locations, and extent of occupied habitat.

The FWS anticipates that stable to increasing populations of Covered Species will indicate that selected Conservation Measures were successfully implemented. However, the FWS recognizes that there are a number of factors contributing to the population trajectory of Covered Species in any given area. Consequently, a change in populations may not be detectable for several years—if they occur in a measurable way at all – due to implementation of selected Conservation Measures as a result of this CCAA.

15 RESCUE OF COVERED SPECIES

If any of the Covered Species become listed under the ESA, the Association agrees to provide the FWS with an opportunity to rescue individuals of the Covered Species on lands with CCAA coverage prior to actions that would cause losses to occur, provided the Association is aware of these actions.

Notification that Covered Species are available for rescue will be provided to the FWS at least 30 days in advance of the action. In no case will failure of the FWS to rescue identified Covered Species populations within the allotted time frame require Participating Members to delay any action(s) which could cause population losses to occur.

16 DURATION OF CCAA AND PERMIT

This CCAA will be in effect for 30 years following its approval and signing by the FWS and the Association. CIs for Participating Members, including any commitments related to funding under FWS programs, will be in effect for up to 30 years following approval and execution of the CI by the Association, or until expiration of this CCAA, whichever is earlier. The Section 10(a)(1)(A) permit authorizing incidental take of the species and providing the assurances described in this CCAA will be effective from the date of listing, should that occur, until the expiration date of this CCAA or the CI, whichever is earlier. The duration stated for this CCAA and the permit is primarily determined based on a timeframe that is sufficient to realize the benefits to the Covered Species and their habitats. The stated duration for CIs also provides a reasonable and efficient timeframe before Participating Members, the Association, and FWS would need to revisit the process for renewal, as appropriate. As long as the CCAA and Section 10(a)(1)(A) permit remain in effect, the Association may renew CIs or CI/CPs, based upon reevaluation of the CI or CI/CP's ability to continue to meet the CCAA Standard and agreement of the Participating Members. A Participating Member may also voluntarily terminate a CI, as described in Appendix E (Section 5.4).

17 MODIFICATIONS OF CCAA

If modifications to the CCAA are proposed, the FWS must determine whether the proposed modification would be a minor or major modification resulting in outcomes significantly different from those analyzed in the original Strategy. Minor modifications involve routine administrative revisions or changes to the operation and management program associated with this CCAA. Minor modifications do

not include the addition or significant alteration of Conservation Measures.

Upon agreement, the FWS and the Association can approve minor modifications to CCAA if the modification does not conflict with the purposes of the CCAA or would not result in some material change to the FWS's analyses (i.e., with respect to meeting the CCAA Standard, the amount of take authorized, the section 7 determination, or the NEPA decision). Minor modifications do not require notice in the Federal Register, but do require written documentation that the FWS and Association approved the modification prior to it becoming effective.

Major modifications may include, but are not limited to, those that result in 1) a different level or type of take than was analyzed in association with this CCAA or 2) a change to the conservation benefits to the Covered Species such that the CCAA Standard might not be met. Proposed major CCAA modifications and Permit amendments must be approved by the FWS in accordance with the procedural requirements of Federal laws and regulations, such as NEPA, and may require additional analysis by the FWS, public notification in the Federal Register, and a formal CCAA amendment process.

Participating Members enrolled in CIs prior to a modification to this CCAA will not be required to implement additional Conservation Measures as a result of the modification, but they may voluntarily choose to do so. Participating Members entering into CI after a modification or amendment to this CCAA will be required to include the CCAA requirements as modified in their CI if appropriate to their properties to be enrolled.

The Association will notify FWS if new members engaged in energy development within the Coverage Area desire coverage after the initial NEPA analysis has been completed. FWS would make a determination whether the new locations for Covered Activities were adequately covered under the initial NEPA analysis and Conference Opinion. The new member applying for a CI or CI/CP shall fund any additional NEPA analysis required by FWS.

18 AMENDMENT OF THE PERMIT

The FWS will amend the permit as appropriate to reflect any modifications to this CCAA approved through the process described in Section 17 above. Prior to doing so, however, the FWS must comply with all applicable legal requirements, including but not limited to the ESA, the National Environmental Policy Act (NEPA), and the FWS' permit regulations at 50 CFR Part 13 and 50 CFR Part 17. The FWS must determine that proposed amendments to the permit conform with the general permit (50 CFR Part 13) and section 10(a)(1)(A) permit requirements before it can amend a permit. The amendment procedure cannot be used to require Conservation Measures on enrolled properties that are not provided for in this CCAA, or to impose additional land, water, or resource use restrictions on enrolled properties, without Participating Member consent.

19 TERMINATION OF THE CCAA

As provided for in the FWS' CCAA Policy (64 FR 32726) the Association may terminate the permit or a Participating Member may terminate a CI prior to the CCAA's or CI's expiration date, even if all the requirements have not been implemented and the expected benefits have not been realized. If terminating their obligations under this CCAA, the Association is required to surrender the permit, thus

extinguishing take authority (if any of the Covered Species had become listed at time of termination) and the assurances granted by the permit. Likewise, if a Participating Member terminates the CI or is unable or unwilling to continue implementation of the Conservation Measures and stipulations of the CI or the CCAA and to otherwise comply with the CI, the take authority and assurances conveyed to the Participating Member by the permit through the CI are relinquished. A Participating Member must provide 30-days written notice to the Association and FWS of intent to terminate a CI. The Association must provide 30-day written notice to the FWS and all Participating Members to terminate the permit.

20 PERMIT SUSPENSION OR REVOCATION

The FWS may suspend the privileges of exercising some or all of the permit authority at any time if the Association is not in compliance with the conditions of the permit or with any applicable laws or regulations governing the conduct of the permitted activity. Such suspension shall remain in effect until the issuing officer determines that the Association has corrected the deficiencies. The FWS may not revoke the permit except as follows:

- The FWS may revoke a permit for any reason set forth in 50 CFR 13.28(a)(1) through (4). This regulation authorizes permit revocation if:
 1. The permittee willfully violates any Federal or state statute or regulation, or any Indian tribal law or regulation, or any law or regulation of any foreign country, which involves a violation of the conditions of the permit or of the laws or regulations governing the permitted activity; or
 2. The permittee fails within 60 days to correct deficiencies that were the cause of a permit suspension; or
 3. The permittee becomes disqualified under 50 CFR 13.21(c); or
 4. A change occurs in the statute or regulation authorizing the permit that prohibits the continuation of a permit issued by the FWS.
- The FWS may also revoke a permit if continuation of the permitted activity would either:
 1. Appreciably reduce the likelihood of survival and recovery in the wild of any listed species; or
 2. Directly or indirectly alter designated critical habitat such that it appreciably diminishes the value of that critical habitat for both the survival and recovery of a listed species.
 3. In the above cases, the FWS would first implement all practicable measures to remedy the situation before revoking a permit.

21 REMEDIES

Each party shall have all remedies otherwise available to enforce the terms of the CCAA and associated CIs and the permit, except that no party shall be liable in monetary damages for any breach of this CCAA or CI, any failure to perform an obligation under this CCAA or a CI, or any other cause of action arising from this CCAA or a CI.

22 DISPUTE RESOLUTION

The informal dispute resolution process among the signatory parties of the conservation Strategy may

utilize the following steps to attempt resolve disputes, unless the parties agree upon another dispute resolution process, or unless an aggrieved party has initiated administrative proceedings or suit in federal court. This process will apply to resolution of any dispute between FWS and the Board as described in Appendix E, Section 6, of this conservation Strategy.

- 1) The aggrieved party will notify the other parties of the potential violation, the basis for contending a violation has occurred, and the remedies it proposes to correct the alleged violation.
- 2) The party alleged to be in violation will have 30 days, or such other time as may be agreed, to respond.
- 3) Within 30 days after such response was provided or was due, representatives of the parties having authority to resolve the dispute will meet and negotiate in good faith toward a solution satisfactory to all involved parties, or will establish a specific process and timetable to seek such a solution.
- 4) If any issues cannot be resolved through such negotiations, the parties involved will consider non-binding mediation and other alternative dispute resolution processes and, if a dispute resolution process is agreed upon, will make good faith efforts to resolve all remaining issues through that process.

23 SUCCESSION AND TRANSFER

The CCAA shall be binding on and shall inure to the benefit of the parties and their respective successors and transferees, in accordance with applicable regulations (50 CFR 13.24 and 13.25). The rights and obligations under the 10(a)(1)(A) permit that is issued pursuant to this Strategy shall run with the ownership of the enrolled property and are transferable to subsequent non-federal landowners pursuant to 50 CFR 13.25. Coverage under the Enhancement of Survival permit issued to the Association will also be extended to the new owner(s) as described in the Strategy. As a party to the original CI and permit, the new owner(s) will have the same rights and obligations with respect to the enrolled property as the original owner. The new owner(s) also will have the option of receiving CCAA assurances by signing a new CI. The Association shall notify the FWS of any transfer of ownership, will attempt to contact the new owner to explain the responsibilities applicable to the property under the existing CI, and seek to interest the new owner in signing the existing CI or a new one to benefit Covered Species on the property. Assignment or transfer of the permit shall be governed by FWS regulations in force at the time.

24 AVAILABILITY OF FUNDS

Implementation of this Strategy is subject to the requirements of the Anti-Deficiency Act and the availability of appropriated funds. Nothing in this Strategy will be construed by the participating parties to require the obligation, appropriation, or expenditure of any funds from the U.S. Treasury. The Association acknowledges that the FWS will not be required under this Strategy to expend any federal agency's appropriated funds unless and until an authorized official of that agency affirmatively acts to commit to such expenditures as evidenced in writing.

25 NO THIRD-PARTY BENEFICIARIES

This Strategy does not create any new right or interest in any member of the public as a third-party

beneficiary, nor shall it authorize anyone not a party to this Strategy to maintain a suit for personal injuries or damages pursuant to the provisions of this Strategy. The duties, obligations, and responsibilities of the parties to this Strategy with respect to third parties shall remain as imposed under existing law.

26 NOTICES AND REPORTS

Any notice or reports, including monitoring and annual reports, required by this Strategy shall be delivered to the person listed below as appropriate:

Thunder Basin Grasslands Prairie Ecosystem Association
671 Steinle Rd
Douglas, WY 82633

Field Supervisor, Wyoming Field Office
U.S. Fish and Wildlife Service
5353 Yellowstone Road, Suite 308A
Cheyenne, WY 82009

IN WITNESS WHEREOF, THE PARTIES HERETO have, as of the last signature date below, executed this Strategy to be in effect as of the date that the last signatory signs this CCAA.



Chairman
Thunder Basin Grasslands Prairie Ecosystem Association



Date



Field Supervisor
US Fish and Wildlife Service



Date

Literature Cited

- Andelt, W. F. 2006. Methods and economics of managing prairie dogs. Pages 129-138, In J. L. Hoogland (Ed.), Conservation of the black-tailed prairie dog: saving North America's western grasslands. Island Press Washington, D.C.
- Andres, B. A. and K. L. Stone. 2009. Conservation plan for the Mountain Plover (*Charadrius montanus*), version 1. Manomet Center for Conservation Sciences. Manomet, MA.
- Anna, L. O. 2009. Geologic assessment of undiscovered oil and gas in the Powder River Basin Province, Wyoming and Montana. U.S. Geological Survey Digital Data Series DDS-69-U.
- Autenrieth, R. E. 1981. Sage grouse management in Idaho. Wildlife Bulletin 9. Idaho Department of Fish and Game.
- Bailey, R. G. 1998. Ecoregions: The ecosystem geography of the oceans and continents. Springer-Verlag NewYork, Inc. New York, NY.
- Barnes, A. M. 1993. A review of plague and its relevance to prairie dog populations and the black-footed ferret. Pages 28-37 in: J. L. Oldemeyer, D. E. Biggins, B. J. Miller, and R. Crete, editors Management of prairie dog complexes for the reintroduction of the black-footed ferret. USFWS Biological Report No. 13, Washington, D.C.
- Barnett, J. K. 1992. Diet and nutrition of female sage grouse during the pre-laying period. M.S. Thesis. Oregon State University, Corvallis, OR.
- Barnett, J. K. and J. A. Crawford. 1994. Pre-laying nutrition of sage grouse hens in Oregon. Journal of Range Management 47:114-118.
- Beauvais, G. P. 2000a. Burrowing owl, *Athene cucularia*. Unpublished report. Wyoming Natural Diversity Database. University of Wyoming. Laramie, WY.
- Beauvais, G. P. 2000b. Ferruginous hawk, *Buteo regalis*. Unpublished report. Wyoming Natural Diversity Database. University of Wyoming. Laramie, WY.
- Bechard, M. J. and J. K. Schmutz. 1995. Ferruginous Hawk (*Buteo regalis*). Available at Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/172> doi:10.2173/bna.172. Accessed 1 July 2013.
- Beck, J. L. and D. L. Mitchell. 2000. Influences of livestock grazing on Sage Grouse habitat. Wildlife Society Bulletin 28:993-1002.
- Berry, J. D. and R. L. Eng. 1985. Interseasonal movements and fidelity to seasonal use areas by female Sage Grouse. Journal of Wildlife Management 49:237-240.
- Biggins, D. E., J. G. Sidle, D. B. Seery, and A. E. Ernst. 2006. Estimating the abundance of prairie dogs. Pages 94-107, In J. L. Hoogland (Ed.), Conservation of the black-tailed prairie dog: saving North America's western grasslands. Island Press Washington, D.C.
- Bock, C. E. and J. H. Bock. 1987. Avian habitat occupancy following fire in a Montana shrubsteppe. Prairie Naturalist 19:153-158.

- Bolger, D. T., T. A. Scott, and J. T. Rotenberry. 1997. Breeding bird abundance in an urbanizing landscape in coastal southern California. *Conservation Biology* 11:406-421.
- Braun, C. E., M. R. Baker, R. L. Eng, J. S. Gashwiler and M. H. Schroeder. 1976. Conservation committee report on effects of alteration of sagebrush communities on the associated avifauna. *Wilson Bulletin* 88:165-171.
- Brooks, M. L., C. M. D'Antonio, D. M. Richardson, J. B. Grace, J. E. Keeley, J. M. DiTomaso, R. J. Hobbs, M. Pellant, and D. Pyke. 2004. Effects of invasive alien plants on fire regimes. *BioScience* 54:677-688.
- Brown, K. G. and K. M Clayton. 2004. Ecology of the Greater Sage-Grouse (*Centrocercus urophasianus*) in the coal mining landscape of Wyoming's Powder River Basin. Thunderbird Wildlife Consulting, Inc. Unpublished Report. Gillette, WY.
- Bureau of Land Management. 2007. Casper Resource Management Plan. Available at http://www.blm.gov/wy/st/en/programs/Planning/rmps/casper/rod_armp.html. Accessed 1 July 2013.
- Buseck, R. S., D. A. Keinath, and E. Everett. 2005. Species assessment for Black-tailed Prairie Dog (*Cynomys ludovicianus*) in Wyoming. Bureau of Land Management.
- Buseck, R. S., D. A. Keinath, and M. H. McGee. 2004. Species assessment for Sage Thrasher (*Oreoscoptes montanus*) in Wyoming. Bureau of Land Management.
- Cagney, J., E. Bainter, B. Budd, T. Christiansen, V. Herren, M. Holloran, B. S. Rashford, M. Smith, and J. Williams. 2009. Grazing influence, management and objective development in Wyoming's Greater Sage-Grouse habitat with emphasis on nesting and early brood rearing.
- Caldwell, M. M. and J. H. Richards. 1989. Hydraulic lift: Water efflux from upper roots improves effectiveness of water uptake by deep roots. *Oecologia* 79(1):1-5.
- Cannings, R. J. 1995. Status of the sage thrasher in British Columbia. *Wildlife Bulletin*, no. B-79. Castrale, J. S. 1982. Effects of two sagebrush control methods on nongame birds. *Journal of Wildlife Management* 46:945-952.
- Ciota, A. T., C. L. Drummond, M. A. Ruby, J. Drobnack, G. D. Ebel, and L. D. Kramer. 2012. Dispersal of *Culex* mosquitoes (Diptera: Culicidae) from a wastewater treatment facility. *Journal of Medical Entomology* 39:35-42.
- Commission for Environmental Cooperation. 2005. North American conservation action plan: Ferruginous hawk, *Buteo regalis*. Available at http://www.cec.org/Storage/59/5170_NACAP-FerruginousHawk_en.pdf. Accessed 1 July 2013.
- Connelly, J. W. and C. E. Braun. 1997. Long-term changes in Sage Grouse *Centrocercus urophasianus* populations in western North America. *Wildlife Biology* 3:229-234.
- Connelly, J. W. and O. D. Markham. 1983. Movements and radionuclide concentrations of Sage Grouse in southeastern Idaho. *Journal of Wildlife Management* 47:169-177.
- Connelly, J. W., C. A. Hagen, and M. A. Schroeder. 2011a. Characteristics and dynamics of Greater Sage-Grouse populations. *Studies in Avian Biology* 38:53-68.

- Connelly, J. W., E. T. Rinkes, and C. E. Braun. 2011b. Characteristics of Greater Sage-Grouse habitats: A landscape species at micro and macro scales. *Studies in Avian Biology* 38:69-84.
- Connelly, J. W., H. W. Browsers, and R. J. Gates. 1988. Seasonal movements of Sage Grouse in southeastern Idaho. *Journal of Wildlife Management* 52:116-122.
- Connelly, J. W., K. P. Reese, R. A. Fischer, and W. L. Wakkinen. 1994. The effects of fire on Sage Grouse populations in southeastern Idaho. Proceedings of the 19th Western States Sage and Columbian Sharp-tailed Grouse Workshop, Reno, NV, July 1994.
- Connelly, J.W., M. A. Schroeder, A. R. Sands, and C. E. Braun. 2000. Guidelines to manage Sage Grouse populations and their habitat. *Wildlife Society Bulletin* 28:967-985.
- Connelly, J. W., S. T. Knick, M. A. Schroeder, and S. J. Stiver. 2004. Conservation assessment of Greater Sage-Grouse and sagebrush habitats. Western Association of Fish and Wildlife Agencies. Unpublished Report. Cheyenne, WY.
- Connelly, J. W., W. J. Arthur, and O. D. Markham. 1981. Sage Grouse leks on recently disturbed sites. *Journal of Range Management* 34:153-154.
- Connelly, J. W., W. L. Wakkinen, A. P. Apa, and K. P. Reese. 1991. Sage Grouse use of nest sites in southeastern Idaho. *Journal of Wildlife Management* 55:521-524.
- Cooper, S. V., P. Lesica, and G. M. Kudray. 2007. Post-fire recovery of Wyoming Big Sagebrush shrub-steppe in central and southeast Montana. Bureau of Land Management.
- Crawford, J. A., R. A. Olson, N. E. West, J. C. Mosley, M. A. Schroeder, T. D. Whitson, R. F. Miller, M. A. Gregg, and C. S. Boyd. 2004. Ecology and management of Sage-Grouse and Sage-Grouse habitat. *Journal of Range Management* 57:2-19.
- Creekmore, T. E., T. E. Rocke, and J. Hurley. 2002. A baiting system for delivery of an oral plague vaccine to Black-tailed Prairie Dogs. *Journal of Wildlife Diseases* 38:32-39.
- Cully, J. F. and E. S. Williams. 2001. Interspecific comparisons of sylvatic plague in prairie dogs. *Journal of Mammalogy* 82:894-905.
- Culley, R. J. 1989. Plague in prairie dog ecosystems: importance for black-footed ferret management. in T. W. Clark, D. Hinckley and T. Rich, editors. *The prairie dog ecosystem: managing for biological diversity*. MT Bureau of Land Management Wildlife Technical Bulletin #2.
- Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, A. L. Zimmerman, and B. R. Euliss. 2003a. Effects of management practices on grassland birds: Ferruginous Hawk. Available at Northern Prairie Wildlife Research Center Online: <http://www.npwrc.usgs.gov/resource/literatr/grasbird/feha/feha.htm> (Version 12DEC2003). Accessed 1 July 2013.
- Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, M. P. Nenneman, and B. R. Euliss. 2003b. Effects of management practices on grassland birds: Mountain Plover. Available at Northern Prairie Wildlife Research Center Online: <http://www.npwrc.usgs.gov/resource/literatr/grasbird/mopl/mopl.htm> (Version

12DEC2003). Accessed 1 July 2013.

Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, P. A. Rabie, and B. R. Euliss. 2003c. Effects of management practices on grassland birds: Burrowing Owl. Available at Northern Prairie Wildlife Research Center Online: <http://www.npwr.usgs.gov/resource/literatr/grasbird/buow/buow.htm> (Version 12AUG2004). Accessed 1 July 2013.

Dinsmore, S. J. 2001. Population biology of mountain plovers in southern Phillips County, Montana. PhD Dissertation. Colorado State University. Fort Collins, CO.

Dobler, F. C., J. Elby, C. Perry, S. Richardson, and M. Vander Haegen. 1996. Status of Washington's shrub-steppe ecosystem: extent, ownership, and wildlife/vegetation relationships. Washington Department of Fish and Wildlife, Wildlife Management Program, Olympia, WA.

Doherty, K. E., D. E. Naugle, B. L. Walker, J. N. Graham. 2008. Greater Sage-Grouse winter habitat selection and energy development. *Journal of Wildlife Management* 72:187-195.

Drut, M. S., W. H. Pyle, and J. A. Crawford. 1994. Technical note: Diets and food selection of Sage Grouse chicks in Oregon. *Journal of Range Management* 47:90-93.

Eng, R. L. and P. Schladweiler. 1972. Sage Grouse winter movements and habitat use in central Montana. *Journal of Wildlife Management* 36:141-146.

Erickson, W., G. Johnson, M. Stickland, D. Young, Jr., K. Sernka, and R. Good. 2001. Avian collisions with wind turbines: A summary of existing studies and comparisons to other sources of avian collision mortality in the United States. Washington, DC: Resolve, Inc. August 2001. Available at http://www.west-inc.com/reports/avian_collisions.pdf. Accessed 1 June 2010.

Fischer, R. A. and K. P. Reese. 1996. Influence of vegetal moisture content and nest fate on timing of female Sage Grouse migration. *Condor* 98:868-872.

Fischer, R. A., A. D. Apa, W. L. Wakkinen, K. P. Reese, and J. W. Connelly. 1993. Nesting-area fidelity of Sage Grouse in southeastern Idaho. *Condor* 95:1038-1041.

Gates, R. J. 1983. Sage Grouse, lagomorph, and pronghorn use of a sagebrush grassland burn site on the Idaho National Engineering Laboratory. M.S. thesis. Montana State University. Bozeman, MT.

Gates, R. J. 1985. Observations of the formation of a Sage Grouse lek. *Wilson Bulletin* 97:219-221.

Gebauer, M. 2004. Sage Thrasher: Accounts and measures for managing identified wildlife. British Columbia Ministry of Environment.

Gill, R. B. 1965. Distribution and abundance of a population of Sage Grouse in North Park, Colorado. M.S. thesis. Colorado State University, Ft. Collins, CO.

Gillihan, S.W., D.J. Hanni, S.W. Hutchings, T. Toombs, and T. VerCouteren. 2001. Sharing your land with shortgrass prairie birds. Rocky Mountain Bird Observatory.

Global Climate Change Impacts in the United States - 2009 report. Available at

<http://nca2009.globalchange.gov/great-plains>. Accessed 1 July 2013.

Graul, W. D. 1975. Breeding biology of the Mountain Plover. *Wilson Bulletin* 87:6-31.

Green, B. H. and H. D. Smith. 1981. Habitat utilization by sage sparrows in mixed desert shrub community. Abstract only. *Encyclia* 58:159.

Hanf, J. M., P. A. Schmidt, and E. B. Groshens. 1994. Sage Grouse in the high desert of central Oregon: Results of a study, 1988-1993. Bureau of Land Management.

Hansley, P. L. and G. P. Beauvais. 2004a. Species assessment for Brewer's Sparrow (*Spizella breweri*) in Wyoming. Bureau of Land Management.

Hansley, P. L. and G. P. Beauvais. 2004b. Species assessment for Sage Sparrow (*Amphispiza belli*) in Wyoming. Bureau of Land Management.

Harrison, C. 1978. A field guide to the nests, eggs and nestlings of North American birds. Collins, Cleveland, OH.

Holloran, M. J. 1999. Sage Grouse (*Centrocercus urophasianus*) seasonal habitat use near Casper, Wyoming. M.S. thesis. University of Wyoming. Laramie, WY.

Holloran, M. J. 2005. Sage-grouse population response to natural gas field development in western Wyoming. PhD Dissertation. University of Wyoming. Laramie, WY.

Holloran, M. J. and S. H. Anderson. 2005. Greater Sage-grouse research in Wyoming: an overview of studies conducted by the Wyoming Cooperative Fish and Wildlife Research Unit between 1994 and 2005. Appendix C in Holloran 2005 PhD Dissertation. University of Wyoming. Laramie, WY.

Holloran, M. J., B. J. Heath, A. G. Lyon, S. J. Slater, J. L. Kuipers, and S. H. Anderson. 2005. Greater Sage-grouse nesting habitat selection and success in Wyoming. *Journal of Wildlife Management* 69:638–649.

Holmes, J. A. and M. J. Johnson. 2005a. Brewer's Sparrow (*Spizella breweri*): A technical conservation assessment. US Forest Service.

Holmes, J. A. and M. J. Johnson. 2005b. Sage Sparrow (*Amphispiza belli*): A technical conservation assessment. US Forest Service.

Honess, R. F. and G. Post. 1968. History of an epizootic in Sage Grouse. Agricultural Experiment Station Science Monograph 14. University of Wyoming. Laramie, WY.

Hoogland, J. L. 2006 Social behavior of prairie dogs. Pages 7-26, In J. L. Hoogland (Ed.), *Conservation of the black-tailed prairie dog: saving North America's western grasslands*. Island Press, Washington, D.C.

Hupp, J. W. and C. E. Braun. 1989. Topographic distribution of Sage Grouse foraging in winter. *Journal of Wildlife Management* 53: 823-829.

Johnson, G. D., W. P. Erickson, M. D. Strickland, M. E. Shepherd, D. A. Shepherd, and S. A. Sarappo. 2002. Collision mortality of local and migrant birds at a large-scale wind-power development on Buffalo Ridge, Minnesota. *Wildlife Society Bulletin* 30:879-887.

- Johnson, N. K. and J. A. Marten. 1992. Macrogeographic patterns of morphometric and genetic variation in the sage sparrow complex. *Condor* 94:1-19.
- Kantrud, H. A. and R. L. Kologiski. 1983. Avian associations of the northern Great Plains grasslands. *Journal of Biogeography* 10:331-350.
- Kempema, S. L. F. 2007. South Dakota black-tailed prairie dog colony acreage and distribution, 2006. Wildlife Division Report 2007-07. South Dakota Department of Game, Fish and Parks. Pierre, SD.
- Klebenow, D. A. 1969. Sage Grouse nesting and brood habitat in Idaho. *Journal of Wildlife Management* 33:649-662.
- Klute, D. S., L. W. Ayers, M. T. Green, W. H. Howe, S. L. Jones, J. A. Shaffer, S. R. Sheffield, and T. S. Zimmerman. 2003. Status Assessment and Conservation Plan for the Western Burrowing Owl in the United States. Biological Technical Publication FWS/BTP-R6001-2003. U.S. Fish and Wildlife Service. Washington, D.C.
- Konrad, P. M. and D. S. Gilmer. 1986. Post fledging behavior of ferruginous hawks in North Dakota. *Raptor Research* 20:35-39.
- Knick, S. T. and J. T. Rotenberry. 1995. Landscape characteristics of fragmented shrubsteppe habitats and breeding passerine birds. *Conservation Biology* 9:1059-1071.
- Knick, S. T. and J. W. Connelly (editors). 2011. Greater Sage-Grouse: ecology and conservation of a landscape species and its habitats. *Studies in Avian Biology Series* (vol. 38), University of California Press, Berkeley, CA.
- Knopf, F. L. and J. R. Rupert. 1996. Reproduction and movements of Mountain Plovers breeding Colorado. *Wilson Bulletin* 108:28-35.
- Knopf, F. L. and M. B. Wunder. 2006. Mountain Plover (*Charadrius montanus*). Available at Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/211> doi:10.2173/bna.211. Accessed 1 July 2013.
- Lantz, S. J. 2005. Nesting ecology and habitat selection of western burrowing owls (*Athene cunicularia hypugaea*) in the Thunder Basin National Grassland, northeastern Wyoming. M.S. Thesis. University of Wyoming. Laramie, WY.
- Larson, D. L. and C. E. Bock. 1984. Determining avian habitat preference by bird-centered vegetation sampling. Pages 37-43 in J. Verner, M.L. Morrison, and C.J. Ralph, editors, *Wildlife 2000: modeling habitat relationships of terrestrial vertebrates*. University of Wisconsin Press, Madison, WI.
- Lesica, P., S. V. Cooper, and G. Kudray. 2008. Recovery of big sagebrush following fire in southwest Montana. *Rangeland Ecology and Management* 60:261-269.
- Lomolino, M. V. and G. A. Smith. 2003. Terrestrial vertebrate communities at black-tailed prairie dog (*Cynomys ludovicianus*) towns. *Biological Conservation* 115:89-100.
- Luce, R. J. 2003. A multi-state conservation plan for the black-tailed prairie dog, *Cynomys ludovicianus*, in the United States: Addendum to the Black-tailed Prairie Dog Conservation Assessment and Strategy.
- Luppens, J. A., D. C. Scott, J. E. Haacke, L. M. Osmonson, T. J. Rohrbacher, and M. S. Ellis. Assessment of coal

geology, resources, and reserves in the Gillette Coalfield, Powder River Basin, Wyoming. USGS Open-File Report 2008-1202.

Lyon, A. G. 2000. The potential effects of natural gas development on Sage Grouse near Pinedale, Wyoming. M.S. thesis. University of Wyoming. Laramie, WY.

MacLaren, P. A., S. H. Anderson, and D. E. Runde. 1988. Food habits and nest characteristics of breeding raptors in southwestern Wyoming. *Great Basin Naturalist* 48:548-552.

Martin, J. W. and B. A. Carlson. 1998. Sage Sparrow (*Artemisiospiza belli*). Available at the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/326> doi:10.2173/bna.326. Accessed 1 July 2013.

Martin, N. S. 1970. Sagebrush control related to habitat and Sage Grouse occurrence. *Journal of Wildlife Management* 34:313-320.

McDonald, D., N. M. Korfanta, and S. J. Lantz. 2004. The burrowing owl (*Athene cunicularia*): A technical conservation assessment. US Forest Service.

Medin, D. E. 1990. Birds of a shadscale (*Artiplex confertifolia*) habitat in east central Nevada. *Great Basin Naturalist* 50:295-298.

Mencher, J. S., S. R. Smith, T. D. Powell, D. T. Stinchcomb, J. R. Osorio, and T. E. Rocke. 2004. Protection of Black-tailed Prairie Dogs (*Cynomys ludovicianus*) against plague after voluntary consumption of baits containing recombinant raccoon poxvirus vaccine. *Infection and Immunity* 72:5502-5505.

National Agricultural Statistics Service. 2012. Wyoming agricultural statistics 2012. Laramie, WY.

National Oceanic and Atmospheric Administration. 1982. Evaporation atlas for the contiguous 48 United States. NOAA Technical Report NWS 33. Washington, D.C.

National Oceanic and Atmospheric Administration. 2013. National Climatic Data Center: Gillette 4 SE. Available at <http://www.ncdc.noaa.gov/cdo-web/datasets/GHCNDMS/stations/GHCND:USC00483855/detail>. Accessed 1 July 2013.

Nicholoff, S. H., compiler. 2003. Wyoming bird conservation plan, Version 2.0, Wyoming Partners In Flight. Wyoming Game and Fish Department, Lander, WY.

Northeast Wyoming Sage-grouse Working Group. 2006. Northeast Wyoming Sage-Grouse conservation plan. August 15, 2006.

Olendorff, R. R. 1993. Biology and management of ferruginous hawk (*Buteo regalis*): A review. Occasional Papers Number 1. Raptor Research and Technical Assistance Center, U.S. Bureau of Land Management, Boise, ID.

Paige, C. and S. A. Ritter. 1999. Birds in a sagebrush sea: managing sagebrush habitats for bird communities. Partners in Flight Western Working Group, Boise, ID.

Parrish, T. L. 1988. Mountain Plover habitat selection in the Powder River basin, Wyoming. Master's thesis, University of Wyoming. Laramie, WY.

Patricelli, G. L., J. L. Blickley, and S. Hooper. Incorporating the impacts of noise pollution into Greater Sage-Grouse conservation planning. PowerPoint presentation. June 2010.

Patterson, R. L. 1952. The Sage Grouse in Wyoming. Wyoming Game and Fish Commission and Sage Books, Inc., Denver, CO.

Pauli, J. N. 2005. Ecological studies of the black-tailed prairie dog (*Cynomys ludovicianus*): Implications for biology and conservation. M.S. Thesis. University of Wyoming. Laramie, WY.

Pauli, J. N. and S. W. Buskirk. 2007. Recreational shooting of prairie dogs: a portal for lead entering wildlife food chains. *Journal of Wildlife Management* 71:103-108.

Peterson, J. G. 1970. The food habits and summer distribution of juvenile Sage Grouse in central Montana. *Journal of Wildlife Management* 34:147-155.

Petersen, K. L. and L. B. Best. 1985. Nest-site selection by sage sparrows. *Condor* 87:217-221.

Petersen, K. L. and L. B. Best. 1991. Nest site selection by sage thrashers in southeastern Idaho. *Great Basin Naturalist* 51:261-266.

Phillips, R. L. and A. E. Beske. 1990. Distribution and abundance of golden eagles and other raptors in Campbell and Converse counties, Wyoming. Fish and Wildlife Technical Report 27. US Fish & Wildlife Service.

Pidgeon, A. M., N. E. Mathews, R. Benoit, and E. V. Nordheim. 2001. Response of avian communities to historic habitat change in the northern Chihuahuan Desert. *Conservation Biology* 15:1772-1788.

Plumb, R. E., F. L. Knopf, and S. H. Anderson. 2005. Minimum populations size of Mountain Plovers breeding in Wyoming. *Wilson Bulletin* 117:15-22.

Poulin, R., L. D. Todd, E. A. Haug, B. A. Millsap, and M. S. Martell. 2011. Burrowing Owl (*Athene cunicularia*). Available at Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/061> doi:10.2173/bna.61. Accessed 1 July 2013.

Reading, R. P. and R. Matchett. 1997. Attributes of Black-Tailed Prairie Dog colonies in northcentral Montana. *Journal of Wildlife Management* 61:664-673.

Reeve, A. F. and T. C. Vosburgh. 2006. Recreational shooting of prairie dogs. Pages 139-156, In J. L. Hoogland (Ed.), *Conservation of the black-tailed prairie dog: saving North America's western grasslands*. Island Press Washington, D.C.

Reynolds, T. 1979. The impact of Loggerhead Shrikes on nesting birds in a sagebrush environment. *Auk* 96:798-800.

Reynolds, T. D. 1981. Nesting of the Sage Thrasher, Sage Sparrow, and Brewer's Sparrow in southeastern Idaho. *Condor* 83:61-64.

Reynolds, T. D., T. D. Rich, and D. A. Stephens. 1999. Sage Thrasher (*Oreoscoptes montanus*). Available at the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/463> doi:10.2173/bna.463. Accessed 1 July 2013.

- Rich, T. 1980. Nest placement in Sage Thrashers, Sage Sparrows and Brewer's Sparrows. *Wilson Bulletin* 92:362-368.
- Rich, T. D. and S. I. Rothstein. 1985. Sage thrashers reject cowbird eggs. *Condor* 87:561-562.
- Rising, J. D. and D.D. Beadle. 1996. *The sparrows of the United States and Canada*. Academic Press Inc. San Diego, CA.
- Robertson, M. D. 1991. Winter ecology of migratory Sage Grouse and associated effects of prescribed fire in southeastern Idaho. M.S. thesis. University of Idaho. Moscow, ID.
- Roe, K. A. and C. M. Roe. 2003. Habitat selection guidelines for Black-Tailed Prairie Dog relocations. *Wildlife Society Bulletin* 31:1246-1253.
- Rotenberry, J. T. 1980. Dietary relationships among shrubsteppe passerine birds: Competition or opportunities in a variable environment. *Ecological Monographs* 50(1):93-110.
- Rotenberry, J. T. and J. A. Wiens. 1980. Habitat structure, patchiness, and avian communities in North American steppe vegetation: A multivariate analysis. 61:1228-1250.
- Rotenberry, J. T. and J. A. Wiens. 1989. Reproductive biology of shrubsteppe passerine birds: Geographical and temporal variation in clutch size, brood size, and fledging success. *Condor* 91:1-14.
- Rotenberry, J. T. and J. A. Wiens. 1991. Weather and reproductive variation in shrubsteppe sparrow: A hierarchical analysis. *Ecology* 72:1325-1335.
- Rotenberry, J. T., M. A. Patten and K. L. Preston. 1999. Brewer's Sparrow (*Spizella breweri*). Available at the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/390> doi:10.2173/bna.390. Accessed 1 July 2013.
- Rowland, M. M., M. J. Wisdom, L. H. Suring, and C. W. Meinke. 2006. Greater Sage-Grouse as an umbrella species for sagebrush-associated vertebrates. *Biological Conservation*. 129:323-335.
- Ryser, F. A. 1985. *Birds of the Great Basin: a natural history*. University of Nevada Press, Reno, NV.
- Sage Grouse National Technical Team. 2011. A report on national Greater Sage-Grouse conservation measures. December 21, 2011.
- Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2012. *The North American Breeding Bird Survey, Results and Analysis 1966 - 2011*. Version 07.03.2013 USGS Patuxent Wildlife Research Center, Laurel, MD.
- Savage, D. E. 1969. The relationship of Sage Grouse to upland meadows in Nevada. *Transactions of the 16th Annual Meeting of the California-Nevada Section of the Wildlife Society*. 16(3):8-17.
- Schroeder, M. A., C. L. Aldridge, A. D. Apa, J. R. Bohne, C. E. Braun, S. D. Bunnell, J. W. Connelly, P. A. Diebert, S. C. Gardner, M. A. Hilliard, G. D. Kobriger, S. M. McAdam, C. W. McCarthy, J. J. McCarthy, D. L. Mitchell, E. V. Rickerson, and S. J. Stiver. 2004. Distribution of Sage-Grouse in North America. *Condor* 106:363-376.

- Schroeder, M. A., J. R. Young, and C. E. Braun. 1999. Sage Grouse (*Centrocercus urophasianus*). A. Poole and F. Gill, editors. The birds of North America, No. 425. The Academy of Natural Sciences, Philadelphia, PA; The American Ornithologists' Union, Washington, D.C.
- Sedgewick, J. A. 2004. Habitat restoration for Gunnison and Greater Sage-Grouse—a literature review. Bureau of Land Management.
- Shinn, S. L. and D. C. Thill. 2002. The response of Yellow Starthistle (*Centaurea solstitialis*), annual grasses, and Smooth Brome (*Bromus inermis*) to Imazapic and Picloram. *Weed Technology* 16:366-370.
- Side, J. G., M. Ball, T. Byer, J.J. Chynoweth, G. Foli, R. Hodorff, G. Moravek, R. Peterson, and D.N. Svingen. 2001. Occurrence of burrowing owls in black-tailed prairie dog colonies on Great Plains National Grasslands. *Journal of Raptor Research* 35:316-321.
- Slater, S. J. 2003. Sage-grouse (*Centrocercus urophasianus*) use of different-aged burns and the effects of coyote control in southwestern Wyoming. M.S. thesis, University of Wyoming. Laramie, WY.
- Small, A. 1994. California birds: their status and distribution. Ibis Publ. Co. Vista, CA.
- Sveum, C. M., J. A. Crawford, and W. D. Edge. 1998. Use and selection of brood-rearing habitat by Sage Grouse in south central Washington. *Great Basin Naturalist* 58:344-351.
- Swenson, J. E. 1986. Differential survival by sex in juvenile Sage Grouse and Gray Partridge. *Ornis Scandinavica* 17:14-17.
- Terres, J.K. 1980. The Audubon Society encyclopedia of North American birds. Alfred A. Knopf, New York.
- Thacker, E.T. 2010. Greater Sage-grouse seasonal ecology and responses to habitat manipulations in northern Utah. PhD Dissertation. Utah State University. Logan, UT.
- Ulrich, G. and S. Bower. 2008. Active methanogenesis and acetate utilization in Powder River Basin coals, United States. *International Journal of Coal Geology* 76:25-33.
- US Fish & Wildlife Service. 2002. Mountain Plover survey guidelines-Montana. March 2002.
- US Fish & Wildlife Service. 2008. Birds of Conservation Concern. Available at <http://www.fws.gov/migratorybirds/NewReportsPublications/SpecialTopics/BCC2008/BCC2008.pdf>. Accessed 1 July 2013.
- US Fish & Wildlife Service. 2010. Powerpoint Presentation (Science and Research). Available at <http://www.fws.gov/mountain-prairie/species/birds/sagegrouse/GSGPresentationForWebFinal.pdf>. Accessed 30 April 2010.
- US Fish & Wildlife Service. 2013. Greater Sage-grouse (*Centrocercus urophasianus*) conservation objectives: Final report (COT). Denver, CO.
- Van Pelt, B. 2007. Nongame Coordinator, Arizona Game and Fish Department, Phoenix, personal communication.
- Vasquez, M. 2005. Brewer's Sparrow (*Spizella breweri*) species assessment. US Forest Service.

- Wakkinen, W. L., K. P. Reese, and J. W. Connelly. 1992. Sage Grouse nest locations in relation to leks. *Journal of Wildlife Management* 56:381-383.
- Walker, B. 2004. Effects of management practices on grassland birds: Brewer's Sparrow. Available at Northern Prairie Wildlife Research Center online: <http://www.npwrc.usgs.gov/resource/literatr/grasbird/brsp/brsp.htm> (Version 12AUG2004). Accessed 1 July 2013.
- Wallestad, R. O. 1971. Summer movements and habitat use by Sage Grouse broods in central Montana. *Journal of Wildlife Management* 35:129-136.
- Wallestad, R. and D. Pyrah. 1974. Movement and nesting of Sage Grouse hens in central Montana. *Journal of Wildlife Management* 38:630-633.
- Wallestad, R., and P. Schladweiler. 1974. Breeding season movements and habitat selection of male Sage Grouse. *Journal of Wildlife Management* 38:634-637.
- Walters, C. J. and R. Hilborn. 1978. Ecological optimization and adaptive management. *Annual Review of Ecology and Systematics* 9:157-188.
- Wiens, J. A. and J. T. Rotenberry. 1981a. Habitat associations and community structure of birds in shrubsteppe environments. *Ecological Monographs* 51:21-42.
- Wiens, J. A. and J. T. Rotenberry. 1981b. Habitat associations of shrubsteppe bird communities. *BioScience* 31:240-241.
- Wiens, J. A., J. T. Rotenberry, and B. Van Horne. 1985. Territory size variations in shrubsteppe birds. *Auk* 102:500-505.
- Wyoming Game and Fish Department. 2003. Wyoming Greater Sage-Grouse conservation plan. Cheyenne, WY.
- Wyoming Game and Fish Department. 2006. Comprehensive wildlife conservation strategy. Cheyenne, WY.
- Wyoming Game and Fish Department. 2007. Sage-grouse habitat management guidelines for Wyoming. Cheyenne, WY.
- Wyoming Game and Fish Department. 2010. Wyoming 2010 species of greatest conservation need. Available at http://wgfd.wyo.gov/web2011/Departments/Wildlife/pdfs/SWAP_SGCN_LIST100002950.pdf. Accessed 1 July 2013.
- Wyoming Mining Association. 2012. The Concise Guide to Wyoming Coal. Cheyenne, WY. Wyoming State Geological Survey. 2013. Geology of Wyoming. Available at <http://www.wsgs.uwyo.edu/Research/Geology/Default.aspx>. Accessed 1 July 2013.
- Zablan, M. A., C. E. Braun, and G. C. White. 2003. Estimation of Greater Sage-Grouse survival in North Park, Colorado. *Journal of Wildlife Management*. 67:144-154.