SOUTHWEST DESERT
GREATER SAGE-GROUSE (*CENTROCERCUS UROPHASIANUS*)
LOCAL CONSERVATION PLAN

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Southwest Desert Adaptive Resource Management Local Working Group

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Southwest Desert Greater Sage-grouse (*Centrocercus urophasianus*)
Local Conservation Plan

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I. Executive Summary

The Southwest Desert Greater Sage-grouse Conservation Plan (Plan) is the culmination of nearly three years of effort by the Southwest Desert Adaptive Resource Management Local Working Group (SWARM). SWARM members include representatives from state and federal land management and resource agencies, non-governmental organizations, private industry, and private landowners. SWARM formed in 2003 to proactively manage Greater Sage-grouse (*Centrocercus urophasianus*) populations and their habitats in response to increasing concern about the status of sage-grouse populations rangewide and within their local area. The impetus for the writing of this Plan came from a mandate by the Utah Division of Wildlife Resources (UDWR) in their Statewide Strategic Management Plan, which was passed by the Wildlife Board in 2002.

The Plan will provide an assessment of the status of the Southwest Desert sage-grouse population. The intent of the Plan is to provide guidance and recommendations to meet the overall goal of maintaining and, where possible, increasing sage-grouse populations and improving habitat conditions in the Southwest Desert. The Plan is designed to meet the guidelines set forth by the USFWS in their Policy for Evaluation of Conservation Efforts (PECE) standards.

The Plan directly and indirectly addresses the five USFWS listing factors as they apply to Greater Sage-grouse in the Southwest Desert area. Recommendations and guidance suggested within the Plan can be adopted by all SWARM partners on a voluntary basis. SWARM encourages participation and adoption of these practices, where applicable, by private landowners in the local area. Participation by private landowners and consideration of the needs of landowners is critical for management of sage-grouse populations and habitat located on private lands, and will be of great importance to meet the overall goals of the Plan. True success can only be achieved by managing on a landscape scale. The Plan provides an opportunity to promote ecologically sound management of private and public lands for sage-grouse without impinging on private property rights.

Information contained in the Plan is based on a thorough review of the published and unpublished literature relevant to sage-grouse and sagebrush habitats and also on the intimate, local knowledge possessed by SWARM partners who live and work in the local area. Because a wealth of general information exists about sage-grouse and is available in published documents (Connelly et al. 2000, Connelly et al. 2005), we only provide a brief overview of general sage-grouse ecology and try instead to focus on conditions and issues specific to the Southwest Desert. Knowledge gaps are also identified.

SWARM analyzed threats currently or potentially affecting sage-grouse and sagebrush habitats in the Southwest Desert. The Threat Analysis, combined with recommended strategies and actions provides a framework for implementation of the Plan for the next ten years by SWARM partners. Implementation will be conducted within an adaptive resource management framework. As relevant information from a local and range-wide perspective becomes available, it will be used to modify and refine management strategies, priorities, and general understanding of sage-grouse ecology in the area. Annual evaluation and reporting will be conducted by SWARM to track progress on the objectives outlined in this Plan.

It is the intent of SWARM that this Plan be read and interpreted in its entirety. If the reader reads only isolated sections of this Plan, then single statements may be taken out of context or misinterpreted.

II. Introduction

A. Purpose

The mission of the Southwest Desert Adaptive Resource Management Sage-grouse Conservation Plan is to help reach the goal of maintaining and improving current abundance and viability of Greater Sage-grouse (*Centrocercus urophasianus*) populations and their habitat in the Southwest Desert, while taking into consideration historical land uses and long-term socioeconomic issues. The Plan will help to meet this goal by providing management solutions based on local or compatible data and research to the extent practical. In addition, SWARM hopes to develop management solutions that will result in diverse and productive sagebrush habitat for sage-grouse while recognizing that healthy sagebrush habitats are valuable to the existence of other species as well. The Plan will identify management areas, key local issues, conservation strategies, population information, research and monitoring needs, and support long-term funding. Adaptive management will be used to maintain the Plan as a continuously evolving document. In addition, the Plan will coordinate the development of project proposals with the Southwest Desert Utah Partners for Conservation and Development Regional Team to maintain and enhance sage-grouse habitat.

This Plan was called for in, and builds on, the Utah Greater Sage-grouse Strategic Management Plan (Strategic Plan) that was passed by the Utah Wildlife Board in 2002. The Strategic Plan was developed by the Utah Greater Sage-grouse Working Group, which included representatives from state and federal natural resource agencies, and local conservation organizations concerned with the health and proper management of Greater Sage-grouse and sagebrush-steppe ecosystems throughout Utah. The primary purpose of the Strategic Plan was to address declining populations of sage-grouse and to develop a framework for agencies to work within. Further, the Strategic Plan identified certain management units throughout the state where Adaptive Resource Management Local Working Groups could be organized to identify local issues. These groups were then expected to implement local adaptive resource management plans to address declining sage-grouse populations, and the loss, degradation, and fragmentation of sagebrush steppe communities, and the protection and conservation of these and other natural resources into the future.

The Plan is designed to meet the guidelines set forth by the USFWS in their Policy for Evaluation of Conservation Efforts (PECE) standards. The USFWS uses PECE standards as a guideline to evaluate whether conservation plans will be considered when making listing and listing priority decisions. The Plan was also written to address the USFWS five Listing Factors:

1. Present or threatened destruction, modification, or curtailment of its habitat or range.
2. Over-utilization for commercial, recreational, scientific, or educational purposes.
3. Disease or predation.
4. Authorities and inadequacy of existing regulatory mechanisms.
5. Other natural or man-made factors affecting its continued existence.

The Plan directly and indirectly addresses the five USFWS listing factors as they apply to Greater Sage-grouse (hereafter referred to as sage-grouse) in the Southwest Desert area. In addition, the Plan will identify issues, potential strategies, and provide for implementation of proposed conservation actions. The Plan is neither a National Environmental Policy Act (NEPA) decision document nor a federal or state recovery plan. Any Candidate Conservation Agreement

with Assurances developed by the UDWR will be based on the Plan, but will include the NEPA process. Use of this plan by agencies, private enterprise, and private individuals is strictly voluntary. State and federal resource management agencies involved with sage-grouse management, however, are required to manage sage-grouse populations and habitat by various state and federal statutes and policies. The information contained in the Plan is intended to serve as a set of guidelines for those state and federal agencies to maintain and enhance sage-grouse populations and their habitat in the Southwest Desert. Participation by private landowners and consideration of the needs of the landowner is critical for management of sage-grouse populations and habitat located on private lands and will be of great importance to meet the overall goals of the Plan. True success will only be achieved by managing on an overall landscape scale. The Plan provides an opportunity to promote ecologically sound management of private and public lands for sage-grouse without impinging on private property rights.

B. Goals and Scope

The goals of this Plan are separated into two categories: Assessment Goals and Strategy Goals. The goals are not listed in any particular order.

Assessment Goals:

The Plan will provide an assessment of the status of the Southwest Desert sage-grouse population by accomplishing the following goals:

1. Estimate current population size and evaluate population trends; estimate amount and condition of habitat.
2. Identify research needs and knowledge gaps.
3. Determine population and habitat needs for the future.
4. Identify and discuss threats that have the potential to impact sage-grouse in the Southwest Desert, especially those associated with the five USFWS Listing Factors.

Strategy Goals:

The intent of the Plan is to maintain and where possible, increase sage-grouse populations and improve habitat conditions in the Southwest Desert by carrying out the following goals:

1. Incorporate management strategies from state and federal agency partners, local governments, and established rangewide conservation and management guidelines (Connelly et al. 2000, Connelly et al. 2004).
2. Increase effective communication with all potential stakeholders in the Southwest Desert and the state of Utah through outreach, information distribution, and education.
3. Address and prioritize threats to aid in prioritizing management solutions.
4. Identify and pursue funding sources, or support partners in their pursuance of funding for projects that will help achieve specific strategies and actions.

Scope

This Plan is designed to span multiple land ownerships and multiple land uses throughout its geographic area. We hope that with the implementation of this plan, specific conservation issues will be addressed, implemented, and monitored across geographic and political boundaries to increase consistency of practices implemented and information collected. The assessment and strategies described herein are specific to the Southwest Desert and developed with the unique ecological, social, and economic concerns of that area in mind. A detailed description of the Southwest Desert Resource Area is provided later in the Plan.

C. Plan Duration

The Plan was designed and written to be a dynamic, adaptive document that can change with the needs of the local sage-grouse population, habitats, and local community as necessary. SWARM will reevaluate sage-grouse populations and habitats and will review progress on strategies listed in the Plan as per the Standard Operating Procedures (SOP; Appendix A). The Plan was written to support conservation actions over a ten-year period. Early termination of the Plan would occur if sage-grouse was listed under the Endangered Species Act (ESA) or if sage-grouse were removed from the UDWR Sensitive Species list. Species on the Sensitive Species list include those that are federally listed, are candidates for federal listing, or for which there is "credible scientific evidence to substantiate a threat to continued population viability" (Utah Division of Wildlife Resources 2005).

D. Southwest Desert Adaptive Resource Management Local Working Group

As a result of the Strategic Plan, the Southwest Desert Adaptive Resource Management Local Working Group (SWARM) was formed in 2004 and has worked consistently and cooperatively toward the completion and implementation of the Plan since that time. SWARM was organized and facilitated by Todd A. Black and S. Nicole Frey of Utah's Community-Based Conservation Program (CBCP); a collaborative partnership between the UDWR and Utah State University Extension Services, with support from the Jack H. Berryman Institute. Dr. Frey and Sarah G. Lupis also served as the technical writer of the Plan itself. SWARM is comprised of state and federal agency personnel, representatives from local government, non-profit organizations, academic institutions, private industry, and private individuals. The agencies, organizations, and individuals who contributed to the Plan through participation in SWARM are listed in Table 1. When "we" or "our" is used in the Plan, it refers to SWARM.

The role of SWARM participants was to guide the development of the Plan and to represent their agencies. After completion of the Plan, SWARM participants will continue to meet to update the Plan, incorporating the results of research and monitoring efforts, new information, and lessons learned through an adaptive management process. Guidance for continued operation of SWARM can be found in the SOP (Appendix A).

SWARM and the CBCP reviewed several local sage-grouse conservation plans, statewide plans, and rangewide plans and assessments from Utah, Colorado, and Nevada to determine the most appropriate structure and content of this Plan. In addition, a thorough literature review was conducted to ensure that the Plan contained the most recent information available on sage-grouse ecology, life history, and habitat requirements. Annual working group meetings, work plans, and

accomplishment reports will monitor progress toward meeting the goals of the Plan. The Plan is intended to be an evolving document. Incorporating principles of adaptive management and changing as new information arises will help to ensure success of the Plan and SWARM.

Table 1. Southwest Desert Adaptive Resource Management (SWARM) Local Working Group agency, industry, and private partners.

Hamlin Valley Landowners
Cedar Livestock Association
Iron and Beaver County Cattlemen Associations
Beaver and Iron County Landowners
Beaver, Iron and Washington County Commissions
Utah Division of Wildlife Resources (UDWR)
USDA Forest Service (USFS)
Bureau of Land Management (BLM)
U.S. Fish and Wildlife Service (USFWS)
USDA Wildlife Services (WS)
Utah Farm Bureau Federation (UFBF)
Natural Resource Conservation Service (NRCS)
NRCS Research, Conservation and Development (RC&D)
Utah State University Extension (USU/EXT)
The Nature Conservancy (TNC)
Utah School and Institutional Trust Lands Administration (SITLA)
Local Soil Conservation Districts

Management strategies and recommendations described in the Plan will updated periodically to incorporate results of research efforts, new information, and the results of management actions through annual reviews and progress reports.

SWARM operates through a public process based on consensus decision making. For decisions regarding the Plan, consensus was reached by participating members or those present at the time the decision was made. Sections 5 and 6 of the ESA direct state and federal agencies to cooperate to develop conservation activities that protect candidate species. Because the responsibility lies with state and federal agencies, ultimately decisions are limited to them. However, all agencies felt that it was important to involve the public in the decision-making and planning process to the greatest extent possible. The importance of public-private partnerships was highlighted in the Statewide Strategic Management Plan (UDWR 2002):

> "An important part of solving the habitat management problems that face sage-grouse, is to work together closely so that all landowners and land managers are aware of the needs of local populations and how to meet them."

SWARM provided regular opportunities for public involvement, participation, and comment on the Plan. Regular meetings were scheduled to meet the needs of the greatest number of SWARM participants possible. Meetings were announced via direct mailings and email, on the

CBCP web site (www.extension.usu.edu/cbcp), and through personal phone calls and invitations. During the planning process, SWARM met at least every other month and often every month. Meeting minutes and critical updates were provided via email, direct mailing, and on the CBCP web site. In addition, an annual community forum was held to update the local community on SWARM's activities and solicit participation and comment from local stakeholders. Annual forums were announced in a similar fashion as regular meetings. The CBCP provided informational material to County Extension offices for display and distribution to the local community, and CBCP personnel met regularly with County governments (commissions and councils) to update them on SWARM's activities and the Plan's progress. The final draft of the Plan was made available to all potential stakeholders that SWARM was aware of and comments were encouraged.

E. Socioeconomic Considerations Including Consequences of Federal Listing

Communities in the Intermountain West are reflective of diverse and complicated relationships between natural resource extraction industries (agriculture, minerals, energy development, etc.), landownership (private vs. public) and local, state, and federal laws and regulations. These rural communities are also reflective of cyclic (boom/bust) economies and global economics that drive commodity prices. In order to be successful, management recommendations and solutions designed to improve sage-grouse populations and habitats must be reflective and sensitive to local socioeconomic issues.

State and federal agencies will coordinate with local landowners, county, and local governments to develop solutions that will meet ecological requirements while maintaining the social and economic values of the local community to the greatest extent possible. Participation by local stakeholders in the planning process has also helped to ensure that recommendations and guidelines presented in the Plan will meet the needs of the community. In many instances, cooperation between landowners and agencies results in more cost-effective and efficient habitat improvement projects that ultimately benefit both sage-grouse and local interests.

Listing the sage-grouse under the provisions of ESA could have a variety of local impacts. Activities that could be affected include noxious weed control, maintenance of rights-of-way, subdivisions and land development, livestock grazing management, big game wildlife management, and recreational land use. Broadly applying "take" regulations under the ESA could have a significant local impact. There will likely be an increase in bureaucratic processes in environmental permitting and compliance. Ultimately, the listing could result in slow growth and the elimination of new projects because of the increased cost of environmental permitting and compliance.

In the event of listing, this Plan along with other local conservation plans, statewide conservation plans, and rangewide conservation assessments and strategies, will be used by the USFWS to develop a federal recovery plan. Should these events transpire, the USFWS will also strive to consider social and economic needs to the maximum extent possible. In the July 1, 1994 Federal Register (59 FR 34272) the USFWS issued a policy to involve stakeholders in the preparation of federal recovery plans to help minimize the social and economic impacts of implementing recovery actions.

F. Management and Legal Authorities

Existing state, federal, and county regulations offer protection to sage-grouse in the Southwest Desert. State laws restrict possession of individual birds. Funding programs in Utah support population and habitat conservation as well as monitoring activities. Federal agencies including the Bureau of Land Management (BLM), U.S. Forest Service (USFS), National Park Service (NPS), Natural Resources Conservation Service (NRCS), and USFWS have laws, regulations, policies, and funding programs that authorize and support conservation efforts. In the Southwest Desert, some counties have provisions for wildlife or sage-grouse conservation.

Utah Division of Wildlife Resources (UDWR)

Title 23 of the Utah Code is the Wildlife Resources Code of Utah and provides the UDWR with the powers, duties, rights, and responsibilities to protect, propagate, manage, conserve, and distribute wildlife throughout the state. Section 23-13-3 declares that wildlife existing within the state, not held by private ownership and legally acquired, is property of the state. Sections 23-14-18 and 23-14-19 authorize the Utah Wildlife Board to prescribe rules and regulations for the taking and/or possession of protected wildlife.

The UDWR's wildlife management philosophy is captured in its Mission Statement, Strategic Plan, and Comprehensive Wildlife Conservation Strategy (CWCS) approved in 2005 (also known as the Utah Wildlife Action Plan). The mission of the Division of Wildlife Resources is, "…to serve the people of Utah as trustee and guardian of the state's wildlife, and to ensure its future and values through management, protection, conservation and education." There are three goals associated with this mission. The resource goal states that the UDWR intends to, "Expand wildlife populations and conserve sensitive species by protecting and improving wildlife habitat." The UDWR 2005–2015 Strategic Plan calls for focusing efforts on increasing the abundance, distribution, and range for species of conservation need by sustaining and restoring habitat functions. A ten-year, 2005–2015 Comprehensive Wildlife Strategy (a.k.a. Utah Wildlife Action Plan) was approved in 2005 to address species and habitat of greatest conservation need, priorities for conservation, and actions and future implementation opportunities through partnerships.

Sage-grouse are classified as a "State Species of Concern" and are among the terrestrial species identified as being in the second tier (i.e., Tier II) of three priority categories of species identified in the CWCS. Approximately 60 species across 5 taxa in Utah are identified as being potentially petitioned for placement on the ESA defined Threatened and/or Endangered Species list.

Counties

The Board of Commissions for Beaver, Iron, Washington Counties serve as the executive and legislative branches of local government. They have the authority to:

1. Protect and promote the health, welfare, and safety of the people of these counties
2. Regulate land use, land planning, and quality and protection of natural resources
3. Duly adopt regulations and policies to exercise such authorities including the review and approval or denial of proposed activities and uses of land and natural resources.

Both Beaver and Iron County are currently revising their Habitat Conservation Plans.

Natural Resources Conservation Service (NRCS)

The USDA NRCS has authority to conserve sage-grouse through:

1. Soil Conservation and Domestic Allotment Act of 1936, as amended (P.L. 74-46
2. Department of Agriculture reorganization Act of 1994 (P.L. 409-354; 7 U.S.C. 6962)
3. The Farm Security and Rural Investment Act (Farm Bill) of 2002 (P.L. 107-171)

The NRCS and Farm Service Agency (FSA) jointly implements programs, which provides landowners with technical and financial assistance to restore and protect grassland, rangeland, pastureland, shrub land, and certain other lands, through long-term agreements and easements.

The USDA NRCS offers help to private landowners through the 2002 Farm Bill programs to improve their range and pasture land to improve sage-grouse habitat. These practices include watershed practices on their private lands such as water developments and fencing for prescribed grazing to improve livestock distribution. Improvements to the vegetation can be accomplished with the seeding of introduced and native species of grasses and forbs for forage improvement to benefit both wildlife and domestic animals. Other Farm Bill programs include wildlife enhancement, conservation easements, watershed and riparian programs, and programs to reduce soil erosion.

Bureau of Land Management (BLM)

The United Sates Department of Interior (USDI) BLM has authority for conservation of sage-grouse through:

1. Federal Land Management Policy Act (FLMPA) of 1976 (43 U.S.C. 1701 et seq.; 90 stat. 2743; PL 94-579)
2. Sikes Act, Title II (16 U.S.C. 670 et seq.)
3. BLM Manual 6840, Special Status Species Management

Specifically, the FLMPA guidance on sensitive species authorizes that "the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, and environmental, air, and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals…(43 U.S.C. 1701 Sec. 102 (a) (8))."

The 6840 Manual defines Special Status Species as, "…any species which is listed, or proposed for listing, as threatened or endangered by the U.S. Fish and Wildlife Service or National Marine Fisheries Service under the provisions of the Endangered Species Act; any species designated by the U.S. Fish and Wildlife Service as a 'listed,' 'candidate,' 'sensitive,' or 'species of concern,' and any species which is listed by the State in a category implying potential danger of extinction." The Manual provides for the BLM to implement management plans that conserve these species and their habitats, and to ensure that actions authorized, funded, or carried out by the BLM do not contribute to the need for the species to become listed under provisions of the ESA. In addition, the USFWS Policy: State-Federal Relationships (43CFR part 24.4 (c)) contends that the Secretary of the Interior is responsible for the management of non-wilderness BLM lands for multiple uses, including the conservation of fish and wildlife populations.

Finally, the BLM provides conservation guidelines for management of sage-grouse on BLM lands in the National Sage-grouse Habitat Conservation Strategy (BLM 2005).

School and Institutional Trust Lands Administration (SITLA)

In 1994, the Utah School and Institutional Trust Lands Administration was created to manage twelve real estate trusts granted to Utah at statehood (1896) by the United States federal government. SITLA is an independent agency of state government established to manage those lands for the support of common schools and other beneficiary institutions, under the Utah Enabling Act (Title 53C-School and Institutional Trust Lands Management Act).

Title to these trust lands is vested in the state as trustee to be administered for the financial support of the trust beneficiaries. As trustee, SITLA must manage the lands and any revenues generated from the lands in the most prudent and profitable manner possible, and not for any purpose inconsistent with the best interest of the trust beneficiaries. The trust principles impose fiduciary duties upon the state, including a duty of undivided loyalty to, and a strict requirement to administer the trust corpus for the exclusive benefit of, the trust beneficiaries. The beneficiaries do not include other governmental institutions or agencies, the public at large, or the general welfare of the state. SITLA must be concerned with both incomes for the current beneficiaries and the preservation of the trust corpus for future beneficiaries. This requires a balance between short and long-term interests so that long-term benefits are not lost in an effort to maximize short-term gains. SITLA has no jurisdiction over wildlife populations on trust lands. Management of rangelands is addressed in Section 53C-5-101 of the School and Institutional Trust Lands Management Act, which states: 1) The director is responsible for the efficient management of all range resources on lands under the director's administration, consistent with his fiduciary duties of financial support to the beneficiaries; and 2) This Management shall be based on sound resource management principles.

United States Forest Service (USFS)

The United States Department of Agriculture (USDA) Forest Service has authority for conservation of sage-grouse though the:

1. Multiple-Use Sustained Yield Act (MUSY) of 1960 (P.L. 86-517, 74 Stat. 215, 16 U.S.C. 528, 528-531)
2. Sikes Act of 1960 (P.L. 86-797, 74 Stat. 1052, 16 U.S.C 670 et seq., as amended)
3. Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974 (P.L. 93-378, 88 Stat. 476, as amended; 16 U.S.C. 1600, 1600-1614)
4. National Forest Management Act (NFMA) of 1976 (P.L. 94-588, 90 Stat. 2949, 16 U.S.C. 472 et seq.) and its implementing regulations (36 CFR 219)
5. Public rangelands Improvement Act of 1978 (P.L. 95-514, 92 Stat. 1806, 43 U.S.C. 1901-1908)
6. USDA Regulation 9500-4 and the Forest Service Manual (FSM) Chapter 2600

MUSY directs the USFS to administer the National Forest for multiple uses including fish and wildlife purposes, in cooperation with interested State and local governmental agencies and others. “Multiple use” refers to the congruent and coordinated management of the various surface renewable resources so that they are utilized in a manner that will best meet the needs of the American people. The Sikes Act provides authority for cooperative planning, habitat

improvement, and providing adequate protection for species considered to be threatened, rare, or endangered by a State agency. RPA and NFMA provide for comprehensive, integrated planning that will provide for the diversity of plant and animal communities to met overall multiple-use objectives. USDA Regulation 9500-4 directs the USFS to manage "habitats for all existing native and desired nonnative plants, fish and wildlife species in order to maintain at least viable populations of such species." USFS policy includes provisions for the development of conservation strategies for species that could be negatively affected by forest plans or proposed projects (FSM 2621.2).

Memorandum of Understanding (MOU)

There are two Memoranda of Understanding (MOU) that address conservation of sage-grouse. The first was signed in 1999 by members of the Western Association of Fish and Wildlife Agencies (WAFWA) to promote conservation and management of sage-grouse and their habitats. Thirteen states, including Utah, and two Canadian provinces were signatories to that MOU. The second MOU, signed in 2000, is between WAFWA, USFS, BLM, and the USFWS. This MOU provides for cooperation among state, provincial, and federal agencies in the development of a rangewide strategy to direct conservation of sage-grouse and their sagebrush habitats.

An MOU between state and federal agencies within the state of Utah is currently being developed. The MOU promotes the conservation of sage-grouse and their sagebrush habitats, encourages cooperation between signatories, and supports Adaptive Resource Management Local Working Groups as the primary format for addressing sage-grouse and sagebrush steppe issues in the state.

G. Policy for Evaluation of Conservation (PECE) Standards

The PECE Standards set criteria for the USFWS to use in determining whether a formalized conservation effort contributes to making listing a species unnecessary, or contributes to forming a basis for listing a species as threatened rather than endangered. The draft PECE was published on June 13, 2000 (65 FR 37102), and was finalized on March 28, 2003 (68 FR 15100-115). The PECE contains nine criteria the USFWS will use to evaluate that the conservation effort will be implemented, and six criteria to determine if the action will be effective. Conservation efforts included under this policy include those identified in conservation agreements, conservation plans, management plans, or similar documents developed by federal agencies, state and local governments, tribal governments, businesses, organizations, individuals, and a combination of the above. The criteria are not considered comprehensive. The USFWS will consider all appropriate factors and unique, specific circumstances when evaluating formalized conservation actions.

PECE reviews will be conducted to individual conservation actions (rather than conservation plans). Should Greater Sage-grouse be petitioned for listing or be listed under the ESA, this Plan will be reviewed and assessed as part of the preparation of a listing decision and will follow the most recent procedural guidance. Neither PECE review of this Plan nor signature of this Plan by the USFWS constitutes a PECE review of this Plan.

III. Conservation Assessment

A. General Sage-grouse Biology/Ecology

Numerous authors have described various aspects of sage-grouse biology, ecology, and life history. Several literature reviews have also been published in recent years. For the purposes of this document, we have included the summary from the Statewide Strategic Plan (UDWR 2002) and would recommend the Conservation of Sage-grouse and Sagebrush Habitats by Connelly et al. (2005) for a thorough discussion.

Physical Description

The sage-grouse is the largest grouse species in North America. Adult males are larger than adult females. Adult males weigh 4-7 pounds (1.7-2.9 kg) and are 27-32 inches (65-75 cm) long compared to adult females weighing 2-4 pounds (1.0-1.8 kg) and measuring 20-25 inches (50-60 cm) long. Both sexes have narrow, pointed tails and a variegated pattern of grayish brown, buff, and black on the upper parts of the body, and a diffuse black abdominal pattern. Males have blackish brown throats, a dark V-shaped pattern on the neck, and white breast feathers. When strutting, males inflate two gular sacs of olive green skin and erect hair-like black feathers (filoplumes) on the back of the neck. Females lack the V-shaped pattern, their throats are buff, and their lower throats and breasts are barred with blackish brown (Schroeder et al. 1999).

There are noticeable morphological differences between Greater Sage-Grouse and Gunnison Sage-Grouse. Gunnison Sage-Grouse are two-thirds the size of Greater Sage-Grouse. Gunnison Sage-Grouse tail feathers have horizontal white barring along their length compared to a variegated pattern found in Greater Sage-Grouse. The filoplumes, found only on male sage-grouse, are much thicker and dense in Gunnison Sage-Grouse than in Greater Sage-Grouse. There are also noticeable differences in the strutting behavior of the two sage-grouse species (Young et al. 2000).

Seasonal Movements and Home Range

Sage-grouse populations can be defined as one of two types: 1) non-migratory – grouse do not make long-distance movements between seasonal ranges; and 2) migratory – grouse make long-distance movements between distinct seasonal ranges. Seasonal movements between ranges can exceed 45 miles (75 km; Connelly et al. 1993).

Home-range size for migratory sage-grouse populations can exceed 540 mi^2 (1,500 km^2; Hulet 1983). For non-migratory sage-grouse populations, home range size varies from 4-11 mi^2 (11 to 31 km^2). Sage-grouse exhibit high fidelity to seasonal ranges (Fischer et al. 1993). Females return to the same area to nest each year and may nest near their previous year's nesting site (Bunnell et al. 2000, Gates 1983).

Breeding

The center of breeding activity for sage-grouse is the "lek" or strutting ground. Male sage-grouse begin to congregate on leks in early March and perform a ritualized courtship display. Use of leks may continue as late as early June. Mating occurs on the lek. Fifty to ninety percent

of the males utilize leks during the breeding season. As sage-grouse populations decline, the number of males attending leks may decline or the use of some leks may be discontinued. Conversely, as populations increase, male attendance on leks may increase and/or new leks may be established or old leks reoccupied (Connelly et al. 1981).

Nesting/Reproduction

Nesting generally takes place 1-2 weeks after mating and may continue as late as early June (Wallestad 1975). Sage-grouse generally have lower reproductive rates and higher survival rates than other species of upland game birds (Connelly and Braun 1997). Nesting rates vary from year to year and from area to area (Bergerud 1988, Connelly et al. 1993, Schroeder 1997, Coggins 1998). Connelly et al. (1993) reported that in Idaho up to 45% of yearling and 22% of adult female sage-grouse do not nest each year. Schroeder (1997) found that essentially all female sage-grouse in Washington nested. The variation is most likely a result of the quality of nutrition available and the health of pre-laying females (Barnett and Crawford 1994). Re-nesting by sage-grouse varies regionally from 20% (Hulet 1983, Connelly et al. 1993) to greater than 80% (Schroeder 1997). In summary, sage-grouse have the lowest reproduction rate of any North American game bird and as a result populations are not able to recover from low numbers as quickly as those of other game birds.

Sage-grouse nest success varies from 12 to 86% (Trueblood 1954, Gregg 1991, Schroeder et al. 1999). Adult females may experience higher nest success rates than yearling females (Wallestad and Pyrah 1974). However, differential nest success between age groups has not been observed in other studies (Connelly et al. 1993, Schroeder 1997). Nest success is dependent on vegetation cover type (Gregg 1991). Gregg (1991) reported that the highest nest success occurred in mountain big sagebrush (*A. t. vaseyana*) cover type. Greater cover of medium-height shrubs with grass 7 inches (>18 cm) in height increases sage-grouse nest success (Gregg et al. 1994).

Clutch size of sage-grouse is extremely variable and relatively low compared to other species of game birds (Schroeder 1997). Average clutch size for first nests varies from 6.0 to 9.5 throughout the specie's range (Schroeder 1997, Sveum 1998). These differences may be related to habitat quality and overall health of pre-laying females (Coggins 1998).

Survival Rates

Annual survival rates for yearling and adult female sage-grouse vary from 35 to 85%; adult male survival rates vary from 38 to 54% (Wallestad 1975, Zablan 1993, Connelly et al. 1994). Lower survival rates for males may be related to physiological demands of sexual dimorphism and higher predation rates on males during the breeding season (Swenson et al. 1987).

Sage-grouse predators include raptors, coyotes, ravens, squirrels, and skunks. The increase in urban development has resulted in the addition of non-native predators such as dogs, cats and foxes (Connelly et al. 1991).

Little information has been published on mortality of juvenile sage-grouse or the level of production necessary to maintain a stable population. Among western states, long-term juvenile to hen ratios have varied from 1.40 to 2.96 juveniles per hen in the fall. In recent years, this ratio

has declined to 1.21 to 2.19 juveniles per hen (Connelly and Braun 1997). It is believed that at least 2.25 juveniles per hen should be present in the fall population to allow for stable to increasing sage-grouse populations (Connelly and Braun 1997, Edelmann et al. 1998).

B. Habitat Requirements

Breeding/Nesting Habitat

Leks, or strutting grounds, tend to be traditional. In general, the same areas are used year after year. Leks typically occur in open areas surrounded by sagebrush (Patterson 1952, Gill 1965). Examples of lek sites include landing strips, old lakebeds or playas, low sagebrush flats, openings on ridges, roads, cropland, and burned areas (Connelly et al. 1981, Gates 1985). Sage-grouse males appear to form leks opportunistically at sites within or adjacent to potential nesting habitat. The lek is thought to be the center of year-round activity for non-migratory grouse populations (Eng and Schladweiler 1972, Wallestad and Pyrah 1974, Wallestad and Schladweiler 1974), but may not be the case in migratory populations (Connelly et al. 1988, Wakkinen et al. 1992). Average distances between nests and the nearest leks vary from 0.6-3.9 miles (1.1-6.2 km), however, some females may nest > 12.5 miles (20 km) away from the lek (Autenrieth 1981, Wakkinen et al. 1992, Fischer 1994, Hanf et al. 1994).

Habitat used by pre-laying hens is also part of the general breeding habitat. These areas provide hens with forbs high in calcium, phosphorus, and protein, all of which are necessary for egg production. The condition and availability of these areas are thought to have a significant effect on reproductive success (Barnett and Crawford 1994, Coggins 1998).

Most sage-grouse nests are located under sagebrush plants (Patterson 1952, Gill 1965, Gray 1967, Wallestad and Pyrah 1974), however, nests have been found under other plant species (Griner 1939, Connelly et al. 1991, Gregg 1991). Those sage-grouse nesting under sagebrush experience a higher nest success than those nesting under other plant species (Connelly et al. 1991). Research on sage-grouse nesting habitat has documented that sage-grouse tend to select sites under sagebrush plants that have large canopies. The canopies provide overhead cover and an herbaceous understory, thus providing lateral cover and allowing birds to hide from view (Patterson 1952, Gray 1967, Klebenow 1969, Wallestad and Pyrah 1974, Wakkinen 1990, Gregg 1991, Fischer 1994, DeLong et al. 1995, Bunnell et al. 2000). Herbaceous cover associated with nest sites may provide scent, visual, and physical barriers to potential predators (DeLong et al. 1995).

Brood-rearing Habitat

Early brood-rearing habitat generally occurs relatively close to nest sites, but movements of individual broods may be highly variable (Connelly 1982, Gates 1983). Early brood-rearing habitats may be relatively open stands of sagebrush when compared to optimum nesting habitat (Martin 1970, Wallestad 1971), but need > 15% canopy cover of forbs and grasses (Sveum et al. 1998, Bunnell et al. 2000). High plant species richness with abundant forbs and insects characterize brood areas (Dunn and Braun 1986, Klott and Lindzey 1989, Drut et al. 1994, Apa 1998). Insects, especially ants and beetles, are an important food component of early brood-rearing habitat (Drut et al. 1994, Fischer 1996). As herbaceous plants mature and dry, hens usually move their broods in June and July to mesic sites where more succulent vegetation is available (Gill 1965, Klebenow 1969, Connelly and Markham 1983, Connelly et al. 1988, Fischer 1996, Bunnell et al. 2000). Sage-grouse broods occupy a variety of habitats during summer including sagebrush, relatively small, burned areas within sagebrush, wet meadows,

farmland, and other irrigated areas adjacent to sagebrush habitats (Savage 1969, Martin 1970, Connelly and Markham 1983, Gates 1983, Connelly et al. 1988, Pyle and Crawford 1996).

Late brood-rearing habitats are highly variable. Patterson (1952) reported that grouse move from summer to winter range in October but during mild weather in late fall some birds may still use summer range. Fall movements to winter range are slow and meandering and occur from late August to December (Connelly et al. 1988). Wallestad (1975) documented a shift in feeding habits from September, when grouse were consuming a large amount of forbs, to December when birds were feeding only on sagebrush.

Winter Habitat

Sage-grouse winter habitats are relatively similar throughout most of their range. Because their winter diet consists almost exclusively of sagebrush, winter habitats must provide adequate sagebrush that remains accessible through the winter. Eng and Schladweiler (1972) and Wallestad (1975) indicated that in Montana most observations of wintering sage-grouse occurred in sagebrush habitats with > 20% canopy cover. However, Robertson (1991) indicated that sage-grouse used sagebrush habitats that had average canopy cover of 15%. Sage-grouse tend to select areas with both high canopy cover and taller individuals of big sagebrush (*Artemisia tridentata*).

During winter, sage-grouse feed almost exclusively on leaves of sagebrush (Patterson 1952, Wallestad 1975). Big sagebrush dominates the diet of sage-grouse in most portions of their range (Patterson 1952, Wallestad 1975, Remington and Braun 1985, Welch et al. 1988), but low sagebrush (*A. arbuscula*), black sagebrush (*A. nova*) (Dalke et al. 1963, Beck 1977), fringed sagebrush (*A. frigida*; Wallestad 1975), and silver sagebrush (*A. cana*; Aldridge 1998) are also consumed in many areas depending on availability. Sage-grouse in some areas apparently have a preference for Wyoming big sagebrush (*A. t. wyomingensis*; Remington and Braun 1985, Meyers 1992) and in other areas, mountain big sagebrush (*A. t. vaseyana*; Welch et al. 1988). Some of the differences in selection may be due to preferences for higher levels of protein (Remington and Braun 1985).

It is critical that sagebrush be exposed at least 10-12 inches (25 cm) above snow level (Hupp and Braun 1989). This provides both food and cover for wintering sage-grouse. In situations where snow covers the sagebrush, birds will move to areas where sagebrush is exposed. During winter, sage-grouse will either partially or completely bury themselves in snow (snow roosting) for added thermal protection from winter temperatures.

C. Distribution and Abundance

Populations of Greater Sage-grouse have been declining for the past 25 years (Braun 1995, Connelly and Braun 1997, Beck et al. 2003, Connelly et al. 2004). Concerns about population status and distribution have heightened awareness about the appropriateness of various monitoring efforts and techniques. Connelly et al. (2000) indicated that monitoring was a key component of sage-grouse management. Utah's Strategic Management Plan (UDWR 2002) also emphasizes the need to monitor sage-grouse populations and habitats. Further, the MOU signed by WAFWA representatives in 1999 and with federal agencies (2000) call for consistent monitoring and data collection.

Utah and the Southwest Desert historically have used several techniques to assess sage-grouse population trends, status, and distribution including lek counts, brood surveys, field bag checks, wing barrels, and hunter surveys. Currently, the primary technique employed by biologists in Utah and in the Southwest Desert is lek counts. This method is described in detail later in this section.

Historic Distribution of Sage-grouse

Determining historic distribution of sage-grouse is difficult and problematic for several reasons, but primarily because scientific studies are not available historically. For many areas, no written or zoological records exist. It is believed that sage-grouse once existed in all 29 Utah counties. Today sage-grouse are found in 26 counties in Utah and are thought to occupy 50% of the habitat they once did (UDWR 2002).

The Rangewide Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats (hereafter referred to as the Rangewide Assessment; Connelly et al. 2004) analyzed the historic distribution of sage-grouse based on historical sage-grouse distribution maps, habitat maps, sage-grouse museum specimens, known lek locations, and research on sage-grouse movement patterns and habitat use. The authors define historic distribution as a "pre-settlement" distribution, occurring prior to 1800 when rapid settlement by people of European descent began.

The Rangewide Plan describes potential historic distribution of sage-grouse in the Southwest Desert as part of the evaluation of historic range in the Wyoming Basin (Connelly et. al. 2004). The authors state that there are no records of sage-grouse observations in the eastern portion of the Wyoming Basin in what is now the Southwest Desert, but are unable to account for this discrepancy with current observations of the species in this area. Further, they indicate that the distribution of forested habitats would have prevented sage-grouse from occupying portions of the Uinta Mountains in Utah.

Lek Counts

During the breeding season, sage-grouse congregate on a relatively small number of sites, called leks, to display and breed. Because sage-grouse demonstrate high fidelity to lek sites, they offer the best opportunity for monitoring populations (Jenni and Hartzler 1978, Beck and Braun 1980, Connelly et al. 2000, 2003, 2004). Lek count methodology was first described by Patterson (1952) who studied sage-grouse in Wyoming. His methodology was based on a count of the

maximum number of males observed on a lek over a series of 3-4 visits. The method described by Patterson (1952) results in an index of the population. Population indices, commonly used by wildlife managers, involve a count or measurement of some aspect of the population that is both convenient to measure and thought to be related to abundance (e.g., bird calls, pellet counts, roadside observations, and track surveys). The shortcomings of this type of sampling were described by Anderson (2001) whose primary criticism was that population indices fail to lead to a defensible estimate of population size or status. Specifically in regard to lek counts, Beck and Braun (1980) noted that conclusions about population size and status are only gleaned when the following information is known: total number of leks in an area, attendance patterns of adult and yearling males, inter-lek movements patterns, and the ratio of males to females (i.e., the relationship between the maximum count and the size of the population).

Despite the problems associated with indices and lek counts, they remain the best available and primary means for assessing population trends and estimating population size and status (Autenrieth et al. 1982, Connelly et al. 2000). Throughout Utah, lek counts are conducted between late February and May (depending on weather conditions and access to lek sites) on all known leks to the extent possible. Leks are counted 3-4 times during this period and counts are made between 30 minutes before and 1 hour after sunrise. An estimate of population size is calculated based on the following assumptions: 1) 75 % of all males were counted on strutting grounds and 2) that the male:female ratio in the population is 1:2 (UDWR 2002).

The number of active leks in an area can also be used as an indicator of population size. Cannon and Knoph (1981) noted that lek numbers seem to increase roughly in proportion to population size. There is evidence that as population size increases, attendance at established, “traditional” leks increases, while smaller “satellite” leks appear and then disappear as population size decreases. In Utah, a lek is defined as a site or area traditionally used for display. Leks are considered “active” when at least two males have been observed for at least three years. Conversely, leks are considered “inactive” when birds have been absent from a traditional site for more than three years. Using the number of “active” or “traditional” leks as an indicator of population size is also problematic. Satellite leks are typically smaller and are likely to be less noticeable, lek detection is likely to vary with both density of leks and population density, and search effort likely plays a large role in detection and consistency of measurement.

D. Assessment of Local Population

Plan Area

The Southwest Desert Resource Area (Resource Area) is located in southwestern Utah, and encompasses Beaver, Iron, and Washington counties, and portions of Garfield, Kane, and Millard, counties. The Resource Area includes 5,672,052 acres, bounded to the north and east by land formations, to the west by the Nevada border, and to the south by the Arizona border (Figure 1). The Resource Area is divided into four focus areas representing sage-grouse breeding complexes. These breeding complexes are based on geographic boundaries and groupings of leks. Although movement between complexes is likely, the complexes represent discrete subpopulations of sage-grouse in the Resource Area (Figure 1).

Southwestern Utah encompasses some of the most varied habitat in North America. The Southwest Desert contains habitat ranging from Alpine Tundra at elevations over 11,000 feet to the Mojave Hot Desert type at elevations as low as 2,000 feet. However, since all present sage-grouse habitat is located with in the cold desert ecotone, the Plan will limit descriptions to this area. Habitat descriptions are adapted from Bowns (2004).

The cold desert is also known as the northern desert shrub, salt-desert shrub, or the Great Basin Desert. The Great Basin is sometimes referred to as a physiographic province, but is more often considered part of the larger Basin and Range Physiographic Province. This desert actually extends beyond the Great Basin into the adjacent Columbia and Colorado Plateaus.

The elevation of sage grouse habitat within the Resource Area is largely between 5,000 and 9,000 feet. Summers are warm and winters are cold. Annual precipitation is mostly between 8 and 16 inches and is most abundant as winter snow, spring storms and brief but high intensity summer monsoonal moisture. As a result, the vegetation is predominantly deep-rooted shrubs or plants that mature prior to the summer drought period. Growth is limited and confined to the brief spring period when plants utilize the deep infiltrated moisture from snow received the previous fall or winter. This desert is a result of its distance from oceanic sources of precipitation and the rain shadow created by high mountain ranges intercepting the westerly flow of the jet stream.

The desert vegetation is conveniently divided into two major units: 1) sagebrush-grass, and 2) salt-desert shrub. Sagebrushes and other genera of the Compositae (sunflower) family as well as several species of grasses dominate the sagebrush-grass vegetation community. The native vertebrate animals residing in this plant community are a mixture of grassland and desert species. Sagebrush obligate vertebrate species are sage-grouse, sage sparrow, Brewers sparrow, sage thrasher, pygmy rabbit, sagebrush vole, sagebrush lizard, and pronghorn antelope. None of these is known to cause major negative feedbacks on vegetation. Jackrabbits, however, which are also present in this community, can cause major impacts on the vegetation.

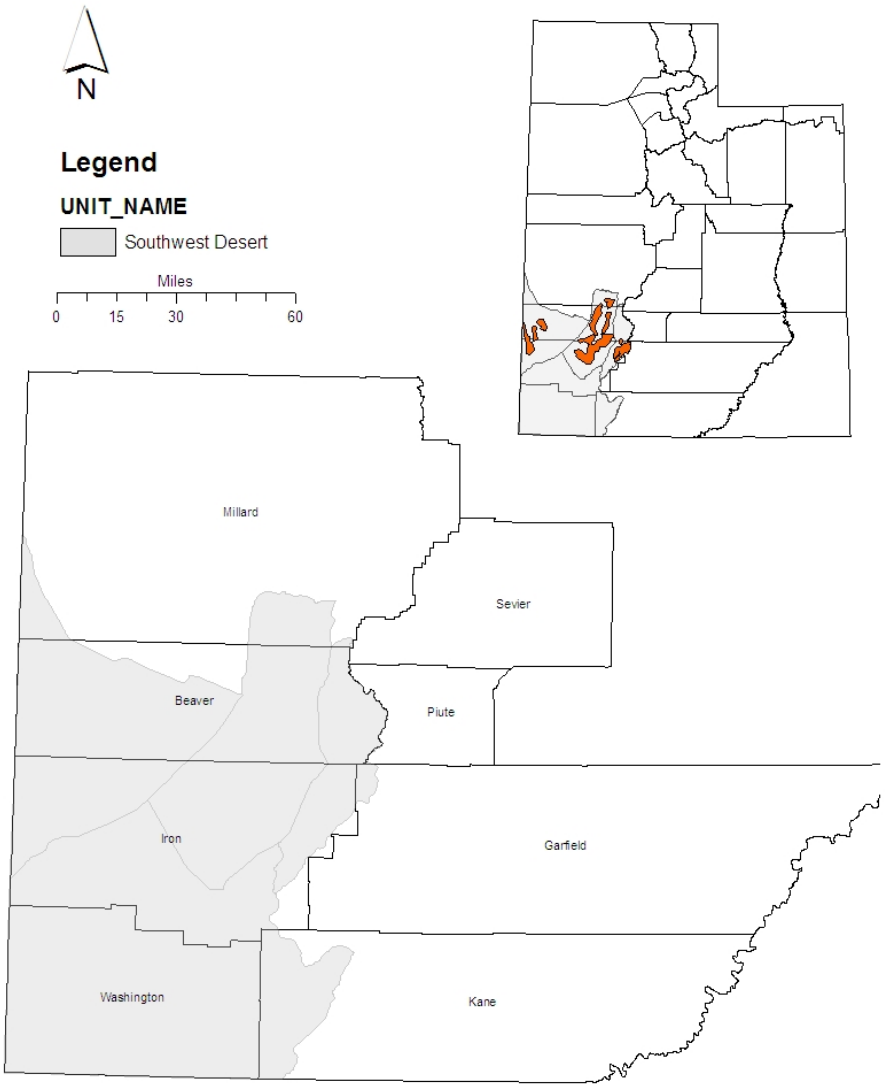

Figure 1. General location of the SWARM Resource Area.

Salt-desert shrub occurs where conditions result in high soil salinity, alkalinity, or both. This generally either occurs at the bottom of drainages in enclosed basins, or on soils derived from marine shales (Mancos or tropic shales). The salt-desert portion of the Great Basin Desert is located in the valley bottoms where salts and fine-textured stream or lake materials have not been able to escape to the oceans, hence the name Great Basin. Common halophytes (salt tolerant plants) are shad scale, gardner saltbush, winter fat, greasewood, four-wing saltbush, seep weed, desert molly, salt grass, and pickle weed. This zone has limited value for sage grouse.

Important shrubs of the Great Basin, in addition to those already mentioned, are bud sagebrush, basin big sagebrush, low rabbit brush, rubber rabbit brush, and spiny hopsage. Cool season grasses, those that evolved under temperate climates and flower in spring or early summer, include Indian rice grass, squirrel tail, blue bunch wheatgrass, needle and thread, and basin wild rye. Warm season grasses, those that evolved under tropical climates and usually flower later in the summer, include sand drop seed, galleta, blue gramma, and alkali sacaton. Perennial grasses have been introduced in many areas, the most common of which is crested wheatgrass.

Forbs are an important component of sage-grouse habitat, but their presence is highly variable due to yearly fluctuations in precipitation patterns and historical management activities. Native annuals are not common in this desert, but several exotic annuals introduced from Eurasia have become very common and have had serious impacts on this ecosystem. The most serious of these annuals are halogeton, Russian thistle, and cheatgrass. Cheatgrass, a winter annual, is widespread throughout the western U.S. and has had the greatest impact on sage-grouse habitat of any nonnative annual plant. It has invaded and sometimes replaced the native vegetation on millions of acres of sagebrush-grass, salt-desert shrub, and other major range types. Cheatgrass has provided fine fuel for fires, which has resulted in changes in fire frequency and intensity and has caused severe depletion of much of the native vegetation. It does provide good forage when it is green and provides reasonably good ground cover for soil stabilization. Production of all annuals is highly variable and varies with the timing and amount of precipitation.

Once desert communities have been taken over by annuals or other undesirable plants, it is extremely difficult or impossible to bring them back to their original condition. Depleted salt-desert shrub ranges are slow to improve under either good range management or complete protection. Therefore, direct re-vegetation seems to be the only satisfactory alternative. Unfortunately, the harsh environment of salt-desert shrub ranges prevents the use of species and direct-seeding methods that have proven successful in other western ranges. The sagebrush-grass zone responds more favorably to restoration methods although care must be taken to avoid hot burns and other methods that are favorable to cheatgrass but would hinder sagebrush reestablishment.

The desert communities have been used mainly for livestock winter ranges and as such are unique among American grazing lands. Because of the arid climate, herbage yields and grazing capacities are low. However, nutritional quality of the dormant shrubs is adequate for the maintenance of breeding or gestating livestock. These winter ranges have been described as the "backbone of the intermountain sheep industry," but are now grazed more by cattle than sheep because of the declines in range sheep numbers.

Fire suppression has facilitated the invasion of sagebrush by pinyon and juniper woodlands

(Beck et al. 2003). This limits sage-grouse habitat in the Southwest Desert and requires birds to make longer migrations over or through marginal habitat areas. While current distribution has made it possible to separate sage-grouse populations into the three focus areas, it is thought that these habitat areas were more connected and less fragmented in the past (Beck et al. 2003). Within the three focus areas, it is believed that populations are both migratory and non-migratory. This is based on cumulative knowledge of the local working group (years of sage-grouse sightings) and unpublished radio telemetry studies conducted by the Utah Division of Wildlife Resources in the 1970s.

This area serves as habitat for wildlife that range in size from insects and small mammals to large herbivores. There is an abundance of birds, small mammals, lizards, snakes, and insects. Several species are important as game, including mourning doves, cottontail rabbits, blue grouse, pronghorn antelope, mule deer, and elk. Sage-grouse, although not currently hunted within the Resource Area, were once a popular game species. Chukar and wild turkey numbers have increased through active management which provide upland game opportunities.

Landownership

Most of the Resource Area is public land; less is in private ownership (Table 2, Figure 2). In Beaver and Iron counties, the majority of federally owned land is managed by the BLM. Land managed by the USFS, Dixie National Forest, and Fishlake National Forest is located in Iron and Washington counties and along the eastern edge of the Resource Area. Private land is scattered throughout the Resource Area with the largest towns, Beaver (Beaver County), Cedar City (Iron County), and St. George (Washington County), located along I-15 which is the primary north–south travel corridor for this area (Figure 1).

Table 2. Landownership and management jurisdiction by acre and percentages within the SWARM Resource Area.

Management Agency	**Acres**	**% of Resource Area**
Bureau of Land Management Wilderness Area	3523	< 1
Bureau of Land Management	2858328	51.3
Native American Tribes	30924	< 1
National Park Service	149918	2.7
Private	1377674	24.7
State of Utah	396388	7.1
State, County, City; Wildlife, Park, and Outdoor Recreation Areas	25860	< 1
US Forest Service	670653	12
US Forest Service Wilderness Area	57305	1
Water	3026	< 1
Total	5574132	

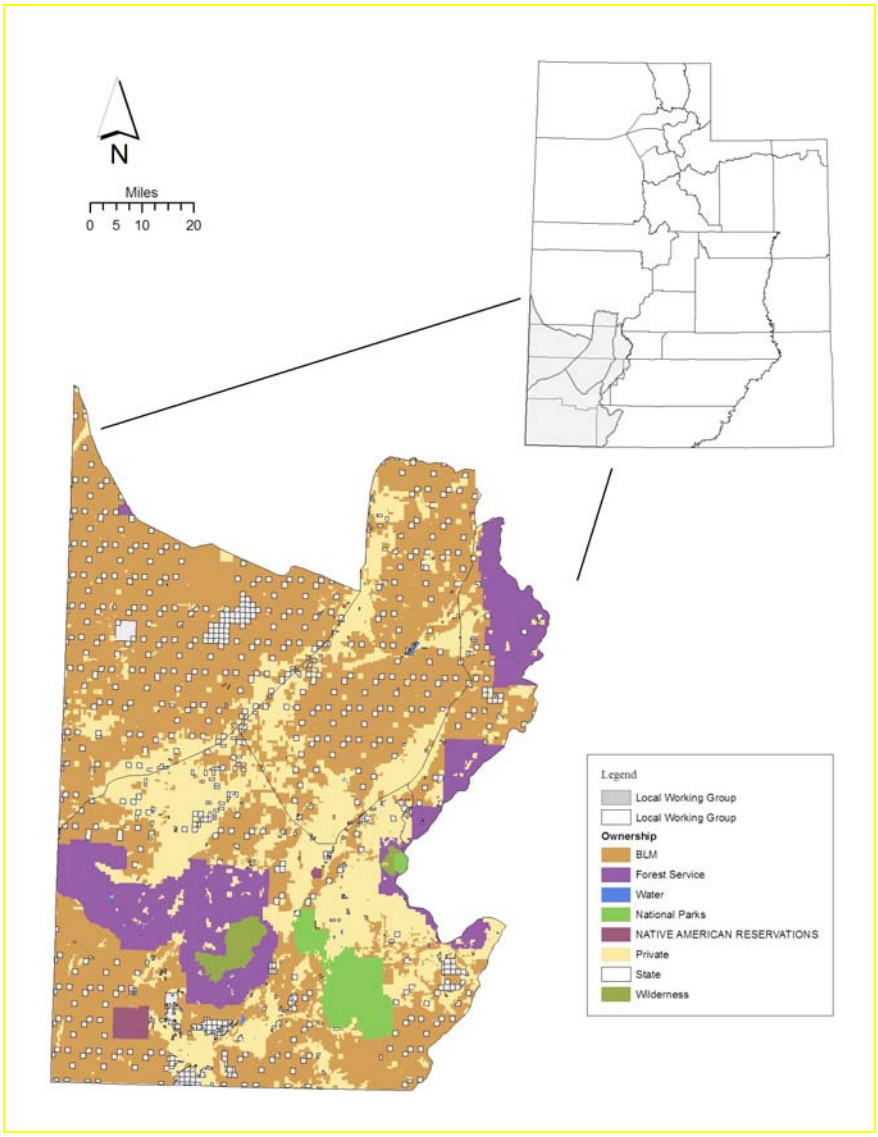

Figure 2. Ownership of land in the Southwest Desert Local Working Group area.

Wildlife Populations

Several species of birds, small mammals, and reptiles are found only in sagebrush environments. Passerine birds obligated to use sagebrush environments include Brewer's sparrow, sage sparrow, and sage thrasher. Additionally, though not obligated to use only sagebrush environments, vesper sparrow and loggerhead shrike are also commonly found in sagebrush communities in this Resource Area. Other obligate species include the sagebrush vole and the sagebrush lizard. In addition to these obligates, a large number of other birds, small mammals, and reptiles commonly make use of sagebrush environments within the Resource Area.

While sage-grouse populations in the Resource Area have been counted and studied, little or nothing is known about the local status of these other wildlife species. We assume that their numbers and geographic extent are tied to the condition and extent of big sagebrush communities. Therefore, this Plan operates with the intent that maintenance of substantial areas of high quality sagebrush steppe, measured by healthy populations of sage-grouse, will provide sufficient habitat for these other sagebrush obligate species.

Human Populations

Parowan Valley in Iron County was a popular home for the Fremont people, and Native American activity has always been common in the Resource Area. The Southern Piute Indian Reservation headquarters is in Cedar City, Iron County. Anglo-American settlers came to southwest Utah in 1851 to set up a county seat in Parowan began iron and coal mining around Cedar City. Unlike many other mining towns, Parowan and Cedar City did not experience a boom-bust cyclic economy. Many of the residents in the surrounding area turned to agriculture and livestock grazing when the mines inevitably closed. The Union Pacific Railroad came through Iron County in the early 1900s, boosting its economy. The railroad also provided early transportation to tourists eager to explore the lands that would soon become National Parks. Iron County is less dependent on agriculture than many rural areas. The largest employer in this county is Southern Utah University and the Iron County School District employs another large segment of the population. There are also several large manufacturing companies, and tourism-related activities cater to more than a million tourists annually. Beaver County was founded in 1856 remaining mostly unsettled until the building of Fort Cameron in 1873 to guard against Native American hostilities. Beaver County's growth was largely attributed to mining activities and the Utah Southern Railroad, which shipped mined products and mercantile to Salt Lake City. Today, Beaver County's economy relies mostly on agriculture, forestry, and fishing.

Livestock Grazing

The history and place of herbivory in the Intermountain West often leads to debate about the appropriateness of domestic livestock grazing on federal lands (Vavra, et al. 1994, Clifford 2002). Young (1994), Young et al. (1976), Vale (1975), and Daubermine (1970) have all indicated our current plant communities are different from those present "pre-European contact." All have listed numerous reasons for this difference including grazing, fire, introduced plants, agriculture, and more recently, climate change. In response to this assumption, historical land management practices (livestock grazing) were developed with an additional assumption that livestock grazing was an unnatural impact on native plant communities. In a somewhat different

slant, Burkhardt (1996) questioned the often-held assumption that Intermountain plant communities evolved without the presence of large herbivores (i.e., bison, elk). A rather large body of research was presented by Burkhardt that indicates plant communities in the Intermountain West did evolve in the presence of grazing by large herbivores, and paleontological/geological records indicate that Pleistocene era plant communities were similar to the present native flora of the Intermountain West.

Livestock grazing was introduced into the intermountain west in the mid to late 1800s. Records indicate livestock grazing was introduced to the southwest desert in the 1850s (Seegmiller 1998). Grazing was unregulated in southwest Utah until the formation of the USFS in 1903 and the formation of the Grazing Service in the 1930s. Historical numbers of livestock in southwest Utah have varied and, like other areas in the west, were affected by weather, markets, and regulations. There has been a great decline in sheep numbers in southwest Utah over the last 100 years while cattle numbers increased into the 1970s and then more or less held steady (Figures 3-5).

Even though the range livestock numbers are declining, grazing still has a significant impact on other sectors of the local economy. Based on declining sage-grouse populations throughout the west, the USFWS has been petitioned to list the species under the provision of the Endangered Species Act. Should the sage-grouse be listed, the livestock industries as well as all natural resource users will fall under intense regulatory scrutiny. Torell et al. (unpublished report) address the economic implications of some grazing management alterations to benefit sage-grouse. Elimination of spring grazing on BLM ranges to enhance sage-grouse nesting habitat would have a significant impact on the viability of many ranches.

Listing sage-grouse under the provisions of ESA could also have a variety of local impacts. Affected activities could include noxious weed control, maintenance of rights-of-way, subdivisions and land development, livestock grazing management, big game wildlife management, and recreational land use.

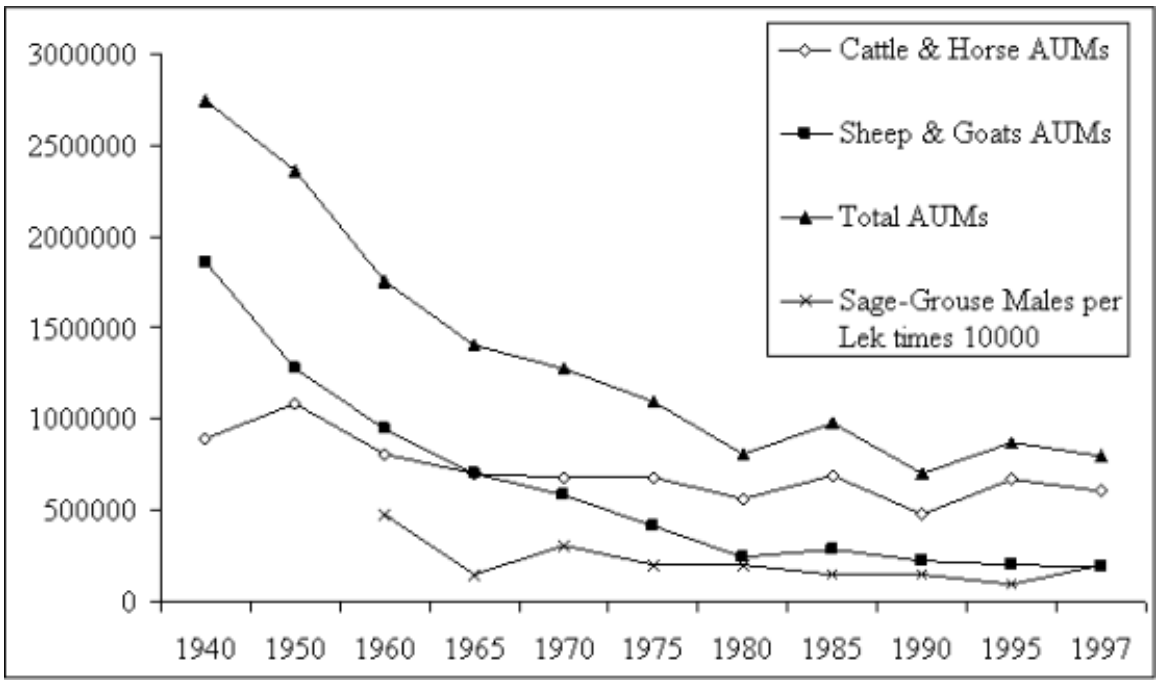

Figure 3. Livestock and sage-grouse numbers on BLM Land in Utah, 1935–1977.

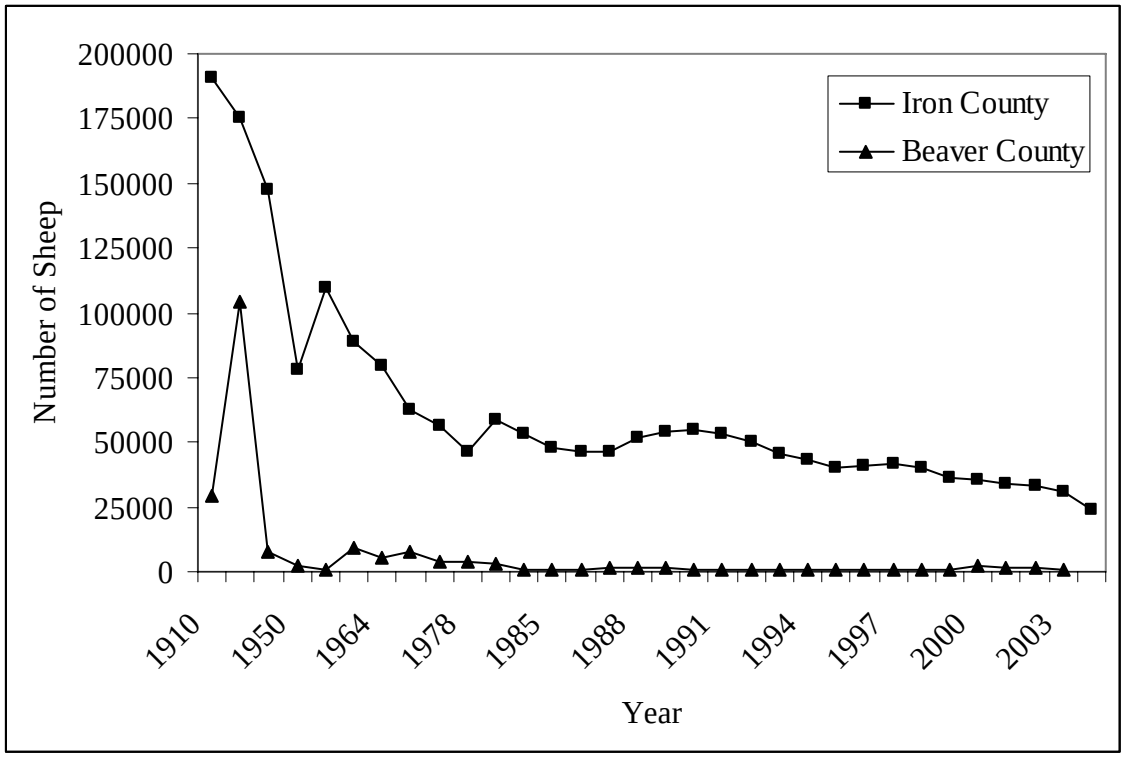

Figure 4. The number of sheep in Iron and Beaver Counties, Utah, 1910–2005.

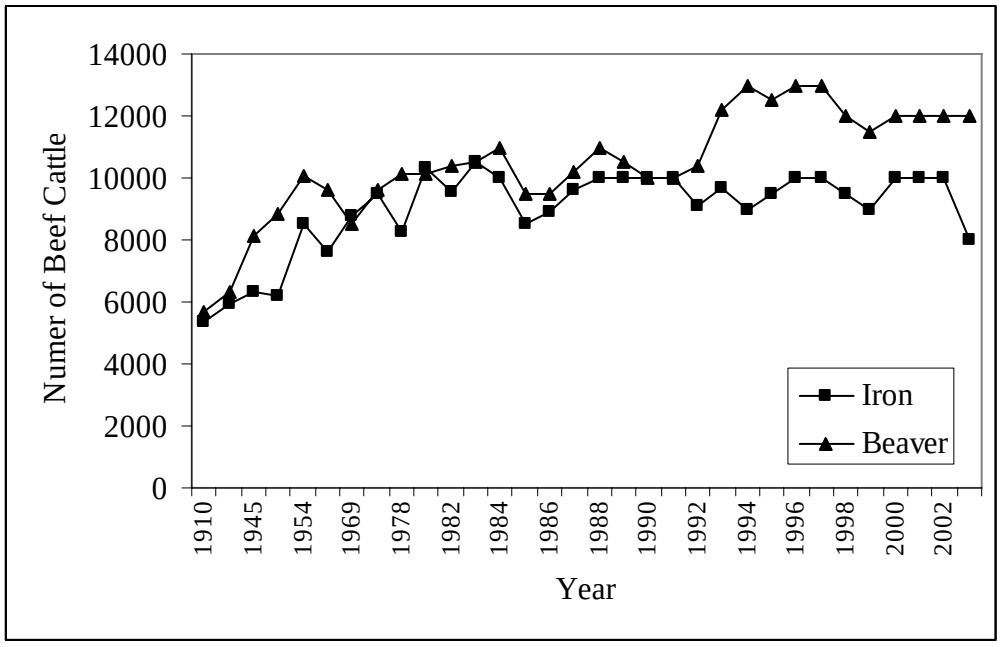

Figure 5. The number of beef cattle in Iron and Beaver Counties, Utah, 1910–2005.

Farming

While range livestock production is still the dominant use of the majority of the landscape, other agriculture operations are important economic enterprises especially in Iron and Beaver Counties. Beaver County leads the state in cash receipts for agriculture operations. It should be mentioned that a large portion of those receipts are generated by a large hog operation cooperative. Iron County ranks first in the state for alfalfa hay production and fourth in sheep and lamb numbers. In fact, from 1992–1997 market value of agriculture products sold increased 67 % in Iron County. (Utah Agricultural Statistics Service, unpublished report).

Population Status and Distribution of Sage-grouse

The UDWR began using lek counts to monitor sage-grouse populations in the Resource Area in 1969 (Figure 6). That year, 100 male sage-grouse were counted on four leks. During early surveys, the locations of only a few leks were known. Thus, most counts of males are accompanied by the number of leks that were counted that year. There was a wide fluctuation in counts of male sage-grouse at leks throughout the data collection period. According to Connelly et al. (2004), a minimum of ten leks must be counted before a reasonably accurate population estimate can be made. It was not until 1998 that ten or more leks were consistently counted each year. By placing a trend line of a five-year moving average over the males per lek counts, it is noticeable that sage-grouse in the Resource Area have been declining since 1993 (Figure 7).

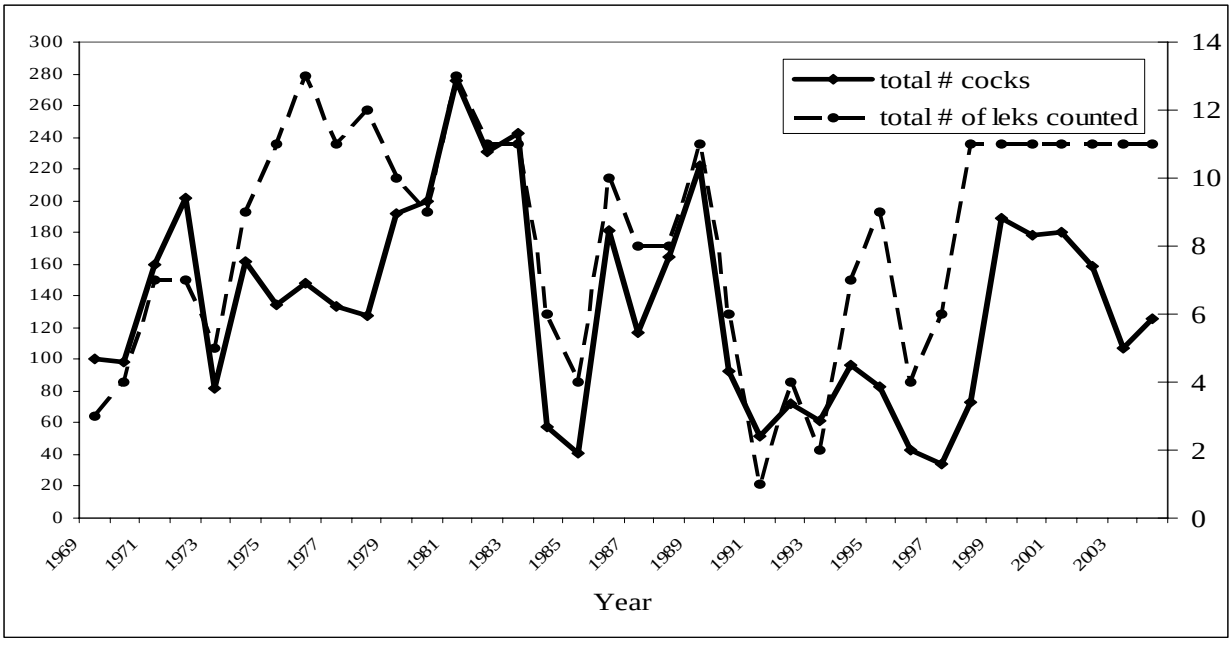

Figure 6. The number of male sage-grouse and sage-grouse leks counted within the SWARM Resource Area, 1969–2005.

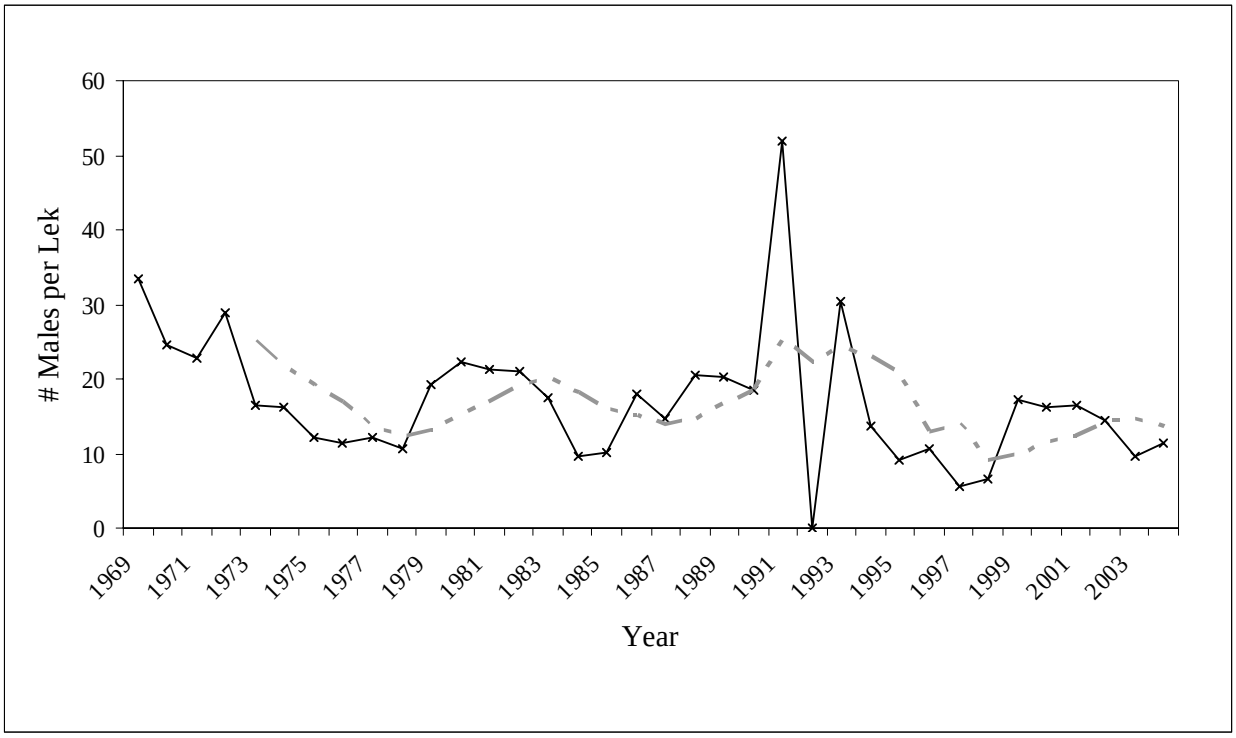

Figure 7. The number of male sage-grouse counted per lek in the SWARM Resource Area 1969–2005, shown with a five-year trend line.

The number of active leks can also be used to index sage-grouse population trends. In recent history, little effort was put forth in the Resource Area to locate new leks or survey activity at historic leks that were no longer being counted. Therefore, in spring 2006, the DWR began searching for undocumented activity. Five new leks were discovered, encouraging the DWR to continue to look for new leks.

Local Ecology and Life History

Little published information is available regarding the ecology and life history of sage-grouse populations in the Resource Area. Although monitoring (lek counts) has been conducted regularly since the late 1960s (Figures 6 and 7), few studies have documented information about aspects of habitat use, survival, sources of mortality, and reproductive success.

Local Habitat

The extent of seasonal habitat types in the Resource Area was mapped by the UDWR in 1999. Figures 8 and 9 illustrate where nesting, brood-rearing, and winter habitats are located in the Resource Area. This depiction is a rough estimate based on historical and present accounts of sage-grouse habitat use, and efforts will be taken to determine actual use in the future

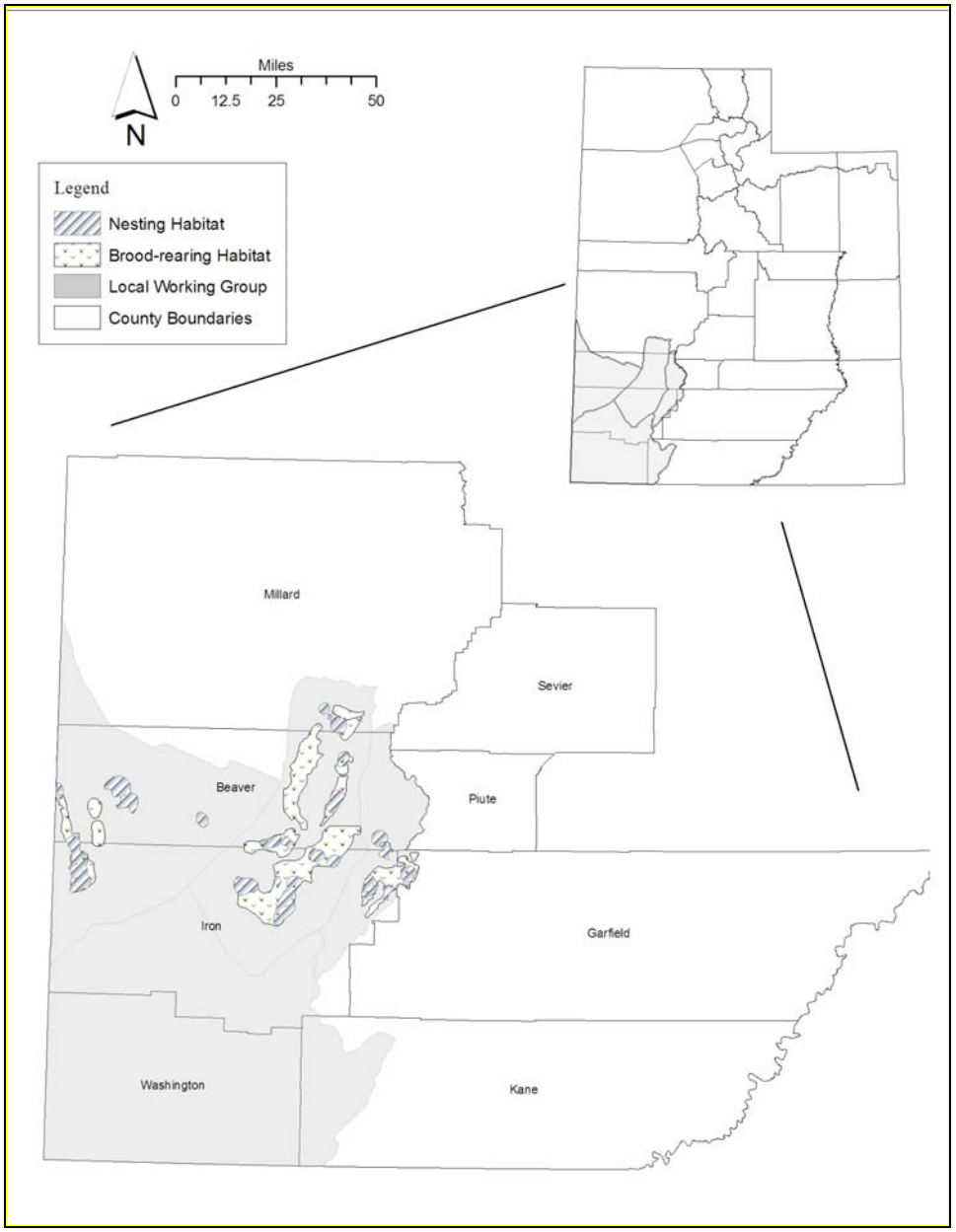

Figure 8. Location of sage-grouse nesting and brood-rearing habitat in the SWARM Resource Area in 1999.

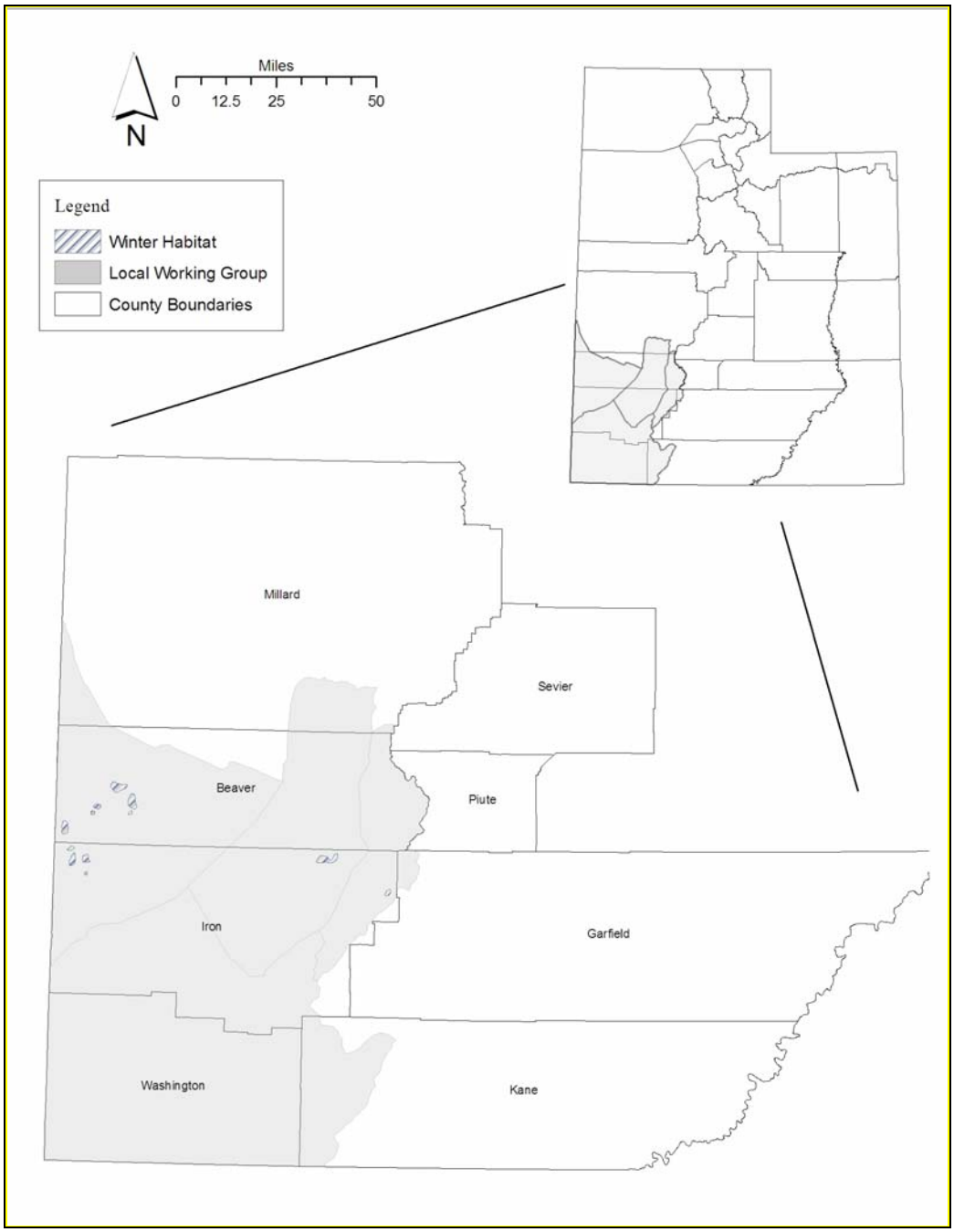

Figure 9. Location of sage-grouse winter habitat in the SWARM Resource Area in 1999.

Habitat Improvements and Completed Conservation Actions

The BLM has participated in several projects to improve areas that were degraded, in an effort to improve sagebrush habitat. For example, in 1999 280-acres and in 2003 370-acres were reseeded to stimulate growth of sagebrush-steppe vegetation. In 2005, the BLM reseeded Lee's Wash after a wildfire to promote the re-growth of this landscape into a healthy sagebrush-steppe ecosystem.

Table 3. Examples of habitat improvement projects implemented in 2005 and proposed for 2006 by land management agencies in the SWARM Resource Area.

Year	Project Name	Acres
2005	Fishlake NF Sagebrush Enhancement	4445
	South Beaver Rehabilitation	2000
2006 (proposed)	Brad Bowler chaining	1000
	North Hills Lop and Scatter	1000
	Blawn Wash Seeding	2700
	Salt Cabin Re-seed	1200
	Pine Valley Guzzler Repair	
	Hamlin Valley Pinyon Juniper Removal	1000
	Hamlin Valley	10
	Mt. Home Post Harrow Cutting	2500
	Parowan Front Dixie Harrow	250

IV. Threat Analysis

In this section, we summarize and describe the potential threats to sage-grouse populations in the Resource Area. Where possible, we describe actual, known impacts to sage-grouse and their habitats, however, due to a lack of empirical information regarding many of the threats described, we are only able to present general information and make educated extrapolations to the local area. Potential threats are listed in alphabetical order below.

A. Development and Human Infrastructure

In this section, we summarize the potential effects of development and human infrastructure including:

1. Homes and cabins
2. Power lines, fences, and other tall structures
3. Renewable and non-renewable energy
4. Roads on sage-grouse populations in the Resource Area

These impacts were considered together because they are associated with similar stresses (loss of habitat quality and quantity, habitat fragmentation, direct disturbance, and increased predator pressure). There is little empirical evidence available regarding the direct or indirect impacts of most of the threats reviewed in this section, especially that specific to the Resource Area.

Home and Cabin Development

Home and cabin development impacts sage-grouse populations through direct loss of habitat, habitat fragmentation, increases in domestic predators (i.e. dogs and cats), and can lead to increases in other threats including power lines, fencing, roads, and incompatible OHV recreation.

Increases in the human population in the Southwest Desert have led to corresponding increases for land being development. In Beaver and Iron counties, the total population in 1950 was 14,498. This population increased to 25,554 by 1990. These counties continued to experience a steady growth in their population through 2004. Beaver County reported over 6,000 residents in 2004 (compared to 5000 in 1990), and Iron County's population had increased to over 36,000. The Cedar City chamber of commerce reported that in January 2005, business permits increased 28% in 18 months. In comparison, Washington County had 9800 people in 1950 and 48,500 people by 1990. The development of housing and industry in Washington County to accommodate these people has been exponential through present day, with no foreseeable reduction of this growth rate in the near future.

Power lines, Fences, and Other Tall Structures

Although this threat is poorly understood, sage-grouse are potentially subject to increased mortality and disturbance resulting from man-made structures including fences, power lines, and other tall structures such as wind turbines and communication towers. Sage-grouse may fly into power lines, fences, and other tall structures, which can result in death or may injure them to the point where they can not effectively avoid predation. Sage-grouse mortalities due to collision

with power lines, fences, and other tall structures has been observed in Colorado, Utah, and other areas (Gunnison Sage-grouse Rangewide Steering Committee 2005). Construction of any structure can result in some habitat loss and fragmentation, which may increase vulnerability to predation.

In areas where farms have been subdivided or developed, fences have increased in number over the years. As rural properties are developed, new county roads are constructed. Power lines have also increased in number and length to meet the needs of the growing urban and suburban populations; transmission and service lines are being constructed to service re-opened mines and transfer electric power out of the area.

Renewable and Non-renewable Energy Development

The Resource Area has several iron and copper mines that are scheduled to be re-opened in the near future. These mines are located 15 miles west of Cedar City. Expansion of the mine activity as well as increased traffic in these areas might have negative impacts on sage-grouse habitat. Currently the Resource Area is not a major contributor of natural gas or wind power. However, with the current economy of coal and oil, the investigation of this area for wind power may be a consideration. Additionally, the BLM has opened several leasing options for mines in the Resource Area. Development of these areas which overlap with sage-grouse habitat, has the potential to be detrimental to sage-grouse.

Roads

Collisions with motor vehicles, while either flying or walking on or across roadways, are also potential causes of direct mortality or severe injury for sage-grouse. Road construction can cause an increase in dust on plants, spread of invasive/alien species, and increased access for predators and incompatible recreation activities (Gunnison Sage-grouse Rangewide Steering Committee 2005). New and expanded highways, roads, and rail sidings have been built to service energy development, ranches, and residential properties throughout the Resource Area. This expansion should increase with the growing population of the Resource Area. While most growth is occurring in areas without sage-grouse, increased activity in previously isolated areas could increase sage-grouse mortality or cause abandonment of lek sites and breeding locations.

B. Drought and Weather

Long periods of below average precipitation, above average summer temperatures, above average snowfall, or below average winter temperatures can have adverse effects on sage-grouse reproductive success and survival. In fact, prolonged drought during the 1930s and in the latter part of the 20th century coincided with declines with sage-grouse populations throughout their range (Patterson 1952, Fischer 1994, Hanf et al. 1994). Extreme climatic conditions have the potential to adversely affect food quality and/or abundance and hiding cover (Hanf et al. 1994, Fischer 1996).

Sage-grouse can be very sensitive to fluctuations in annual moisture (Patterson 1952, Fischer 1994, Hanf et al. 1994). Sage-grouse summer diet, especially for chicks, is heavily dependent on insects and succulent plant growth. Sage-grouse population declines in some areas have been linked to years of low precipitation, most likely due to low nest success and/or poor chick survival (Hanf et al. 1994; Fischer 1996).

The Resource Area experienced drought conditions from 2000–04 and is currently considered to be emerging from drought conditions. Drought can cause sagebrush die-off as well as limit the availability of brood-rearing habitat in intermittently riparian areas. In areas where die-off due to drought has occurred, the Utah Division of Wildlife and cooperating federal agencies are addressing this die-off with their habitat restoration initiative.

Severe winter conditions can be a factor in reducing grouse survival but there is no conclusive evidence to support this claim (Wallestad 1975; Beck 1977; Robertson 1991). Winter snow accumulations force birds to move to areas blown free of snow or areas in which sagebrush extends above the snow (Eng and Schladweiler 1972; Wallestad 1975; Beck 1977; Hupp and Braun 1987; Robertson 1991).

The winter of 1983–84 was particularly severe, bringing extreme cold and heavy snow to Utah (and many parts of the western United States) for an extended period. It is believed that sage-grouse populations declined dramatically during this winter. A less severe, but still harsh, winter occurred in 1992–93. However, the impact of this winter on sage-grouse populations in the Resource Area is not well documented.

Poor weather conditions in the spring are also suspected of influencing sage-grouse production (Connelly et al. 2000). Good winters followed by relatively wet springs can increase production (Wallestad 1975, Autenrieth 1981) by promoting insect and forb production. In contrast, severe spring weather (cold temperature combined with rain and wind) that coincides with hatching can decrease production (Wallestad 1975).

C. Hunting Pressure

Connelly et al. (2000) maintain that most sage-grouse populations can sustain controlled hunting seasons, but caution that sage-grouse have the lowest reproductive potential of the upland game birds, that small populations (< 100 male sage-grouse counted during spring lek counts) are highly vulnerable, and that harvest rates should not exceed 10% of the fall population. Connelly et al. (2003) found that non-hunted populations recovered faster than populations receiving light to moderate hunting pressure. They recommend that sage-grouse hunting seasons be conservative and permits are issued in light of current population trend and habitat quality (Connelly et al. 2003).

Sage-grouse have been hunted legally in Utah since 1951. From 1951–1962, harvest was limited by issuing permits. Statewide harvest peaked in the late 1970s and early 1980s with the highest harvest at 28,280 sage-grouse in 1979 and the lowest harvest (1,303) occurring in 1967. Harvest for 2000 was estimated at 1,498 sage-grouse, reduced 77% from the 1999 estimate. The number of sage-grouse harvested per hunter has shown an overall decrease from 1967–2000 with the lowest rate of 0.31 sage-grouse/hunter attained during the 1997 hunting season. The number of sage-grouse harvested per hunter-day has also shown a decline from 1967–1999 (UDWR 2002).

The UDWR reduced the number of sage-grouse hunting units in 2000 due to declining populations. Currently, there is no legal hunting of sage-grouse in the Resource Area. Illegal harvesting of sage-grouse likely occurs at a low level in the Resource Area, however we have no documentation of this activity. In the future, communication and education regarding the natural history and status of sage-grouse may continue to maintain the relatively low levels of illegal harvesting. Additionally, the Resource Area may be considered for legal harvesting of sage-grouse in the future when populations are large enough to support such activity.

D. Incompatible Fire Management

Across the Intermountain west, fire suppression is believed to have caused sagebrush stands to increase in canopy cover and density with a resulting reduction or loss of herbaceous understory species in many areas. Sagebrush stands have become more even-aged and less productive across large areas of sage-grouse habitat. Fires that do start tend to burn greater acreage and at higher intensity due to the increased amount of fuel available to the fire. BLM fire data shows a rise in fire starts and acreage burned within the last 20 years (LSFO Fire Management Plan 2000).

The effects of any particular fire event depend on several characteristics of the local area including dominate sagebrush species, aridity, soils, topography, and disturbance (Bunting et al. 1987, Miller and Eddleman 2000). In general, sagebrush species are fire adapted and will recolonize an area after a burn. Other threats such as invasive/alien species (e.g. cheatgrass, *Bromus tectorum*), livestock grazing, and agricultural cultivation, are now present in sagebrush biomes and contribute to the frequency, intensity, and duration of fire disturbances.

Fire, in general, is not detrimental to sage-grouse. In fact, sage-grouse have been observed to use burned areas so long as suitable cover and food are present (Slater 2003). However, two altered fire regimes have emerged as being potentially incompatible with habitat management for sage-grouse populations. In the first, invasion of cheatgrass has increased the frequency of fire disturbances, potentially changing sagebrush-steppe plant communities into grasslands (Miller and Eddleman 2000, Connelly et al. 2000). In the second, the occurrence of fire suppression has prevented the regular setback of succession and promoted the advancement of pinyon-juniper stands (Burkhardt and Tisdale 1969, Young and Evans 1981, Miller and Rose 1995, Miller et al. 2000). In these areas, there is the potential for sagebrush seed sources to be lost; reducing the likelihood that sagebrush could become reestablished after an eventual fire disturbance.

In the Resource Area, fire planning and management falls under the purview of land management agencies like the BLM and USFS and local governments. The USFS Dixie National Forest operates according to a Fire Management Plan that is currently under revision. According to the draft 2005 Fire Management Plan (USFS 2005), the USFS fire management goals are to protect human life, both the public and firefighters; protect human communities, their infrastructure, and the natural resources on which they depend; and protect other property and improvements. The plan calls for the use of prescribed fire, wildfires, mechanical fuels reduction, and other available techniques to achieve these goals.

Today, cheatgrass and pinyon-juniper encroachment is not yet widespread within the Resource Area. Fire management by the BLM and the USFS is done in close cooperation with the UDWR who often provides a seed mix for post-burn rehabilitation. Fire planning is done carefully and cautiously in the Resource Area to reduce the threat of encroaching post-burn cheatgrass. Additionally, land management agencies are actively using mechanical techniques to remove juniper and pinyon pines that have invaded sagebrush-steppe communities and altered this ecosystem.

E. Incompatibility of Wildlife and Livestock Grazing

Livestock grazing is an important use of current and potential sage-grouse habitat in the Resource Area and throughout the range of sage-grouse in the West. The impact of concentrated livestock grazing on sage-grouse habitat is not clear, yet the debate is often contentious and controversial, perhaps more so than any other issue. Published literature and opinions run the gamut from completely compensatory or beneficial influence at one extreme, to a totally incompatible, harmful practice that should be eliminated (Connelly et al. 2005). Because of controversy and Rowland's thorough and recently published (2004) review on the subject, we have chosen to follow the lead of the Gunnison Sage-grouse Rangewide Steering Committee (2005) and simply provide several quotes from her Rowland's publication. In addition, the potential impacts of livestock grazing on sage-grouse are covered extensively in Connelly et al. (2005).

Concentrations of wildlife such as elk and wild horses have also been reported to detrimentally affect sage-grouse habitat. To date, there is no research available to determine the effects of this use on sage-grouse behavior. However, similar uses of the landscape by wildlife as those described by grazing livestock would likely have similar effects.

Impacts to Sage-grouse Habitat

Rowland (2004:17-19) noted cases where livestock grazing was reported to have had a positive effect:

> "Some positive effects of livestock grazing were noted. When cattle were introduced into a meadow with residual grass, sage-grouse initially preferred the grazed openings, which had an effective cover height (sensu Robel et al. 1970) of 5 to 15 cm, compared to 30 to 50 cm in the lightly grazed surrounding areas. Grouse avoided dense, ungrazed basin wild rye meadows but were observed in adjacent wild rye that was grazed. One 40-ha meadow that was lightly grazed by cattle (41 yearling heifers, 60 days in June- August) was used throughout the summer by sage-grouse and had more sage-grouse (100) than any other meadow on the refuge. Effective cover height in the meadow did not decrease below 5 cm during the summer."

Rowland (2004:17–19) also summarized studies that suggest livestock grazing has a negative impact on sage-grouse habitat:

> "Beck and Mitchell (2000) summarized potential effects of livestock grazing on sage-grouse habitats, and cited only four references that provide empirical evidence of direct negative effects of livestock grazing on sage-grouse, as follows. Of 161 nests examined in Utah, two were trampled by livestock (one sheep, one cattle) and five were deserted due to disturbance by livestock (Rasmussen and Griner 1938). In Nevada, sage-grouse habitat in wet meadows was degraded through overgrazing by domestic livestock and altered system hydrology (Oakleaf 1971, Klebenow 1985; as reported by Beck and Mitchell 2000). Klebenow (1982) examined sage-grouse habitat use in relation to grazing at the Sheldon NWR in Nevada, where sheep and cattle had grazed for > 130 yr. Dominant sagebrush

> species at the refuge were low sagebrush, mountain big sagebrush, and Wyoming big sagebrush. Grasses included Sandberg and Cusick's bluegrass (*Poa secunda* and *P. cusickii*, respectively) in wet meadows, and Sandberg bluegrass and mat muhly (*Muhlenbergia richardsonis*) in dry meadows. A rest-rotation system was implemented for cattle grazing in 1980 over the majority of the refuge, where season-long grazing had occurred historically; a smaller portion had previously been managed under deferred rotation. Meadows heavily grazed by livestock (e.g., with few forbs and grasses and dense shrubs present) were avoided by sage-grouse, with the exception of use for free water when available (Klebenow 1982). (No explicit definitions were provided for light versus moderate or heavy grazing.)"

Impacts on Sage-grouse Behavior and Demographics

Studies that focused on sage-grouse behavior and demographic parameter response to grazing reported mixed impacts (Rowland 2004:17-19):

> "Danvir (2002) reported two instances of nest abandonment related to livestock grazing in northern Utah during 7 yr of observations; one was caused by cattle, the other by sheep. Sage-grouse behavior on leks did not appear to be altered by the presence of cattle grazing (Danvir 2002). Sheep grazing in Idaho did not appear to disrupt use of leks by sage-grouse (Hulet 1983). Autenrieth (1981), however, cautioned against grazing sheep in sage-grouse winter habitat. He also suggested that livestock use of meadows occupied by sage-grouse, as well as livestock drives in sage-grouse habitat, could be detrimental to sage-grouse. In Wyoming, nesting densities of sage-grouse were considerably lower (10 nests/100 ha) in areas heavily grazed by domestic sheep compared to adjacent sites with moderate grazing (28 nests/100 ha) (Patterson 1952). Nest desertion caused by migrant bands of sheep also was documented (Patterson 1952). Heath et al. (1998) compared sage-grouse nesting and breeding success at three ranches with different grazing operations and levels of predator control in Wyoming. They found that, despite heavier livestock use (removal of >50% of annual herbaceous production, and grazing by both sheep and cattle) and long-term predator control on one ranch, nesting and breeding success of sage-grouse did not differ substantially among the three sites. Chick survival to 21 days was, however, greater on the ranch with lighter grazing, suggesting that predator control did not fully compensate for the greater reductions in herbaceous production (Heath et al. 1998). Further, hens were documented leaving the more heavily grazed ranch to nest elsewhere but returning to that ranch to rear broods (Heath et al. 1998). In a similar study, Holloran (1999) examined sage-grouse habitat use and productivity in relation to grazing management strategies at four ranches in southeastern Wyoming. He found no differences in nest success, brood survival, or numbers of chicks fledged among the ranches. Some differences in habitat use by sage-grouse were found among the ranches; however, these could not be ascribed to differences in grazing pressure, but were ascribed to differences in soil types and precipitation patterns (Holloran 1999). Above-average precipitation during the study, however, may have obscured any potential differences in habitat suitability for sage-grouse among sites. Neither of these studies employed control sites or replication."

Recommendations

In her extensive literature review, Rowland (2004:11) summarized recommendations found in the literature related to timing of grazing and reduction of impact to riparian areas used during brood-rearing. In addition, Rowland (2004: 24) made her own recommendations:

> "Timing of grazing greatly influences the effects of livestock grazing in meadows and riparian areas. These sites are particularly vulnerable in late summer when excessive grazing and browsing may damage riparian shrubs, reduce the yield and availability of succulent herbs (Kovalchik and Elmore 1992), and cause deterioration of riparian function over time (Klebenow 1985). However, moderate utilization by livestock in spring, early summer, or winter is sustainable in non-degraded meadow and riparian areas within sagebrush habitat (Shaw 1992, Clary et al. 1996, Mosley et al. 1997). Moderate use equates to a 10-cm residual stubble height for most grasses and sedges and 5-cm for Kentucky bluegrass (Mosley et al. 1997, Clary and Leininger 2000). Shrub utilization should not exceed 50-60% during the growing season, and at least 50% protective ground cover (i.e., plant basal area + mulch + rocks + gravel) should remain after grazing (Mosley et al. 1997). While hydrophytic shrubs may not directly serve as sage-grouse habitat, they do impact the stability of riparian and meadow habitats important to sage-grouse (Winward 2000). The length of time livestock have access to meadows may be more important than the level of utilization; it has been suggested that livestock access be limited to 3 weeks (Meyers 1989, Mosley et al. 1997). In riparian and meadow habitat degraded by heavy livestock utilization, rest from grazing may be necessary for recovery (Clary and Webster 1989).
>
> Manage livestock grazing through stocking rates and season of use on all seasonal ranges of sage-grouse to avoid habitat degradation (Paige and Ritter 1999, Beck and Mitchell 2000, Wisdom et al. 2000), especially on recently disturbed sites, such as those sprayed or burned (Braun et al. 1977). In nesting and brood-rearing habitats, ensure that grazing does not reduce herbaceous understory cover below levels that serve as a deterrent to potential predators of eggs and chicks (Connelly et al. 2000b, Hockett 2002). Healthy native understories also support insects and forbs that are important in diets of pre-laying hens and chicks (Johnson and Boyce 1990, Barnett and Crawford 1994, Drut et al. 1994b). Riparian areas and wet meadows used for brood rearing are especially sensitive to grazing by livestock; in these habitats, removal of livestock before the nesting season may be prudent (Beck and Mitchell 2000, Hockett 2002)."

Conclusions

Livestock grazing is an important use of sagebrush rangelands in the Resource Area. Although some incompatible grazing likely occurs within the Resource Area, the majority of livestock operations appear to be coexisting with sage-grouse, and sage-grouse populations are stable to increasing. Personal observations have documented the simultaneous use of meadows by cattle and sage-grouse. Additionally, cattle have recently been used to improve habitat conditions for sage-grouse by improving the age-class distribution of the vegetation. However, no studies have been conducted in the Resource Area to measure the positive or negative effects of grazing on

sage-grouse.

Similarly, there have been no studies published that examine the effects of wildlife grazing on sage-grouse habitat or behavior. However, use of habitat by wildlife or wild horses in a similar manner to those described by Rowland would logically have the same effect. Therefore, congregations of elk, pronghorn, deer, and/or feral animals such as wild horses around riparian areas or critical winter habitat should be avoided.

F. Incompatibility of Outdoor Recreation

The effects of off-highway vehicle (OHV) recreation and other forms of recreation (snowmobiles, birdwatching, etc.) on sage-grouse behavior and populations are poorly understood. Impacts of recreational activities are likely to be of two forms: disturbance of individuals and alteration of habitat.

Recreational activities, specifically OHV recreation, likely has the potential to impact individual birds or flocks of birds by flushing them from breeding grounds, nests, roost sites, or foraging areas depending on the season in question. Noise associated with OHV recreation is likely the primary cause of disturbance to individual or flock behavior. Disturbance during nesting season may result in nest abandonment or failure. Disturbance during any time of year may increase the vulnerability of sage-grouse to predators. OHV recreation, and other forms of recreation, may also trample plants, disturb soils, and otherwise alter and degrade habitat. In many instances, specific areas are designated for use of OHVs. When confined to specific use areas, impacts are likely to be reduced.

OHV recreation is relatively common in the Resource Area; however, specific impacts to sage-grouse populations are unknown, but thought to be minimal. Activities such as mountain biking, hiking, and other non-motorized sports are thought to have minimal or no negative effects on sage-grouse and their habitats. However, these activities are increasing in the Resource Area as the urban and suburban population increases. This increase in general human activity could potentially affect sage-grouse use of an area and thus should be monitored.

G. Cheatgrass and Invasive/Noxious Weeds

The Utah Department of Agriculture (Section 4-17-2) defines noxious weeds as "...any plant the commissioner determines to be especially injurious to public health, crops, livestock, land, or other property." At the federal level, an invasive species is defined as one which is not native to the ecosystem in question and whose introduction causes or is likely to cause economic or environmental harm, or harm to human health (Executive Order 13112, signed by President Clinton, 1999). Under the Utah Noxious Weed Act (4-17-10) county weed departments are charged to "...develop, implement, and pursue an effective program for the control and containment of noxious weeds on all lands under their control or jurisdiction, including highways, roadways, rights-of-way, easements, game management areas, and state parks and recreation areas."

Russian knapweed (*Centaurea repens*), dyers woad (*isatis tinctoria* L), and several other species of thistle, grasses, and knapweed are listed on the Utah Noxious Weed List (Section 4-17-3, Utah Noxious Weed Act). Cheatgrass, however, is not listed, nor is it included in individual county lists for Southwest Desert Resource Area. Cheatgrass is an annual grass native to Russia and parts of northern Europe. When it invades sagebrush communities, cheatgrass increases fire frequency and has the potential to convert sagebrush communities to grasslands or annual grass rangelands. This increase in fire events leads to devastation of the native forb sandbank after which there are limited options for restoring the area to its native condition. Cheatgrass has also been reported to encourage establishment of other invasive species (Grahame and Sisk 2002). Thus, efforts at combating cheatgrass invasions are critical to maintaining sage-grouse habitat.

Invasive species affect the species composition, nutrient cycling, and physical structure of sagebrush systems. Invasive species also have impacts on the function of sagebrush systems, especially their ability to recover from fire. These impacts often culminate in an alteration of wildlife species diversity and abundance in these systems.

Noxious weeds are recognized within the Resource Area as a serious problem by County Weed Control departments, BLM, and USFS. County weed control departments maintain records of the location, extent, and severity of weed establishment, and actively work to control the spread and establishment of weeds in their respective counties. In January 1996, the BLM published Partners Against Weeds (PAW), an action plan for the Weed Management program in the Bureau. The PAW plan lists seven goals, the first being to develop a prevention and early detection program. The PAW recommends developing and enforcing a policy to "ensure seeds, seed mixtures, hays, grains and straws are free of weed seed" as a prevention and detection strategy. Utah's BLM Resource Advisory Council developed a guideline requiring certified weed free forage to be used on BLM lands by anyone having the need to take forage with them when using BLM public lands. Both the Utah State Director and the Secretary of the Interior approved the guidelines in 1997. Since 2002, users of all federal lands and trust lands in Utah are required to use only certified noxious weed -free (cheatgrass is not considered a noxious weed) hay, straw, or mulch. The USFS is also committed to a campaign against the spread of invasive species. Working with agency and local government partners the USFS aims to create Cooperative Weed Management Area (CWMA) Participative Agreements for all USFS lands.

H. Lack of Communication Among Responsible Parties

The impact of a lack of communication among management agencies such as the BLM, USFS, UDWR, and other responsible parties such as county and city planning commissions is intangible. Additionally, lack of communication to the interested public is a lost opportunity for the understanding and partnerships needed to properly manage all the issues that arise with developing a sage-grouse management strategy. Without proper communication, each management agency maintains a separate database concerning vegetation treatments, sage-grouse population counts, and critical habitat locations. Thus, implementation of strategies would possibly be repetitive and an inefficient use of available funds. Much damage due to the threats discussed in this analysis (i.e., development, recreational uses, and vegetation treatments) may be avoided or diminished with the guidance of a working group involving representatives from the entire community.

I. Parasitism and Disease

Several bacterial and parasitic diseases may affect sage-grouse to varying degrees. Sage-grouse have long co-existed with a range of pathogens and many produce no or few ill effects in individuals and populations. Large-scale (i.e. rangewide or statewide) impacts to sage-grouse have not been reported. Below, we discuss a few of the pathogens that appear most likely to impact sage-grouse populations (Connelly et al. 2005).

West Nile Virus

West Nile virus (WNV) is an arbovirus, or arthropod-borne virus, of the flavivirus family, which also includes Dengue and Yellow Fever. WNV is one of many mosquito-borne viral infections. Mosquitoes of the Culex family primarily transmit West Nile Virus during normal blood feeding. Some species in this family feed primarily on birds, which act as reservoirs or amplifying hosts of the virus. Although many species of birds are known to contract WNV, species in the Corvid family (crows, ravens, and jays) are more susceptible to the disease and are therefore useful geographic detectors of WNV. Mammals, including humans and horses, are considered incidental hosts and are therefore viral "dead ends." Humans are most likely to acquire WNV from an infected mosquito. Other mammals, such as horses, do not maintain a high enough level of the virus in the blood stream to transmit the virus to humans.

WNV was first detected in the Western Hemisphere in 1999 and has since rapidly spread across the North American continent into all 48 continental states, seven Canadian provinces, and throughout Mexico. In addition, WNV activity has been detected in Puerto Rico, the Dominican Republic, Jamaica, Guadeloupe, and El Salvador.

In 2003, several cases of WNV were confirmed in sage-grouse in Wyoming (19 birds), Montana (3 birds), and Alberta, Canada (5 birds). In that same year, WNV was detected in chickens in Price, Utah and in mosquito pools in the Uintah Basin. In 2004, sage-grouse in Wyoming, Montana, Colorado, and California tested positive for the virus. In 2005, the virus was confirmed in a dead sage-grouse in the Uintah Basin and also in a prairie falcon in Carbon County. A limited percentage of sage-grouse appear to be capable of developing immunity to the virus (Cornish, unpublished data) and infection appears to be almost always fatal within 24-48 hours.

Macro-parasites

Coccidiosis—Coccidiosis is an intestinal disease caused by one or more species of the protozoan genus Emieria (Jolly 1982): *E. angusta, E. centrocerci, and E. pattersoni*. Infection results in diarrhea caused by damage to the mucosal lining of the digestive tract. The disease is transmitted through consumption of contaminated feces. Coccidiosis is the most well known of all diseases infecting sage-grouse (Connelly et al. 2005). In Wyoming, Colorado, and Idaho from 1932–1953 this disease resulted in significant losses of young sage-grouse (Honess and Post 1968). No cases, however, have been documented since the 1960s (Connelly et al. 2005). Cases were typically reported in areas where large numbers of birds are concentrated. The concentration led to contamination and spread via water and food sources. Connelly et al. (2005) speculated that this disease lacks prevalence in recent years because sage-grouse density has decreased. No cases of Coccidiosis are known from the Resource Area; however this does not

imply that the condition does not exist or have the potential to exist. Specifically, drought conditions that result in a decrease in water sources may potentially increase sage-grouse concentrations in localized areas, thereby increasing the potential for impacts from this infection.

Tapeworms—Sage-grouse are the only known host of the cestode tapeworm *Raillietina centrocerci* (Honess 1982). There is little consensus on the impact *R. centrocerci* have on sage-grouse populations. The Canadian Sage Grouse Recovery Strategy indicates that this infection may be a largely overlooked cause of mortality. Still, Honess (1982) suggested that there was a synergy between host and parasite with little negative impacts to sage-grouse. The parasite does not affect the quality of sage-grouse meat. There are no documented cases of *R. centrocerci* in the Resource Area however; this does not imply that this infection does not affect sage-grouse therein.

Filarid Worms—A filarial nematode, *Ornithofilaria tuvensis*, which utilizes the connective tissue between skin and breast muscle in sage-grouse, appears to prevent flight in infected birds (Hepworth 1962). This infection is rare but appears to have significant impacts. This infection is not known to occur in the Resource Area; however, it may yet exist, undetected.

Avian Malaria—Avian malaria, caused by the protozoan *Plasmodium pediocetti*, is known to infect wild sage-grouse but is considered rare. Although this infection does not have a profound impact on sage-grouse populations, it does cause birds to reduce activity during morning hours and may influence courtship and breeding of strutting males (Boyce 1990, Johnson and Boyce 1991). Biting flies (Friend and Franson 1999) transmit this disease.

Conclusions

We currently consider WNV to be the disease/parasite with greatest potential to affect sage-grouse populations in the Resource Area. As previously mentioned, in 2005 a dead sage-grouse infected with WNV was found in eastern Utah. Additionally, parts of Colorado and Wyoming have also detected infected birds. Thus, there is potential for the disease to spread into the Resource Area.

As previously mentioned, other diseases discussed in this section may have an effect on sage-grouse but have not been documented in the Resource Area and, therefore, do not pose as great a potential threat.

J. Predation

Sage-grouse occupy an important place in the food web in sagebrush environments and are preyed upon by a wide variety of terrestrial and avian predators. Numerous predators have been documented preying upon differing ages of sage grouse and/or their nests. Documented nest predators include weasel, badger, elk, coyote, common raven, American crow, red fox, striped skunk, black-billed magpie, and various species of snakes (Batterson and Morse 1948, Patterson 1952, Nelson 1955, Autenrieth 1981, Hanf et al. 1994, Young 1994, DeLong et al. 1995, Sveum 1995). Numerous species have also been documented killing and/or consuming adult sage-grouse and include Cooper's, ferruginous, red-tailed, and Swainson's hawks; Northern goshawks, coyote, red fox, and bobcat (Girard 1937, Rasmussen and Griner 1938, Batterson and Morse 1948, Nelson 1955, Rogers 1964, Beck 1977, Dunkle 1977, Autenrieth 1981). Numerous predator species, many of which are listed above, have been documented to kill juvenile sage-grouse. Because of the small size of young sage-grouse, additional predators have been documented and include American kestrels, merlin, Northern harrier, common raven, and weasel (Girard 1937, Patterson 1952, Nelson 1955, Rogers 1964, Autenrieth 1981).

Predation is the end result for the vast majority of sage-grouse throughout their range, both historically and presently (Bergerud 1988). Schroeder and Baydack (2001:26) suggest that predation has the potential to affect the annual life cycle of sage-grouse in 3 primary ways: 1) success of nests; 2) survival of juveniles during the first few weeks after hatch; and 3) annual survival of breeding-age birds." Peterson and Silvy (1996) conclude that the relative importance of predation on the viability of sage-grouse populations is relatively unknown and needs further study.

Nest success varies by year, area, population density, and/or management strategy (Connelly et al. 1998, Schroeder et al. 1999). Connelly et al. (2000) suggested that several studies on nest success have illustrated success > 40 % and that nest predation does not appear to be a problem across the range of the sage-grouse. In contrast, Gregg (1991) and Gregg et al. (1994) suggested that nest predation might be limiting grouse numbers in Oregon. Red foxes and common ravens have been implicated in affecting nest success and the annual survival of breeding age birds in the Strawberry valley area of Utah (Bunnell 2000). Researchers suggest that the advancing population of a nonnative predator, red fox, is responsible for preying upon a large portion of the population in that area (Flinders 1999). In artificial nest studies conducted in Strawberry Valley, ravens depredated 98% of artificial nests within 48 hours of their placement. Remote cameras were used to verify the identity of artificial nest predators (Baxter and Flinders, unpublished).

History of Predator Management in Utah

The following sections on the history of predator management and effects of predator management on sage-grouse populations were written, in conjunction with CoCARM, for the Plan by representatives from USDA-WS. Wildlife Services has been managing predator populations and collecting data on predator population trends in the state for several decades. They also have an extensive body of personal knowledge about predator population management and the impacts of various management practices.

Understanding the impact of predation on sage-grouse is difficult, as the primary effects (the

number of sage-grouse killed by predators) is affected by habitat variables, variables associated with the predator population, and variables within the sage-grouse population itself. Secondary effects of predation exist and are indicated when habitat choices are dictated by the risk of predation. What we currently know about habitat needs of sage-grouse is developed from studies of core sage grouse range. However, if predation or the risk of predation is effecting habitat selection, then otherwise good habitat is made unavailable to sage-grouse. To more completely understand the role predation management may have played historically, it is important to examine records of the past.

Predator management in Utah began in the late 1800s with territorial bounties followed by a federal appropriation in 1917. The original purpose for the federal program was the suppression of rabies. The program has gone through several changes with both State and Federal agencies involved. The US Biological Survey managed predator control in early years and developed the structure that was later used by the USFWS, which is to have supervised men in designated Wildlife Services districts (districts). From 1936 to 1986, the USFWS managed the program as Animal Damage Control. In 1986, it was moved to the United States Department of Agriculture under the Animal and Plant Health Inspection Service and in 1996 was renamed as Wildlife Services (again; USDA-WS).

Correlations exist between livestock inventories and the intensity of predator management efforts. Domestic sheep numbers are recorded (Utah Agricultural Statistics) at a high of 2.7 million in 1931. Breeding sheep inventories as of January 1, 2003 were reported at 290,000 head, or 10.7% of the maximum number. Sheep numbers varied from year to year in some cases, and from decade to decade since the early 1900s. Toxicants were used extensively in the early years when sheep numbers were high. Additionally, predator management in the early years involved many trappers setting and tending steel traps statewide. As many as 132 men were hired (1936) to set and bait traps. Figure 10 shows the recorded take of coyotes from the predator control program between 1917 and 2004. These data do not include poisoned coyotes, which were not found but estimated as 7-10 coyotes for each one found.

Strychnine and thallium treated single lethal dose (SLD) baits were the main toxicants used between 1920 and 1950. Compound 1080 was developed around 1945, first as a rodenticide and later as a predicide in large bait stations. USDA-WS records indicate that 1443 bait stations were applied in 1969, covering 54% of the townships in the state. Bait placement from 1950 to 1972 were large bait stations while SLD baits were used prior to that. From about 1950 to 1972, Compound 1080 became the main force in controlling coyotes in all districts of Utah by the government and by private individuals. The low government take of coyotes during this period indicates that coyote populations were suppressed by bait station use. Toxicants were banned in federal programs in 1972 and current policies allow only two very selective toxicants and then only for limited use.

Early predation control also extended to ravens, crows, eagles, and magpies. Records indicate that single baits were applied around “draw stations” to target birds. Records also note that UDWR personnel targeted areas for bird suppression that were not treated by the federal program.

It is difficult to assess the poison years in terms of suppressing populations of species such as ravens, coyotes, and even red foxes. Individual species records are presented below:

Red Fox—While some early records of red foxes exist, red foxes are believed to have been virtually absent on the landscape before the 1970s. Red fox do not exist in government records before 1972, and have increased since then. Red foxes may have been successfully suppressed by rabies or by bait station use, or possibly both. Figure 10 shows coyote take from 1917–2004 and Figure 11 shows red fox take from 1972–2004.

It is interesting to observe that the statewide increase in red fox abundance has occurred during the lowest period of coyote control. Sargeant (1984, 1987) theorizes that protection for coyotes would allow coyote populations to increase, thus suppressing red fox populations. This has not happened on a landscape basis in Utah.

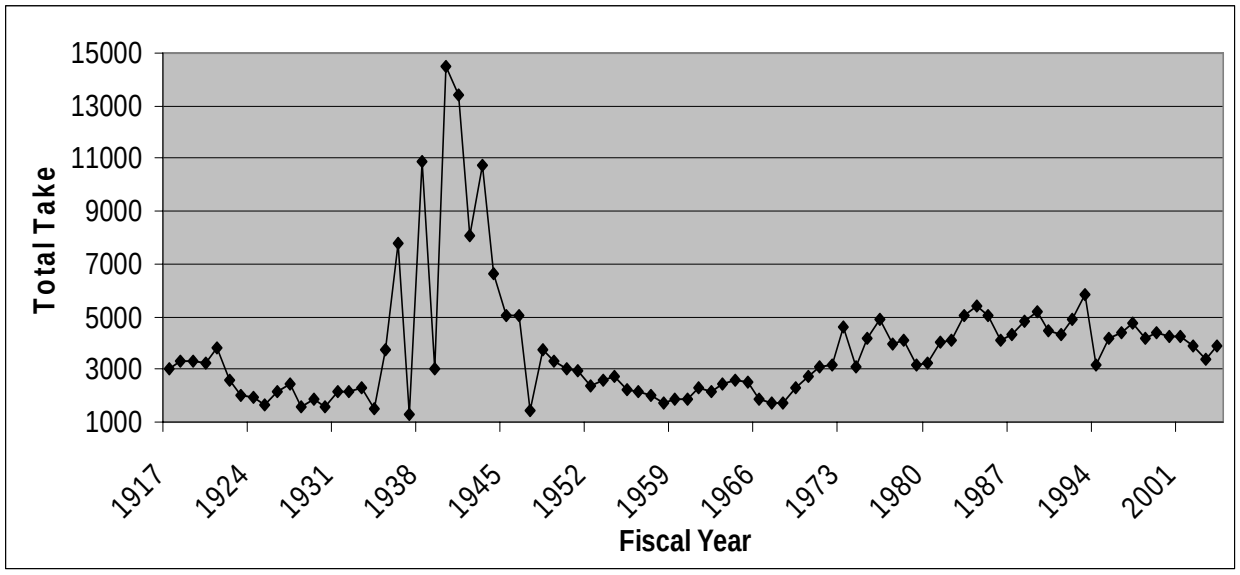

Figure 10. USDA-WS reported coyote take in Utah 1917–2004.

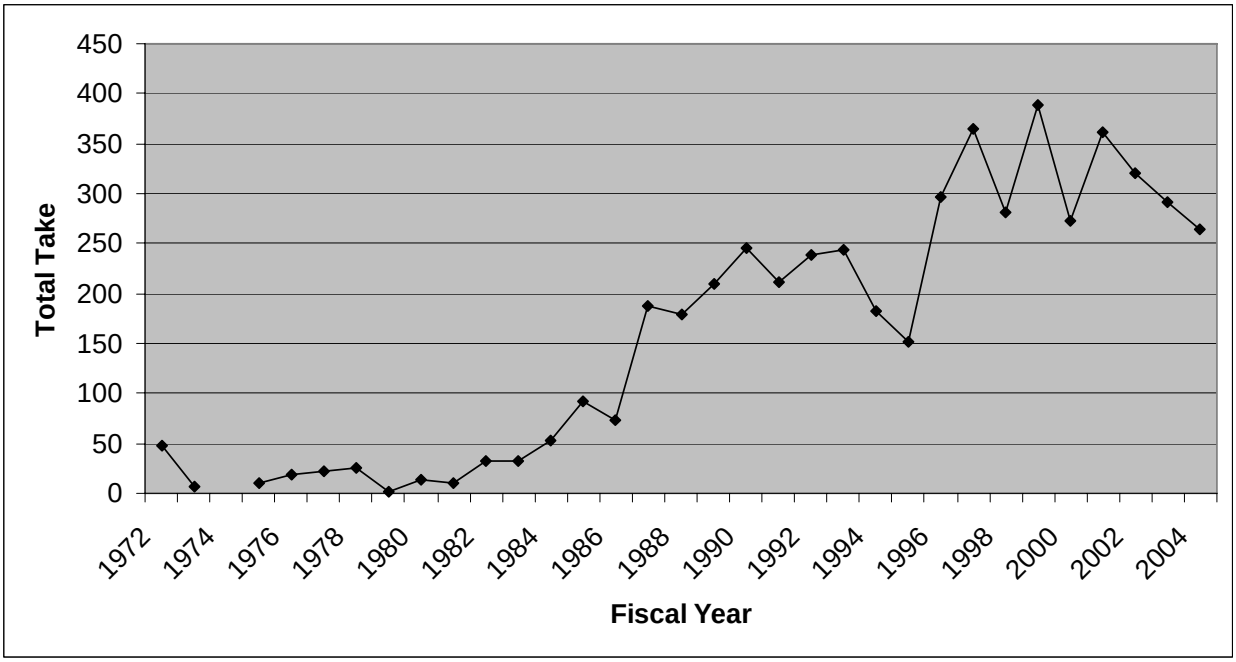

Figure 11. USDA-WS reported fox take in Utah 1972– 2004.

An argument may be made that red fox in Utah are an invasive species based on historical data. Red foxes were historically divided into two species, *Vulpes vulpes* in the Old World and *V. fulva* in the New World, but today they are considered to be one species in the U.S. (*V. vulpes*). Churcher (1959) reviewed twelve subspecies of red foxes in North America with nine subspecies currently recognized in Canada. Churcher (1959) suggested that the red fox was introduced from Europe to the southern colonies around 1790.

Following the introductions there was confusion as to which populations were expanding. Audubon and Bachman (cited in Churcher 1959) believed that Pennsylvania was the southern limit of the red fox's range in 1750 and documented a range extension southwards to Georgia by 1850. Leopold (1935) reported the expansion of red fox in Wisconsin which was displacing the grey fox, and Godin (1977) reported *V. fulva* had established itself by 1850 and was displacing the gray fox to some degree along the southeastern seaboard. Godin also speculated that the introduced foxes might have interbred with a scarce population of indigenous red foxes, but historical accounts do not support this. Churcher (1959) concluded from the available evidence that the red fox was native to North America north of 40-45 degree N but was scarce or absent in the hardwood forests where gray foxes were common. Churcher (1973) suggested that the "original" habitat was the northern mixed hardwood and softwood forest zones; he also observed that the red fox might have been found in the hardwoods to the south and the tundra to the north. Gilmore (1946) believed that red foxes were absent from Pennsylvania during aboriginal times and concluded that they did not range into the mideastern United States. Rhoads (1903 cited in Churcher 1959) stated, "In earlier colonial times the red fox was unknown in the austral zone (southern states).

Archaeological evidence from Ontario, Canada (Peterson et al. 1953) has shown that the red fox was present in the Midland area prior to introductions during the decade 1639–49 and that it was present earlier in the Oxford and Middlesex counties of southern Ontario, Canada. Sites farther

south did not have red foxes (Gilmore 1946).

Once the red fox began to spread south and west from northeastern U.S. after its introduction from Europe, it expanded its range to include the prairies of the Midwest and continued to expand west to Colorado and Utah. It has reached the Utah-Nevada line and seems likely to invade Nevada as well.

Striped Skunk—Historically, what may be significant is the relatively few skunks found in Utah. Figure 12 shows skunk take by USDA-WS in Utah from 1917–2004. Periodic rabies eruptions suppressed skunk populations in the early years of the century. As an example, in 1918 with 51 full time personnel setting traps, only 10 skunks were removed statewide. In the 1920s, following years of SLD bait placements, skunk take in the program increased to above 100 annually, but then declined to none in 1933, 12 in 1934, 35 in 1935, and up to 98 in 1936. The cycle of skunk removal probably reflects the population level effect of rabies in skunks. The last skunk rabies incident in USDA-WS records occurred in 1972 in Davis County, with a countywide control program initiated as a result.

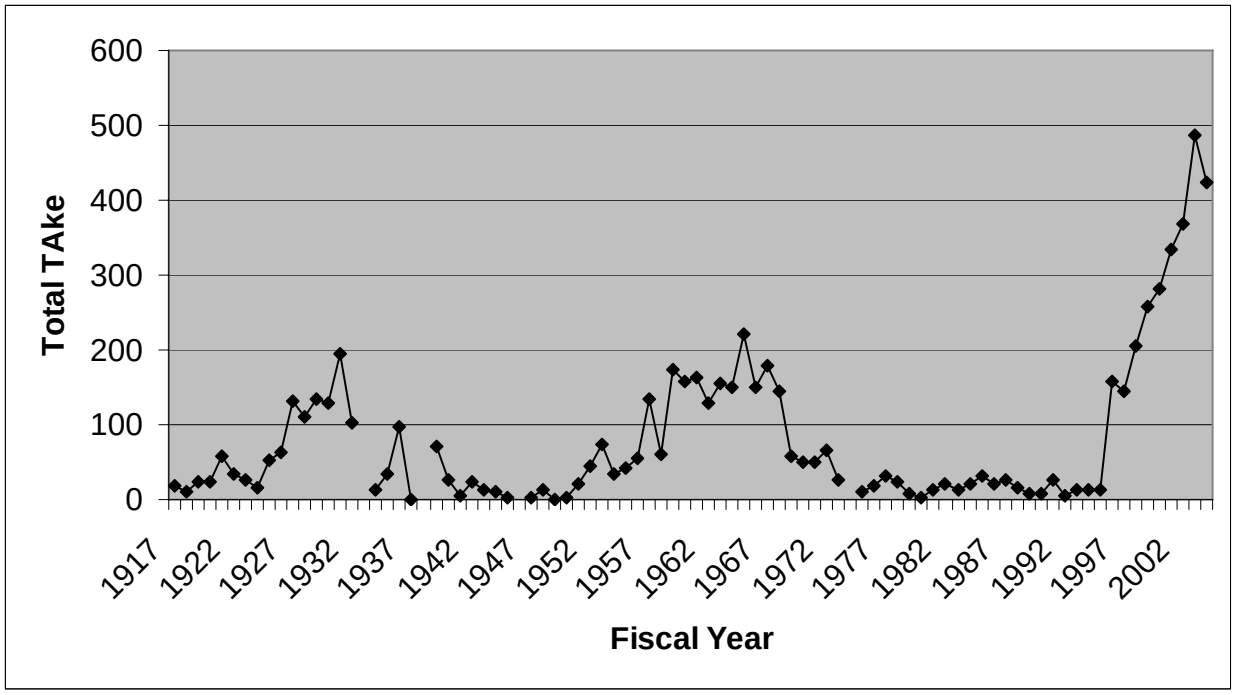

Figure 12. USDA-WS reported striped skunk take in Utah 1972–2004.

Raven and Magpie—Breeding bird survey results indicate a 300% increase in raven numbers from 1968 to the present. While most biologists believe the increase is due to more favorable conditions and anthropogenic food sources, the increase in populations also follows the reduction in use of poisons, which likely kept their numbers low.

Magpies were targeted along with ravens at draw stations with smaller baits placed especially for birds. USDA-WS records show that UDWR personnel placed baits to target birds in areas where federal poison programs were not active.

Coyote—Intensive coyote control prior to 1972 suppressed coyote populations. Since that time, the design of the predation management program has been to reduce coyote damage while not impacting populations. Analyses by Connolly and Longhurst (1975) and Pitt et al. (2002) indicate that the current level of exploitation does not affect coyote populations. It seems likely that coyote populations have never been higher than in modern times.

Impacts of Predation on Sage-grouse

Given that predators and nest predators are abundant and many are present in all time high numbers, impacts to sage-grouse may take one of two forms. Sage-grouse may be killed directly by predators (primary effects), and most mortality of sage-grouse is predation. Direct predation has negative population effects when it exceeds recruitment.

Secondary effects of predation include biological effects, which are the result of behavioral changes in sage-grouse. These behavioral changes result from the risk of predation and may take the form of lower fecundity, longer dispersals, use of suboptimal habitat, nest abandonment, and a number of other behaviors that may affect populations.

Autenrieth (1981) suggested that nest predation was likely the most important population constraint on sage-grouse though predation on adult birds does occur and may be significant in some cases. Presnall and Wood (1953) reported tracking a coyote approximately five miles to its den in northern Colorado, and finding evidence along the way that the coyote had killed three adult sage-grouse and destroyed a sage-grouse nest. Examination of the stomach contents from an adult female coyote removed the next day showed parts of an adult sage-grouse plus six newly hatched sage-grouse chicks. The area around the den site was littered with sage-grouse bones and feathers. No other prey animal remains were found around the den, and it appeared that the pups had been raised largely upon sage-grouse. Till (1982) documented sage-grouse remains at four of the thirty coyote den sites examined during his study in south central Wyoming, but provided no indication of the relative abundance or distribution of sage-grouse in his study area. In northern Utah, researchers from Brigham Young University (BYU) confirmed predation, primarily by red fox and coyote, as the cause of death for 13 of 21 radio-instrumented sage-grouse in the first year in their study area (Bunnell and Flinders 1999). Two additional instrumented birds could not be found but were suspected to have been killed by predators, suggesting a 71% predation loss of instrumented birds. Additionally, eleven other sage-grouse were found dead in their study area, and all but one of these birds were killed by mammalian predators. USDA-WS is not aware of controlled studies conducted to determine if coyote and red fox control would actually result in significant benefits to sage-grouse populations. However, the above studies indicate there may be some benefit to the removal of these predators in some situations

In addition to primary predation affects, secondary predation impacts likely exist in a number of populations. The risk of coyote predation may cause habitat abandonment or, through habitat choices, reduce fitness and make grouse more susceptible to other mortality. Coyote damage management may be indicated for populations not performing to habitat potential.

Meso-predator Release—As red fox have been implicated as primary predators of sage-grouse in many areas, the notion of some natural control of red fox by coyotes has been suggested. The idea that coyote removal may benefit red fox, and thus be a detriment to sage-grouse, has been

offered by some as a need to limit coyote removal. The potential for an indirect affect on sage-grouse by coyote removal would take the form of a "meso-predator release" which is the increase in smaller mammalian carnivore species after larger carnivores have been reduced or eliminated. The meso-predator release theory allows that smaller predators are allowed to increase due to either a lack of predation or release from competition or both. Gehrt and Clark (2003) present an opposing view of meso-predator release and point out several weaknesses in the circumstantial evidence that has been used to suggest that meso-predator release occurs.

Sargeant, et al. (1984) reported on the effects of red fox predation on breeding ducks. Their data were collected when coyote populations were presumably suppressed by widespread use of predicide, and he notes that at the time (1968-73), "[c]oyote populations in most of the mid-continent area appear to be suppressed by man." The authors noted an inverse relationship between red fox and coyote populations and speculated, "...protection of coyotes will result in expansion of local or regional populations that in turn will cause reductions in fox populations." They inferred that this would reduce predation on upland nesting ducks. Sargeant et al. (1987) reported on spatial relationships between coyotes and red foxes and showed that home ranges of fox families did not overlap the core centers of coyote home ranges on a North Dakota study site. Although none of their radio-collared foxes were killed by coyotes in their study, they hypothesized that red foxes tended to avoid coyote territories, presumably to avoid being killed by coyotes. Thus, they inferred that a red fox population would increase if the coyote population were reduced because the removal of territorial coyotes would create vacant coyote territories that could then become occupied by red foxes.

The presence of coyotes does not completely displace red foxes, however. Voigt and Earle (1983) verified that red fox travel through coyote areas during dispersal but did not establish there. They also reported that, "...individual foxes and coyotes can occur in close proximity to each other along territory borders and when coyotes travel into fox areas." They also noted that "fox-coyote range overlap near borders was similar to fox-fox range overlap near borders," and that coyotes do not "completely displace foxes over areas." Gese et al. (1996) reported that coyotes tolerated red foxes when encountered about half of the time in Yellowstone National Park although at times they were aggressive toward, and would sometimes kill, foxes.

Other studies suggest that coyote territories would not remain vacant for long after coyotes are removed. Gese (1998) noted that adjacent coyote packs adjusted territorial boundaries following social disruption in a neighboring pack, thus allowing for complete occupancy of the area despite removal of breeding coyotes. Blejwas et al. (2002) noted that a replacement pair of coyotes occupied a territory in approximately 43 days following the removal of the territorial pair. Williams et al. (2003) noted that temporal genetic variation in coyote populations experiencing high turnover (due to control) indicated, "...localized removal did not negatively impact population size..." When we consider the level of coyote removals of USDA-WS coyote damage management activities (2-4% of the estimated population) it is likely that coyote populations are probably not affected enough, even at the individual territorial level, to create the vacant territories that would theoretically allow red fox populations to increase substantially at the local level based on the North Dakota studies discussed above. Therefore, we believe it would be unlikely for USDA-WS coyote removal actions to lead to indirect increases in predation effects on grouse populations. To the contrary, where populations are not performing to the full potential of the habitat, predation management may be necessary as part of applied management for sage-grouse.

Predation Defense Mechanisms—Sage-grouse have adapted to live, and have evolved with, many of these predators. Sage-grouse and other ground nesting birds have developed effective strategies for hiding from predators when they occupy habitat of sufficient quality. Schroeder et al. (1999) briefly describe some of those adaptations. The actual timing of the strutting display and/or the formation of leks may have evolved due to predation selective pressures (Patterson 1952, Hartzler 1972, Bergerud 1988a, Phillips 1990). Sage-grouse also avoid predation by either crouching in dense vegetation or flying away from an attacking predator (Hartzler 1972, Ellis 1984). Female Greater Sage-grouse have also been documented defending their nests from ground squirrels (Schroeder 1997). Girard (1937) observed females attacking predators in the defense of their brood. In an attempt to lead potential predators away from nests and young chicks, females have been documented performing distraction displays. The distraction display includes dragging wings on the ground while moving erratically (Peterson 1980). In addition, a female will occasionally re-nest if predators destroy her first nest early in the incubation period (Patterson 1952, Eng 1963, Connelly et al. 1993, Schroeder 1997). Still, re-nesting rates for sage-grouse are relatively low (Connelly et al. 1993).

Predator Control and Livestock Populations

Predator control activities began in Utah in 1888 with Territorial Bounty laws, which continued into Statehood and through the early 1900s. The inauguration of the government sponsored predator control program began in 1915 with small appropriations of funds used to hire a supervisor and eight men in designated areas where control was needed to protect livestock. Today the program is managed by USDA-WS.

Utah sheep numbers were at a record high of 2.7 million in 1931. Numbers varied annually in some cases and from decade to decade since the early 1900s. Today, approximately 265,000 sheep graze in Utah. Although sheep numbers are down, today more cattle ranching operations exist in the state compared to 1931.

With the arrival of more cattle, predator control was reinvigorated after having been relaxed due to reduced sheep numbers. Improved methods of hunting with aircraft increased efficiency and effectiveness since the early 1970s, but poisons were used extensively in the early years when sheep numbers were high. Congress passed the Animal Damage Control Act of March 2, 1931. Records show that in 1936 up to 132 men were hired for predator control. Poison baits placed by men in the various field districts were more effective at controlling predator populations over a larger area than are currently worked today. Government trappers took a documented figure of 16,719 predators in 1939 and that figure does not reflect all of those poisoned. This amount was a record catch for any one fiscal year and shows more predators were taken in early years than records of today. The number of predators taken during this era not only exceeds the modern "take," but also likely represented a larger percentage of the population of the day. Modern records (since 1972) show that on average, USDA-WS in Utah takes about 5,000 coyotes per year by using 25 field men and several fixed-wing aircraft along with contracted helicopter work. Another 5,000 coyotes (on average) are taken by private hunters and trappers annually in Utah.

The coyote population in Utah today is near 100,000, based on studies by USDA-WS research personnel (Connelly 1996). Predator damage management today focuses on individuals causing damage, as opposed to the large-scale population reductions (or eradication in the case of the

wolf) of the past. Current control is practiced on less of the land mass, with more restrictions and for the protection of fewer livestock, than at any time in Utah history. Correspondingly, there are probably more coyotes alive today than at any time in Utah history.

Strychnine and thallium were the main poisons used in the early 1900s until the advent of Compound 1080 in about 1945. Compound 1080 was first effectively used on rodents and later on predators. From about 1950 to 1972, 1080 became the main method in controlling coyotes in all districts of Utah by the government and by private individuals. It is impossible to know precisely the effects it had on the coyote population, as population censuses were not conducted and the main objective of control was eradication.

It is reasonable to believe that Compound 1080 reduced coyote numbers considerably in large tracks of land that are no longer controlled because current land use practices prohibit coyote control. Strychnine baits used for coyote control before 1972 (in conjunction with Compound 1080) likely controlled ravens and raptors that fed on the baits. Compound 1080 is highly selective to canines but was overused by most of the applicators because there were no dosage restrictions or regulations in place.

It is difficult to assess the extent of population suppression for ravens, coyotes and even red foxes during the poison years. Some red foxes were found in Utah in low numbers and at high elevations early in the Territorial history. However, most biologists believe the red fox in Utah today, is an invasive species that arrived in the 1970s. Ravens have increased in numbers from the 1970s likely because of more favorable conditions including human-created food sources such as landfills. The increase in the raven population also follows the reduction in use of poisons that could have kept their numbers low. Early records show raven predation on lambs in the 1950s and public concern to control them.

The effects of reduced coyote control on sage-grouse are not well understood. The decline of sage-grouse occurred at the same time as coyote populations expanded. It could be concluded that the poison ban allowed coyotes, raptors, and ravens to expand in population numbers and range. At the same time, protections were placed on ravens and magpies through the removal of bounties and addition of laws that prohibited shooting and nest destruction. In addition, red foxes arrived and expanded in numbers because of the more favorable environments as previously discussed.

Incidentally, sage-grouse could also have benefited from the high numbers of sheep concentrated in winter areas. Proper sheep grazing in the winter has the effect of rejuvenating sagebrush. As sheep numbers declined, sagebrush became decadent to some degree. Although natural cycles may have once occurred in sage-grouse populations, change in the environment since the 1970s has caused a long-term decline. Once a decline in sage-grouse numbers occurred, the increase in predator numbers, especially red fox and ravens, would be more detrimental to the grouse.

Conclusions

No empirical evidence is available specifically related to the effects of predation on sage-grouse in the Resource Area. Many of the sage-grouse predators discussed above are known to occur in the Resource Area. USDA-WS does conduct predator control in the area related to livestock operations, which is likely to influence predator-prey dynamics involving sage-grouse. Under

these management conditions, sage-grouse numbers in the Resource Area are increasing or stable and, given current circumstances and management actions, predation by native predators, excluding ravens in some instances, is considered a moderate threat to sage-grouse populations in the area. Predation by nonnative predators, including domestic animals, red foxes, and raccoons, and native (but anthropomorphically inflated) raven populations, is an issue of greater concern when the cumulative effects of increased nonnative predator populations, habitat fragmentation, reduced habitat quality are considered. Nonnative red fox populations have decimated relatively isolated populations of sage-grouse in Strawberry Valley, Utah (Bunnell et al. 2000), and there is some concern that increasing populations of red foxes and raccoons in the Resource Area could have a negative impact on sage-grouse populations.

K. Vegetation Management

Vegetation management conducted in the past was a reflection of the priorities of the time and the mandates and policies of the federal government concerning management of federal land. Because much of the land in the Resource Area is under federal management, this is an important consideration when evaluating past and current conditions. In the past, many vegetation treatments were conducted to increase forage for livestock.

Recently, vegetation management has increasingly focused on restoring health to sagebrush rangelands. Management is increasingly performed in a proactive manner. For example, seeing controlled burns to prevent the establishment of nonnative plants, setting back succession in sagebrush stands to create a mosaic of sagebrush cover classes across the landscape, and adjusting grazing practices to retain tall grasses for nesting cover. Habitat management also involves treatments designed to remove cheatgrass and other invasive/noxious weeds, removal of pinyon-juniper stands, and restoring native species.

Several treatment types are used to manipulate sagebrush communities. Connelly et al. (2005:7-46 to 7-50) describes the mechanical, chemical, and biological techniques available and discusses their successes and challenges.

Given the current climate of vegetation management (i.e. restore/maintain the plant/wildlife community health), vegetation management is not likely to affect sage-grouse populations in the Resource Area. As discussed in an earlier section of this Plan, several habitat management projects have been implemented and are proposed for 2006, which are designed to improve sage-grouse habitat. Further, the Utah Partners for Conservation and Development (UPCD), a collection of resource management agencies, NGO, and private individuals recently established a Regional Team in the Resource Area. The purpose of the UPCD Regional Team is to increase communication, coordination, and sharing of resources and information regarding habitat and watershed improvements in the Resource Area. Increased focus and coordination is likely to improve project planning, implementation, and outcomes.

No empirical data exists regarding how sage-grouse have responded to vegetation treatments in the Resource Area. Several thousand acres have been treated in the Resource Area with the intent of improving sagebrush-steppe habitat (Table 3). We are not aware of post-treatment data that indicates the treatments resulted in conditions preferred by sage-grouse; however, that does not mean that those conditions do not exist or that the treatments were unsuccessful. Overall, we feel there is need to more rigorously monitor vegetation treatments in the Resource Area to expand our understanding of the effects of vegetation management on sage-grouse populations and habitats in the Resource Area.

V. Conservation Strategy

One of the main purposes of this Plan is to provide a framework of strategies and associated actions that can be implemented to abate threats, address information gaps, and guide monitoring efforts. Strategies and actions listed below (the order is irrelevant) were developed by SWARM partners. Several other documents and publications provide recommendations and guidelines for management of sage-grouse populations and their habitats, many of which were reviewed in the Introduction of this Plan. Strategies developed by SWARM are designed to be specific to the local area while taking into consideration the guidelines provided at a rangewide level.

Implementation of strategies and actions is strictly voluntary on the part of SWARM partners. Despite this, we have designated for each strategy the public and private partners who might be involved in implementation. Designation does not imply responsibility or commitment of resources of any sort to implementing, initiating, or completing any actions; however, it provides a framework of resources and expertise.

A. Strategies and Actions

1. **Strategy:** Improve age distribution of sagebrush-steppe communities by 2016.
   - 1.1. **Action:** Identify and prioritize target areas needing improvement.
   - 1.2. **Action:** Coordinate associations among agencies and landowners to fund implementation of projects and monitoring.
   - 1.3. **Action:** Monitor the response of sage-grouse to changing habitat conditions.
   - 1.4. **Action:** Implement treatments to change age class distribution of sagebrush.
   - 1.5. **Action:** Assist agencies in assessing wildfires in focus areas and restoration needs for sagebrush seed in mixes.

   Partners: UDWR, BLM, USU EXT, USFS, local county residents
   Threats Addressed: Fire and vegetation management, communication among parties, invasive/alien vegetation species
   Aspects of Sage-grouse Ecology Addressed: Lack of key habitat-type connectivity, poor condition of surrounding communities, degradation of winter habitat quality, loss of breeding habitat quality, loss of brood-rearing habitat quality, loss of riparian area quality, reduction of population size, reduction of population distribution

2. **Strategy:** Improve water availability in brood-rearing habitat by 2016.
   - 2.1. **Action:** Survey and evaluate current water sources and needs.
   - 2.2. **Action:** Partner with watershed specialists to identify new water sources.
   - 2.3. **Action:** Consider new water developments that are multi-use and multi-purpose.
     - 2.3.1. **Action step:** Construct guzzlers in areas identified as needing water.
   - 2.4. **Action:** Coordinate with private landowners to protect current water availability that benefits brood-rearing habitat.
   - 2.5. **Action:** Conduct vegetation treatments to improve water yield.
   - 2.6. **Action:** Restore and improve wildlife access to water.
   - 2.7. **Action:** Improve riparian conditions.

   Partners:UDWR, BLM, NRCS, interest groups
   Threats Addressed: Invasive/alien vegetation species, concentrated wildlife and/or livestock use
   Aspects of Sage-grouse Ecology Addressed: Loss of brood-rearing habitat quality, loss of

riparian area quality, reduction of population size, reduction of population distribution

3. **Strategy:** Improve wildlife and livestock distribution in winter and brood-rearing habitat throughout the next ten years.
   3.1. **Action:** Identify and prioritize target areas needing improvement.
   3.2. **Action:** Implement habitat improvements and direct management actions to improve distribution.

   Partners: UDWR, BLM, FS, USU EXT, SITLA, NRCS
   Threats Addressed: Concentrated wildlife and/or livestock use
   Aspects of Sage-grouse Ecology Addressed: Degradation of winter habitat quality, loss of brood-rearing habitat quality, reduction of population size, reduction of population distribution

4. **Strategy:** Increase participation of local public and private landowners with SWARM over the next ten years.
   4.1. **Action:** Develop partnerships with landowners and interest groups to increase visibility of sage-grouse management.
      4.1.1. **Action step:** Develop fact sheet to distribute to special interest groups concerning sage-grouse natural history and threats to populations.
      4.1.2. **Action step:** Identify regional groups and their contact person to promote cooperation from these groups.
   4.2. **Action:** Support partnership efforts for special designations that promote sage-grouse habitat.
      4.2.1. **Action step:** Write letters of support for new partnerships.
   4.3. **Action:** Host open houses, field tours, and presentations.
   4.4. **Action:** Distribute annual reports to local management agencies, county commissioners, and other interested parties.
   4.5. **Action:** Develop incentives for landowners and interest groups.
      4.5.1. **Action step:** Host educational field trips and provide interpretive areas.

   Partners: USU EXT, NRCS, RC&D
   Threats Addressed: Lack of communication among public parties, alternative land uses (mining, wind power, water development), development of roads or utilities, recreational use
   Aspects of Sage-grouse Ecology Addressed: Lack of key habitat type connectivity, poor condition of surrounding communities, degradation of winter habitat quality, loss of breeding habitat quality, loss of brood-rearing habitat quality, loss of riparian area quality, reduction of population size, reduction of population distribution

5. **Strategy:** Locate and monitor new active lek sites over the next ten years.
   5.1. **Action:** Survey landowners and land users to determine sage-grouse distributions.
   5.2. **Action:** Investigate possible new lek sites based on local reports.
   5.3. **Action:** Survey for new lek sites during lek counts and survey historic sites for new activity.
   5.4. **Action:** Rejuvenate historic lek site habitat for potential re-use.
   5.5. **Action:** Maintain and improve current lek site habitat.

   Partners: UDWR, USFS, BLM, USU EXT, interest groups
   Threats Addressed: Enhanced native and domestic predators, recreational use, concentrated wildlife and/or livestock use, fire and vegetation management, development of roads or utilities, alternative land uses (mining, wind power, water development), dramatic weather

events
Aspects of Sage-grouse Ecology Addressed: Loss of breeding quality (leks and nesting) habitat

6. **Strategy:** Maintain or increase sage-grouse populations through direct management.
   6.1. **Action:** Evaluate potential of translocation to supplement local populations.
   6.2. **Action:** Work with enforcement agencies to prevent illegal harvest of sage-grouse.
   6.3. **Action:** Monitor the presence of West Nile Virus or other diseases in sage-grouse populations.
   6.4. **Action:** Identify and implement steps to reduce presence of West Nile Virus.
   Partners: UDWR, USU EXT, BLM, SITLA
   Threats Addressed: Diseases and parasites
   Aspects of Sage-grouse Ecology Addressed: Loss of breeding quality (leks and nesting) habitat, reduction of population size, reduction of population distribution

7. **Strategy:** Manage unwanted plant species in sage-brush steppe habitat by 2016.
   7.1. **Action:** Remove juniper and pinyon pines from brood-rearing habitat.
   7.2. **Action:** Reduce abundance of unwanted and/or invasive plant species.
      7.2.1. **Action step:** Re-seed area after land disturbances such as mechanical treatments, fire, and human development.
      7.2.2. **Action step:** Utilize dedicated hunters to help with re-seeding and rehabilitation efforts.
   7.3. **Action:** Evaluate and utilize chemical applications where appropriate to restore habitat dominated by cheatgrass and/or noxious weeds.
   7.4. **Action:** Evaluate the use of fire as a tool in areas where cheatgrass has been established or is prone to establish.
   Partners: UDWR, BLM, USFS, USU EXT, interest groups
   Threats Addressed: Invasive/alien vegetation species, fire and vegetation management
   Aspects of Sage-grouse Ecology Addressed: Loss of brood-rearing habitat quality, reduction of population size, reduction of population distribution, lack of key habitat type connectivity, poor condition of surrounding communities, degradation of winter habitat quality, loss of breeding quality (leks and nesting) habitat

8. **Strategy:** Minimize impacts of new land developments and/or recreational uses on sage-grouse populations during the next ten years.
   8.1. **Action:** Provide consultations and recommendations for new land developments and/or recreational uses.
   8.2. **Action:** Regularly discuss new developments and alternative land uses to management agencies at local working group meetings.
   8.3. **Action:** Identify and maintain list of contact people involved in land and recreational developments.
   8.4. **Action:** Involve local county and city planning commissions in SWARM meetings.
   8.5. **Action:** Provide input into management plans for federal, state, and local agencies.
   Partners: USU EXT, UDWR, SITLA, NRCS, USFS, BLM, interest groups
   Threats Addressed: Alternative land uses (mining, wind power, water development), development of roads or utilities, lack of communication among public parties, recreational uses

Aspects of Sage-grouse Ecology Addressed: Reduction of population size, lack of key habitat type connectivity, poor condition of surrounding communities, reduction of population distribution, loss of breeding quality (leks and nesting) habitat, loss of brood-rearing habitat quality, loss of riparian area quality

9. **Strategy:** Take steps to reduce the negative impact of dramatic weather events during the next ten years.
   9.1. **Action:** Survey habitat after short-term dramatic weather events for damage to habitat.
   9.2. **Action:** Manage for diverse and healthy habitat that will withstand effects of drought or other long-term weather events.

   Partners: UDWR, BLM, USFS, SITLA
   Threats Addressed: Dramatic weather events
   Aspects of Sage-grouse Ecology Addressed: degradation of winter habitat quality, loss of breeding habitat quality, loss of brood-rearing habitat quality, loss of riparian area quality, reduction of population size, reduction of population distribution

10. **Strategy:** Reduce threat of predators on sage-grouse over ten-year period.
    10.1. **Action:** Remove current and avoid creating new raptor nesting in sage-grouse habitat.
    10.2. **Action:** Enlist Wildlife Services to reduce population numbers of problematic predator species.
    10.3. **Action:** Support current predator management efforts by other groups or agencies in the focus areas.
    10.4. **Action:** Determine predator community composition and depredation rate.
    10.5. **Action:** Identify threatening predators species.

    Partners: UDWR, USU EXT, WS
    Threats Addressed: Enhanced native and domestic predators
    Aspects of Sage-grouse Ecology Addressed: Loss of breeding quality (leks and nesting) habitat, loss of brood-rearing habitat quality, reduction of population size, reduction of population distribution

B. Priority Evaluation

In order to help prioritize strategies, actions, and most effectively allocate resources, we have assigned a rank of “low,” “medium,” “high,” or “very high” to each threat with regards to its contribution to reduction in population health or habitat condition (Table 4). Again, given the stipulations regarding a lack of empirical, locally based information in many cases, these rankings are based on the best information available to us and our implicit, experiential knowledge of the Resource Area. Ranking definitions are based on The Nature Conservancy’s Conservation Action Planning process (TNC 2005). Rankings are provided to help highlight potential priorities for subsequent strategies and actions.

SWARM partners and others can use the rankings in Table 4, combined with the strategies and actions listed above, to prioritize implementation and direct resources to efficiently and effectively abate threats, and maintain and improve sage-grouse populations and their habitats in the Resource Area.

Table 4. Relative importance/contribution of individual threats to reducing or degrading aspects of sage-grouse populations in the SWARM Resource Area. Threats are described in the "Threat Analysis" section of this Plan. Ranks are defined according to TNC (2005).

	Aspects of Sage-grouse population in the SWARM Resource Area							
Threat	Lack of key habitat type connectivity	Poor Condition of Surrounding Communities	Degradation of Winter Habitat Quality	Loss of Breeding Quality (Leks and nesting) Habitat	Loss of Brood-rearing habitat quality	Loss of Riparian Area Quality	Reduction of Population Size	Reduction of Population Distribution
Enhanced native and domestic predators	Medium	Low	Low	High	High	Medium	High	High
Recreational use	Medium	Medium	Medium	High	High	High	Medium	Medium
Invasive/alien vegetation species	High	High	High	Very High	High	Medium	High	High
Concentrated wildlife and/or livestock use	High	Medium	Medium	High	High	Medium	Medium	Medium
Fire and Vegetation Management	High	Medium	Medium	High	High	High	High	High
Development of roads or utilities	High	Medium	Low	Very High	High	Medium	Medium	High
Lack of communication among public parties	Medium	Medium	Low	High	Medium	Medium	Medium	Medium
Diseases and parasites	Medium	Medium	Low	High	Medium	Medium	High	High
Alternative Land Uses (mining, wind power, water development)	High	High	Medium	High	High	High	High	High
Dramatic Weather Events	High	Medium	Medium	Very High	High	High	High	High

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Appendix A

SWARM Standard Operating Procedures