STRAWBERRY VALLEY
GREATER SAGE-GROUSE
(*CENTROCERCUS UROPHASIANUS*)
LOCAL CONSERVATION PLAN

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Strawberry Valley Adaptive Resource Management Local Working Group

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Utah State University Extension
UMC 5230
Logan, Utah 84322-5230

and

Jack H. Berryman Institute
UMC 5230
Logan, Utah 84322-5230

and

Utah Division of Wildlife Resources
1594 W. North Temple
Salt Lake City, Utah 84116

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Strawberry Valley Greater Sage-grouse (*Centrocercus urophasianus*)
Local Conservation Plan

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I. Executive Summary

The Strawberry Valley Greater Sage-grouse (*Centrocercus urophasianus*) Conservation Plan (Plan) is the culmination of nearly three years of effort by the Strawberry Valley Adaptive Resource Management Local Working Group (SVARM). The Strawberry Valley Resource Area (Resource Area) is located in Wasatch and Duchesne counties in northeastern Utah. The Resource Area encompasses the greater Strawberry Valley area. It is bounded on the south by Reservation Ridge and the Wasatch-Utah county boundary, on the east by Indian Canyon, the north by Highway 35, and on the west by Strawberry Ridge (Figure 1, in Section II of this Plan). Members of SVARM include representatives from state and federal land management and resource agencies, non-governmental organizations, private industry, and private landowners. In 2003, SVARM formed 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 provides an assessment of the status of the sage-grouse populations in the Resource Area. 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 Resource Area. The Plan is designed to meet the guidelines set forth by the U.S. Fish and Wildlife Service (USFWS) in their Policy for Evaluation of Conservation Efforts (PECE) standards.

The Plan addresses the five USFWS listing factors as they apply to Greater Sage-grouse in the Resource Area. Recommendations and guidance suggested within the Plan can be adopted by all SVARM partners on a voluntary basis. Participation in SVARM and adoption of these practices, where applicable, by private landowners in the local area is encouraged. Participation by private landowners and consideration of landowner needs are 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 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 as well as an in-depth, local knowledge possessed by SVARM partners who live and work in the Resource Area. Because a wealth of general information exists about sage-grouse and is available in published documents, we provide only a brief overview of general sage-grouse ecology and tried to focus on conditions and issues specific to the Resource Area. Knowledge gaps are also identified.

Sage-grouse are a sagebrush obligate species that depend on a variety of habitats throughout their annual life cycle. Between March and May, sage-grouse congregate on lek sites to display and mate. Lek sites are typically located in openings in the sagebrush with shorter vegetation. Hens often nest near lek sites (within two miles), where they will build a shallow depression nest under a sagebrush bush or other shrub of suitable height. Broods hatch after about 32 days and typically stay near the nest site if suitable habitat is available. As summer progresses, sage-grouse broods move to wetter areas where available, or to higher elevations where food resources are more abundant. Males and unsuccessful hens follow similar habitat-use patterns in

late summer. Sage-grouse lack a well-developed gizzard and eat soft plant parts, sagebrush leaves, and insects. Young sage-grouse especially depend on succulent forbs and insects for nutrition and protein as they grow. In winter, sage-grouse congregate in larger flocks in areas where sagebrush remains uncovered by snow, as their primary food source in winter is sagebrush leaves. Some populations of sage-grouse are migratory, moving >10km to winter habitat, while others are non-migratory and remain near breeding habitat throughout the year.

Sage-grouse populations in the Resource Area were estimated to be between 3,000 and 4,000 birds in the late 1930s. In the 1980s and 1990s, the population was estimated to be no more than 350 breeding adults. In the early part of this century, estimates were as low as 100 adult sage-grouse. In 2003, an intensive translocation program was initiated and today, population estimates show an increasing trend, with the most recent estimate being about 350 breeding birds. Population declines of the past were attributed largely to predation by non-native red foxes. Alterations to habitat, increased fragmentation, and loss of habitat, likely played a role in population declines since the 1930s.

Threats currently or potentially affecting sage-grouse and sagebrush habitats in the Resource Area were analyzed by SVARM partners. Threats identified and analyzed by SVARM included livestock grazing, predation, home/cabin development, renewable and nonrenewable energy development, historic vegetation treatments, drought, roads, and power lines/fences/other tall structures. The Threat Analysis, combined with recommended strategies and actions provides a framework for implementation of the Plan for the next ten years by SVARM partners.

Implementation of Plan strategies and actions will be conducted within an adaptive resource management framework. As relevant information from a local and rangewide perspective becomes available, it will be used to modify and refine management strategies, priorities, and general understanding of sage-grouse ecology in the Resource Area. Annual evaluation and reporting will be conducted by SVARM to track progress on the strategies and actions outlined in this Plan.

II. Introduction

A. Purpose

The mission of the Strawberry Valley 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 while taking into consideration historical land uses and long term socioeconomic issues. The Plan applies to areas within the Strawberry Valley Resource Area. The Resource Area is located in Wasatch and Duchesne counties in northeastern Utah. The Resource Area encompasses the greater Strawberry Valley area and is bounded on the south by Reservation Ridge and the Wasatch-Utah county boundary, on the east by Indian Canyon, the north by Highway 35, and on the west by Strawberry Ridge (Figure 1). The Plan will help meet this goal by providing local management solutions based on local or compatible data and research to the extent practical. In addition, SVARM hopes to develop management solutions that will result in diverse and productive sagebrush habitat for sage-grouse, while recognizing healthy sagebrush habitats are valuable to the existence of other species. 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 with the Central Utah Partners for Conservation and Development Regional Team in developing project proposals 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), 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 and implement local adaptive resource management plans. These groups are tasked to address declining sage-grouse populations associated with the loss, degradation, and fragmentation of sagebrush steppe communities, with the overarching goal of protecting and conserving these and other natural resources, into the future.

The Plan is designed to meet the guidelines set forth by the USFWS in their 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

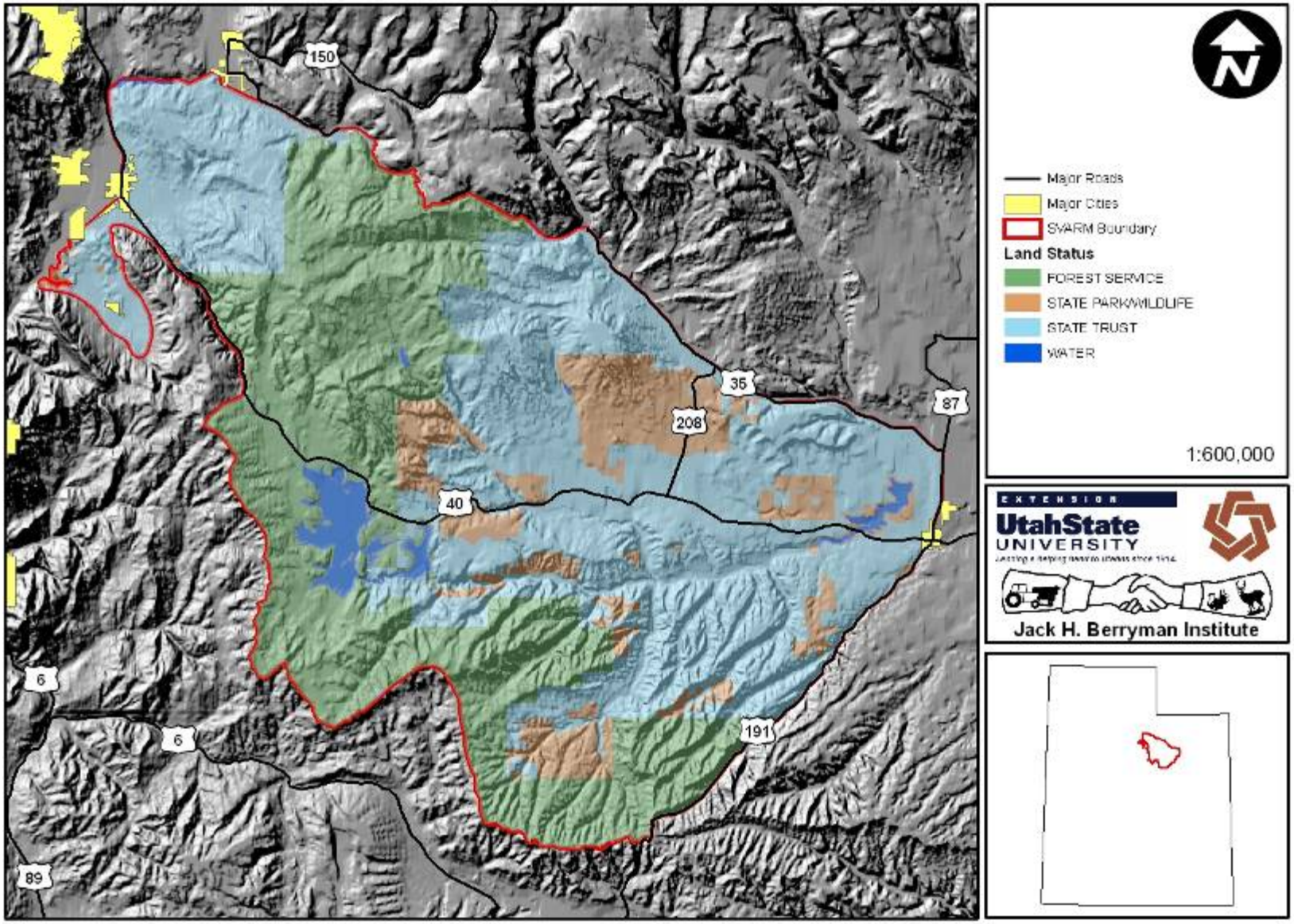

Figure 1. The SVARM Resource Area and subunits with land management and landownership designated.

Greater Sage-grouse (hereafter referred to as sage-grouse) in the Resource 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 also 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 this Plan is intended to serve as a set of guidelines for state and federal agencies to maintain and enhance sage-grouse habitat and populations in the Resource Area. Participation by private landowners and consideration of landowner needs are 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 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.

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

B. Goals and Scope

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

<u>Assessment Goals:</u>

The Plan will provide an assessment of the status of the sage-grouse population in the Resource Area 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 potential impact sage-grouse in the Resource Area

<u>Strategy Goals:</u>

The intent of the Plan is to maintain and, where possible, increase sage-grouse populations and improve habitat conditions in The Resource Area by implementing the following strategies:

1. Implement appropriate management strategies to conserve sage-grouse and their habitats
2. Increase effective communication with all potential stakeholders in the Resource Area 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. It is hoped that with implementation of this adaptive plan, specific conservation issues will be addressed, implemented, and monitored across geographic and political boundaries, thereby increasing the consistency of practices implemented and information collected. The assessment and strategies described herein are specific to the Resource Area and were developed with the unique ecological, social, and economic concerns of that area in mind.

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. SVARM 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 the sage-grouse was listed under the Endangered Species Act (ESA) or if sage-grouse were removed from the UDWR's Sensitive Species list. Species on the Sensitive Species list include species 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 2006).

D. Strawberry Valley Adaptive Resource Management Local Working Group

As a result of the Strategic Plan, the Strawberry Valley Adaptive Resource Management Local Working Group (SVARM) was formed in 2004 and has worked consistently and cooperatively toward the completion and implementation of the Plan since that time. SVARM was organized and is facilitated by Todd A. Black and Sarah G. Lupis 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. Ms. Lupis also served as the technical writer and compiler of the Plan itself. SVARM 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 their participation in SVARM are listed in Table 1. When 'we' or 'our' is used in the Plan it refers to SVARM.

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

SVARM 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 ensure the success of the Plan and SVARM.

Table 1. Strawberry Valley Adaptive Resource Management (SVARM) Local Working Group agency, industry, academic, and private partners.

East Daniels Grazing Association
Brigham Young University
Wasatch County Council
Utah Division of Wildlife Resources (UDWR)
USDA Forest Service (USFS)
Utah School and Institutional Trust Lands Administration (SITLA)
Bureau of Land Management (BLM)
U.S. Fish and Wildlife Service (USFWS)
USDA Wildlife Services (WS)
Farm Services Agency (FSA)
Natural Resource Conservation Service (NRCS)
Utah State University Extension (USU/EXT)
The Nature Conservancy (TNC)
Farm Bureau Federation
Pine Hollow Property Owners
Friends of Strawberry Valley
Utah Reclamation Mitigation and Conservation Commission (URMCC)

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

SVARM operates through an open public process based on consensus decision making. For decisions regarding the Plan, consensus was reached by participating members and/or those present at the time the decision was made. Sections 5 and 6 of the ESA direct state and federal agencies to cooperate in developing conservation activities that protect candidate species. Because the responsibility lies with state and federal agencies, decisions are ultimately made by 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."

SVARM 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 SVARM participants possible. Meetings were announced by direct mailings, on the CBCP website (www.extension.usu.edu/cbcp), via email, and through personal phone calls and invitations.

During the planning process, SVARM met at least every other month and often monthly. Meeting minutes and critical updates were provided via email, direct mailing, and on the CBCP website. In addition, an annual community forum was held to update the local community on SVARMs 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 SVARMs activities and the Plan's progress. The final draft of the Plan was made available to all potential stakeholders that SVARM 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 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 local community. In many instances, cooperation between landowners and agencies, results in more useful and cost-effective 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 slowed 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, 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 Resource

Area. State laws restrict possession of individual birds. Funding programs in Utah support population and habitat conservation and 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 Resource Area, 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 "State Species of Concern" and are among the terrestrial species identified in the second tier (i.e., Tier II) of three priority categories of species identified in the CWCS. Approximately 60 species across five taxa in Utah are identified as being potentially petitioned for placement on the ESA defined Threatened and/or Endangered Species list.

Counties

The Wasatch County Council and the Duchesne County Commission 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 Wasatch and Duchesne counties 2) regulate land use, land planning, and quality and protection of natural resources; and 3) have duly adopted regulations and policies to exercise such authorities including the review and approval or denial of proposed activities and uses of land and natural resources (Wasatch County Commission 2005**)**. The Wasatch County Code (Section 16.28.05) contains the following provisions related to wildlife:

> Wildlife studies may be required in any large-scale development being planned within any foothill, canyon or rural area, prior to any development, to determine the presence of critical or important wildlife habitat. The foothills and canyon areas provide important

wildlife habitat for a wide variety of animal and bird species. As a result of past development activities, many habitat areas have been impaired, altered, or fragmented. The following requirements have been developed to promote and preserve valuable wildlife habitats and to protect them from adverse effects and potentially irreversible impacts.

(1) Applicability.

(a) The requirements of this chapter shall apply to large-scale (more than five (5) lots or units) developments being planned on property that contains wildlife habitats designated as Critical and High Value Use Areas. If information is not available, a wildlife study should be done to make this determination. The Planning Department may have this study reviewed by the Utah State Division of Wildlife Resources.

(b) Maintain buffers between areas dominated by human activities and core areas of wildlife habitat.

(c) Facilitate wildlife movement across areas dominated by human activities by maintaining connections between open space parcels on adjacent and near-by parcels, locating roads and recreational trails away from natural travel corridors used by wildlife such as riparian areas and prohibiting fencing types that inhibit the movement of wildlife species, except directly adjacent to the structures in order to protect adjacent landscaping features.

(d) Mimic features of the local natural lands vegetation in developed areas by retaining pre-development, high quality habitat to the maximum extent feasible, including large patches of natural, vegetated areas that have not yet been fragmented by roads or residential development; minimizing the levels of disturbance to trees, the under story, and other structural landscape features during construction; designing lots in a fashion consistent with local natural habitats by landscaping with native vegetation; enhancing the habitat value of degraded pre-development landscapes.

(e) Clustering of development to limit the areas to be disturbed.

The Duchesne County Code (Duchesne County 1997, amended 2005) contains the following provisions related to wildlife:

a. Wildlife management agencies, public land management agencies and the County shall work together to manage big game populations.

b. Wildlife agencies shall find effective ways to mitigate and compensate landowners for damage caused by big game animals on private property. Duchesne County recognizes that the Utah Division of Wildlife Resources is mandated by Utah Code to mitigate damage to agricultural crops, equipment and improvements and that a process to do so is in place.

c. Wildlife populations shall not be increased nor shall new species be introduced until forage allocations have been provided and an impact analysis completed for the effects on other wildlife species and livestock.

d. Reduction in forage allocation resulting from forage studies, drought, or other natural disasters will be shared proportionately by wildlife, livestock and other uses.

e. Increases in forage allocation resulting from improved range conditions shall be shared proportionally by wildlife, livestock and other uses.

f. Wildlife target levels and/or populations must not exceed the forage assigned in the RMP forage allocations.

g. Predator and wildlife numbers must be controlled to protect livestock and other private property and to prevent population decline in other wildlife species.
h. Resource-use and management decisions by federal land management and regulatory agencies should support state-sponsored initiatives or programs designed to stabilize wildlife populations that may be experiencing a scientifically proven decline in numbers.

Natural Resources Conservation Service (NRCS)

The United States Department of Agriculture (USDA) NRCS has authority to conserve sage-grouse through:
1. The Soil Conservation and Domestic Allotment Act of 1936, as amended (P.L. 74-46)
2. The 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 provide 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 for 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. Vegetative or brush management practices 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

The United Sates Department of Interior (USDI) BLM has authority for conservation of sage-grouse through: 1) the Federal Land Management Policy Act (FLMPA) of 1976 (43 U.S.C. 1701 et seq.; 90 stat. 2743; PL 94-579; 2) the Sikes Act, Title II (16 U.S.C. 670 et seq.), as amended; and 3) the BLM Manual 6840, Special Status Species Management. Specifically, the FLMPA guidance on sensitive species authorizes that "the public lands be managed in a manner tat 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 authorize, 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)

SITLA was created in 1994 to manage twelve real estate trusts granted to the state at statehood (1896) to Utah by the United States federal government. SITLA is an independent agency of the 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 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, which requires a balancing of 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 USFS has authority for conservation of sage-grouse though:

1. The Multiple-Use Sustained Yield Act (MUSY) of 1960 (P.L. 86-517, 74 Stat. 215, 16 U.S.C. 528, 528-531)
2. The Sikes Act of 1960 (P.L. 86-797, 74 Stat. 1052, 16 U.S.C 670 et seq., as amended)
3. The 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. The 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, 2005)
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 meet 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

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.

II. Conservation Assessment

A. General Sage-grouse Biology/Ecology

Numerous authors have described various aspects of sage-grouse biology, ecology, and life history; several more have, in recent years, published summaries. For the purposes of this document, we have included the summary from the Statewide Strategic Plan (UDWR 2002) and would also recommend the Conservation of Sage-grouse and Sagebrush Habitats by Connelly et al. (2004) 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. In comparison, adult females weigh 2-4 pounds (1.0-1.8 kg) and measure 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 and 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 more 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. Movements between seasonal 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. Likewise, 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). Renesting 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 most other game birds.

Sage-grouse nest success varies from 12–86% (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. The 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 6.0–9.5 throughout the species range (Schroeder 1997, Sveum et al. 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 35-85%; adult male survival rates vary from 38-54% (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 1.40–2.96 juveniles per hen in the fall. In recent years, this ratio has declined to 1.21–2.19 juveniles per hen (Connelly and Braun 1997). It is thought 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 considered 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 this may not be the case for 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). Sage-grouse that nest 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 be hidden 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 (14% canopy cover) 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 to more mesic sites during June and July where more succulent vegetation is available (Gill 1965, Klebenow 1969, Connelly et al. 1981, 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 et al. 1981, 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. Movements from fall to winter ranges 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 is accessible through the winter. Eng and Schladweiler (1972) and Wallestad (1975) indicated that most observations of sage-grouse during winter in Montana 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 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 the availability. Sage-grouse in some areas apparently prefer Wyoming big sagebrush (*A. t. wyomingensis*) (Remington and Braun 1985, Myers 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 with federal agencies (2000), calls for consistent monitoring and data collection.

Several techniques have historically been utilized in Utah and in the Resource Area 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 Resource Area 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 from historic time frames in question. For many areas, no written or zoological records exist. It is thought 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 Plan) (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 Resource Area as part of an evaluation of historic range in the Southern Great Basin (Connelly et. al. 2004). The Southern Great Basin includes areas from California, through Nevada, and east to the mountains of central Utah. Most of the Resource Area is encompassed by this area. The authors indicate that although sage-grouse likely did not occupy the entire Southern Great Basin area (excluded from barren salt flats west of the Great Salt Lake and forested mountain areas), populations likely were more connected pre-European settlement.

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, 2003a, 2004). Lek count methodology was first described by Patterson (1952), who studied sage-grouse in Wyoming, and 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, track surveys). Anderson (2001), whose primary criticism was that they fail to lead to defensible estimate of population size or status, described the shortcomings of this type of sampling. With regards specifically to lek counts, Beck and Braun (1980) noted that they only lead to conclusions about population size and status when the following information is known: total number of leks in an area, attendance patters 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 specifically, they remain the best and primary available 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 greatest extent possible. Leks are counted three to four 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, established, ‘traditional’ lek attendance increases and smaller ‘satellite’ leks appear and then disappear as population size decreases again. 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. Conversly, leks are considered ‘inactive’ when birds have been absent from a traditional site for more than years. The use of 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 Strawberry Valley Resource Area is located in Wasatch and Duchesne counties in northeastern Utah. The Resource Area encompasses the greater Strawberry Valley area. It is bounded on the south by Reservation Ridge and the Wasatch-Utah county boundary, on the east by Indian Canyon, the north by Highway 35, and on the west by Strawberry Ridge (Figure 1). The Resource Area encompasses approximately 948,568 acres, managed primarily by the U.S. Forest Service (USFS) and private land owners. The predominant land uses in the area include livestock grazing, recreation, mineral development, summer home development, fishing, hunting, and big game spring, summer, and winter range.

Landownership

Land in the Resource Area is owned and/or managed by several entities including private landowners, federal agencies, state agencies, and tribal governments (Table 2, Figure 1). The greatest percentage of land is owned or managed by the USFS and private landowners.

Wildlife Populations

Several species of birds, small mammals, and reptiles are found only in sagebrush environments within the Resource Area. Several neo-tropical passerine birds obligated to use sagebrush environments include Brewer's sparrow, sage sparrow, and sage thrasher. Further, though not obligated to use only sagebrush environments, vesper sparrow and loggerhead shrike are also commonly found in sagebrush communities in Utah. Other species found in sagebrush plant communities include the sagebrush vole and the sagebrush lizard. In addition to these obligates, a large number of other birds, small and big game mammals and reptiles commonly make use of sagebrush environments within Resource Area. Paige and Ritter (1999) address bird species found in sagebrush areas and Yanishevsky and Petring-Rupp (1998) provide habitat management guidelines for several species of sagebrush nesting birds. Welch and Criddle (2003) describe many of the vertebrate and invertebrate species using big sagebrush for food or shelter.

Table 2. Landownership (acres, miles^2, and % total area) in the SVARM Resource Area.

Landowner	Acres	Miles^2	Percentage of SVARM Resource Area*
Bureau of Land Management	2,079	3.2	0.2
Indian Reservation	76,595	119.7	7.9
Private	370,224	587.5	38.2
State Institutional Trust Lands (SITLA)	29,735	46.5	3.1
U.S. Forest Service	360,382	563.1	37.2
State	108,950	170.2	11.2
*Total SVARM area (969,040 acres, 1,514 mi^2) includes land covered by water.			

While sage-grouse populations in the Resource Area have been extensively counted and studied, little or nothing is known about the local status of the other wildlife species listed above. It is assumed that their numbers and geographic extent are tied to the condition and extent of big sagebrush communities. 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 other sagebrush obligate species to thrive in the Resource Area.

Human Populations

The Timpanogos Utes were early residents of what is now Wasatch County, Strawberry Valley, and areas beyond Strawberry Valley encompassed by the Resource Area. This area was considered an important hunting ground for Native American tribes (Fuller 1994).

The Heber Valley was first settled in 1859. Small homesteads were scattered across much of the area, generally located near water sources and wet meadows. These homesteads may have protected water sources from extensive livestock grazing. Many of these homesteads maintained small alfalfa fields, which provided sage-grouse brood habitat. Most of these homesteads, and their associated hayfields, were abandoned by the end of the 1950s.

In 1903, the Strawberry Valley Project was quickly authorized and construction began on the Strawberry Dam in 1908. The dam was completed in 1922. The newly formed Strawberry Reservoir had a capacity of 283,000-acre-feet. In 1974, the Bureau of Reclamation enlarged the reservoir with the addition of the Soldier Creek Dam, located 7 miles downstream from the old Strawberry Dam. The reservoir created by Soldier Creek Dam has the capacity to raise the water surface of Strawberry Reservoir by about 45 feet. When this level is reached, the enlarged reservoir will have a capacity of 1,106,500 acre-feet and a surface area of 17,000 acres.

Creation of Strawberry Reservoir has increased recreational opportunities in the area. Today, anglers, hunters, boaters, hikers, photographers, and off-highway vehicle (OHV) users, frequent the area in and around the reservoir during all seasons of the year.

New and expanded highways, roads, and rail sidings have cropped up to service mines, ranches, and residential properties. Fences have increased in number over the years as allotments have been split and cross-fenced, as rural properties are developed, and as new county roads cross sage-grouse habitat. Power lines have also increased in number and length. Several large transmission lines cross sage-grouse habitat to service mines and transfer electric power out of the area. Numerous service lines are also found in sage-grouse habitat.

Livestock Grazing

The history and place of livestock grazing 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 ‘pre-European contact.’ All have listed numerous reasons for this difference including grazing, fire, introduced plants, agriculture and more recently, climate change. In a somewhat different slant, Burkhardt (1996) questioned the often-held assumption that Intermountain plant communities evolved without the

presence of large herbivores. In response to this assumption, land management practices (livestock grazing) were often developed with an additional assumption that livestock grazing was an unnatural impact on native plant communities. A rather large body of research was presented by Burkhardt (1996) 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 Resource Area in the 1860s (USDA_FS 2004). In 1892, the Valley Indian Reservation, who then controlled land in Strawberry Valley, leased Strawberry lands to Heber Valley ranchers for grazing. In 1902, with plans for Strawberry Reservoir being developed, management of lands in Strawberry Valley was transferred to the Bureau of Reclamation. Lease fees increased shortly thereafter and ranchers were forced to overstock pastures to make a profit. Starting in 1925, ranchers leased grazing rights from the Strawberry Valley Water Users Association (SVWUA) who used the money to finance the construction of the Strawberry Project (Frandensen 1995). These lands were intensively used between the months of June and October. Recorded stocking rates varied from 3,780 cattle in 1983 to 2,322 in 1985, and 7,386 sheep in 1965 to 3,454 in 1986 (USDA-FS 2004).

In 1988, management authority of these lands was transferred to the USFS, Uinta National Forest, through Congressional bill H.R. 3408. Cattle and sheep had been grazed on Uinta National Forest lands since the early 1900s. At that time, sheep herds from as far away as Wyoming grazed in the area. During the early and mid-1900s, it was common to graze an area several times over until the 'Fall Feed' was gone. Fall feed species (i.e. peavine and western cone flower) are not palatable forage until after the first hard frost (USDA-FS 2004). Sheep and cattle often grazed the same area. Cattle were turned out on May 16 while sheep arrived later. This created constant competition between sheep and cattle ranchers over good forage.

Historical numbers of livestock in Resource Area have varied and, like other areas in the west, were affected by weather, markets, regulation, etc. There has been a general decline in sheep numbers in the Resource Area over the last 50 to 60 years while cattle numbers increased into the 1960s before their decline. On the Uinta National Forest, grazing management has shifted to a rest-rotation management scheme. Cattle numbers on the Forest are down by 18% and sheep are down by 20% from 1977 rates. Today, the earliest turn-out date has been pushed back to June 16 (USDA-FS 2004).

Farming

Early settlers to the Resource Area and surrounding areas farmed to raise food for themselves and their livestock. Today, hay is the primary agricultural product produced in the Resource Area.

Population Status and Distribution

Sage-grouse were likely historically found in all 29 Utah counties. Today, sage-grouse are found in 26 of Utah's counties and are only thought to occupy less than 50% of their historic habitat (Beck et al. 2003).

Greater sage-grouse were once abundant in the Resource Area. In the 1930s, flocks of 400 to 500 birds were flushed along Windy Ridge during early winter and the population was estimated to be between 3,000 and 4,000 birds (Griner 1939). The UDWR began monitoring sage-grouse populations by annually counting males on leks in 1970 (Figure 2, Figure 3). That year, a total of 127 male sage-grouse were counted on 4 leks. Under the assumption that 75% of all males in the population were observed and counted, and assuming a sex ratio of 2 females to each male (UDWR 2002, Zablan et al. 2003), the estimated population size in 1970 was about 603 birds in the spring of 1970. Bunnell et al. (2000) estimated the population in the Strawberry Valley to be 250-350 grouse in 1999, representing a population decrease of 41-58%. From 1984 to 2004, 6 leks became inactive. Several factors may have contributed to population declines and loss of lek sites between the 1930s, 1970s (when lek counting began) and 1999 including habitat degradation from livestock grazing, loss and degradation of habitat caused by aerial herbicide (2,4-D) spraying, and loss of mesic habitat from incised stream channels, channel diversions, and other factors that would have lowered the water table (USDA-FS 2004). Aerial photographs of the Strawberry Valley area indicate that willow habitat along riparian corridors was eliminated between 1964 and 1971 (USDA-FS 2004); Smith and Greenwood commented in their report that "Past herbicidal treatments of large expanses of sagebrush have been extremely detrimental to nesting and brood habitat [of sage-grouse]." They further concluded that "Loss of habitat is believed to be the major factor responsible for the reduction in the grouse population. Quality and quantity of sagebrush habitat has been reduced in the Resource Area in both Strawberry Valley and on winter ranges to the east. Habitat loss has resulted from cultivation, herbicidal spraying of sagebrush, road and housing construction, construction of campgrounds, reservoir enlargement, and associated increased human activities."

As of 2006, 2 leks in the Resource Area, Road Hollow and Lower Red Creek, were active. That year, a total of 135 males were counted (all on the Road Hollow lek) for an estimated population size of 641 breeding birds. The primary factors associated with population rebounds in the Resource Area are predator control efforts and translocation of hens into the Resource Area from other parts of the state (see Appendix B for details of translocation efforts). Also in 2006, sage-grouse were observed strutting in 2 new locations. Monitoring of these areas will continue to see if sage-grouse continue to use them. In addition, sage-grouse may be translocated onto those leks (R. Baxter, BYU, personal communication).

Another study on sage-grouse in the Resource Area was conducted from 1986-1989 by USFS personnel (Welch et al. 1990). This study estimated the Strawberry Valley sage-grouse population to be between 160 and 185 birds. Welch et al. (1990) concluded that population declines were primarily due to loss of riparian habitat, herbicide treatments on sagebrush, and expansion of the reservoir.

Overgrazing by domestic livestock, often cited as a potential reason for sage-grouse population declines (Beck et al. 2003, USDA-FS 2004), does not appear to have contributed to more recent sage-grouse population declines in the Resource Area. Following transfer of approximately

57,000 acres of land to the Uinta National Forest in 1988, all livestock grazing was removed from the Strawberry Grazing Association lands. Intensive stream bank rehabilitation efforts were initiated along with restoration of riparian habitats. The removal of livestock from those thousands of acres of critical sage-grouse habitat has had no apparent effect on the recovery of population numbers as lek count numbers continued to decline and/or remain low through the late 1980s and throughout the 1990s.

Research conducted by BYU graduate students since 1998 has illustrated the importance of red fox predation on sage-grouse survival and raven predation on nest failure (Bunnell 2000, Baxter, unpublished). This research has demonstrated how predation is likely the main factor responsible for low recruitment of juvenile birds (Bunnell et al. 2000, USDA-FS 2000, Baxter, unpublished).

Bunnell et al. (2000) concluded that red fox predation was a major limiting factor in the recovery and expansion of the resident sage-grouse population in Strawberry Valley. Red fox were suspected to be the cause of extremely low (30% for females and 29.7% for males) adult survival and almost complete reproductive failure from 1998-1999. Red foxes became common in the Strawberry Valley in the 1980s and are currently controlled by USDA Wildlife Services (USDA-WS) (Bunnell et al. 2000). BYU's research has demonstrated that habitat used by sage-grouse broods meets requirements for productive sage-grouse brood rearing habitat as described by Connelly et al. (2000) (Bambrough and Flinders 2001).

Several species of potential nest predators are known to occur in Strawberry Valley including common raven, red fox, raccoons, skunks, and badgers (USDA-FS 2004). However; artificial nest studies conducted in 2003 demonstrated that raven populations were likely having a significant impact on sage-grouse nesting success (Baxter, unpublished). Ravens were implicated in the depredating 97% of artificial nests in the study. Starting in 2003, USDA WS was responsible for controlling raven populations during sage-grouse nesting season through the use of poisoned egg baits.

In an effort to reverse the downward sage-grouse population trends in Strawberry Valley and to recover the population, 38, 34, 70, and 103 female sage-grouse were translocated to the Strawberry Valley in 2003, 2004, 2005, and 2006 respectively. Sage grouse were trapped in the spring on and around leks on Parker Mountain in south-central Utah, from Diamond Mountain in northeastern Utah, Box Elder County and Rich County in northern Utah. Sage-grouse were transported overnight to the Strawberry Valley and were released by opening the boxes in live sagebrush at the edge of the Road Hollow lek, the only known active lek in the valley in order to provide them with visual breeding cues and the opportunity to intermix with actively strutting resident sage-grouse. To date, only one mortality has occurred during the capture, transport, or release phase of the translocations. Preliminary results show exceptional survival, nest initiation, nest success, and overall growth of the translocation population. Pre-translocation population estimates were between 100-120 birds, and the current population estimate, just over 3 years later, is approximately 641 birds.

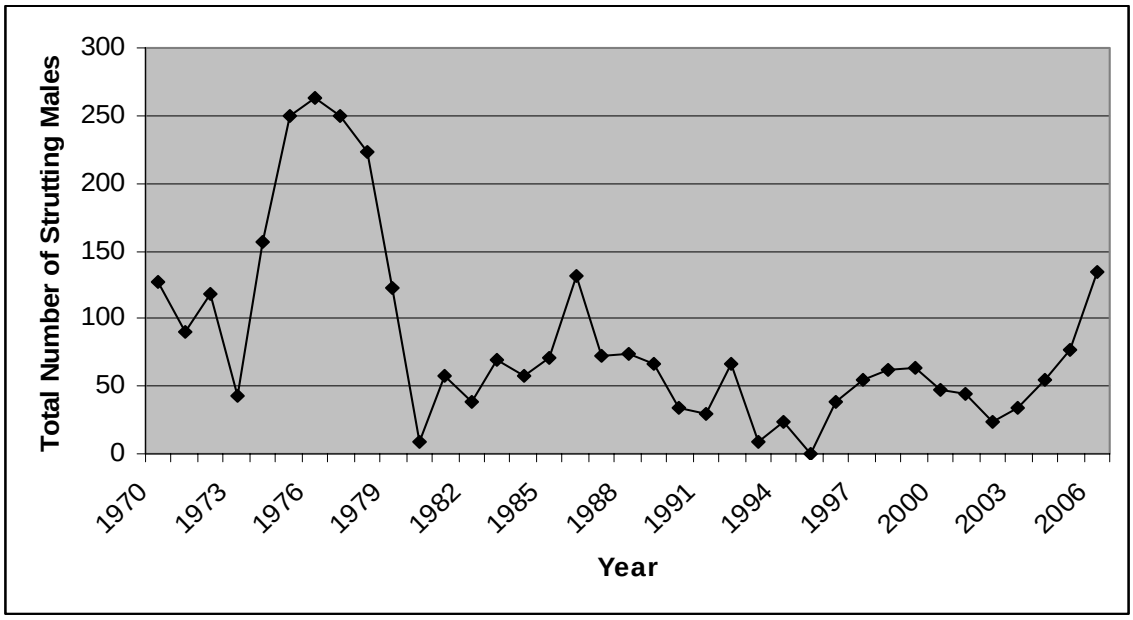

Figure 2. Maximum total number of males counted on leks in the SVARM Resource Area, 1970-2006.

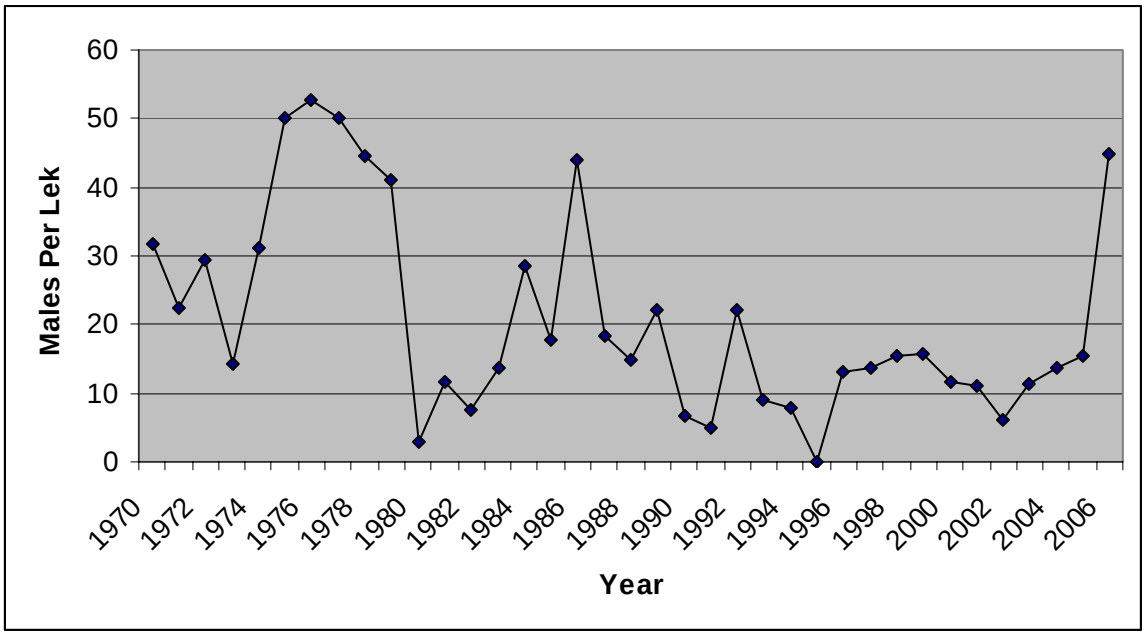

Figure 3. The number of males per lek in the SVARM Resource Area, 1970-2006.

Local Ecology & Life History

Intensive research efforts have been conducted on sage-grouse in the Resource Area, with emphasis on populations in the Strawberry Valley itself (Bunnell et al. 2000, Baxter and Flinders, unpublished). Since 1999, graduate students from BYU, under the direction of Dr. Jerran Flinders, have investigated nearly every aspect of sage-grouse ecology, population dynamics, and habitat use for both resident and translocated birds. Rather than summarizing the extensive body of literature available regarding habitat use, movement patters, survival, recruitment, and sources of mortality for sage-grouse in the Resource Area, we have elected to provide all available quarterly reports, annual reports, and final reports for the study in Appendix B. Research efforts in and around the Strawberry Valley are on-going and will be used continuously to revise and adapt management strategies and this Plan.

Local Habitat

The extent of seasonal habitat types in the Resource Area was mapped by the UDWR in 1999. Figures 4 and 5 illustrate where nesting, brood-rearing, and winter habitats are located in the Resource Area.

The UDWR Big Game Range Trend project has been monitoring sites throughout the Resource Area to track changes in vegetation composition, structure, and diversity. Although these sites were placed in areas used by big game, where they overlap with sage-grouse seasonal habitat types (Figure 6), they can provide information about vegetation and habitat conditions in those areas in a general sense. Data collected at these sites are summarized and available at: http://www.wildlife.utah.gov/range/

Graduate students from BYU and field biologists from the UDWR have collected extensive data habitat characteristics of sage-grouse use areas, as determined by radio-collared birds. This information is provided in a series of reports in Appendix C.

Habitat Improvements & Completed Conservation Actions

The UDWR and USFS have implemented several habitat improvement projects in the Resource Area targeted at restoring or enhancing sage-grouse habitat. In 2004, approximately 1,400 acres of habitat in the Resource Area were treated, and an additional 300 acres were treated in 2005. Treatments were aimed at reducing sagebrush canopy in a mosaic pattern to enhancing native grass/forb cover in the understory. Additional habitat improvement projects are planned for 2006. The UDWR anticipates treating 2,690 acres in the Resource Area in 2006. The location of some habitat improvement projects is given in Figure 6. Table 3 lists the acreage and general location of habitat improvement projects implemented in 2004 and 2005 and proposed for 2006 by the UDWR.

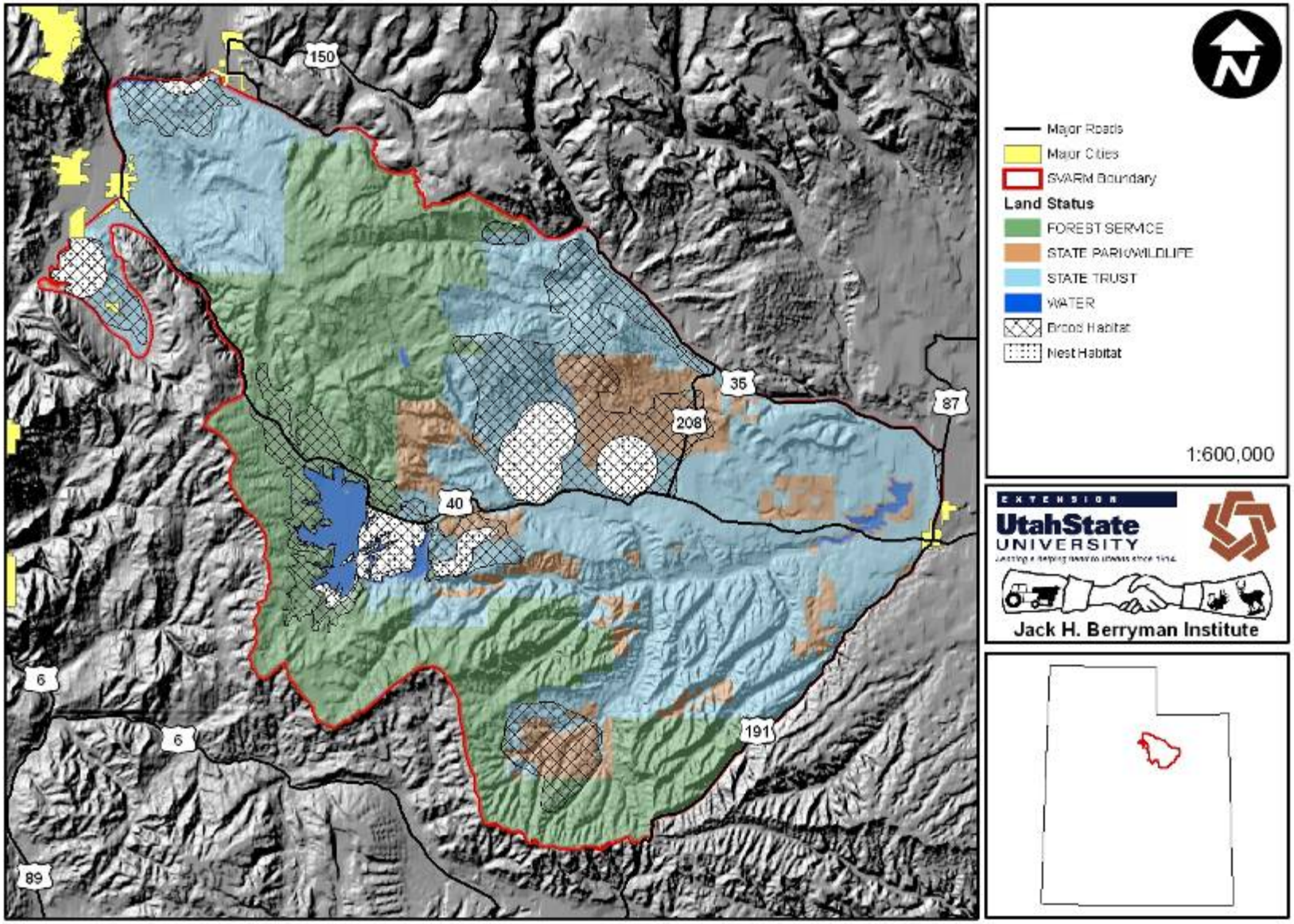

Figure 4. Location of sage-grouse nesting and brood-rearing habitat in the SVARM Resource Area, as identified by the UDWR, 1999.

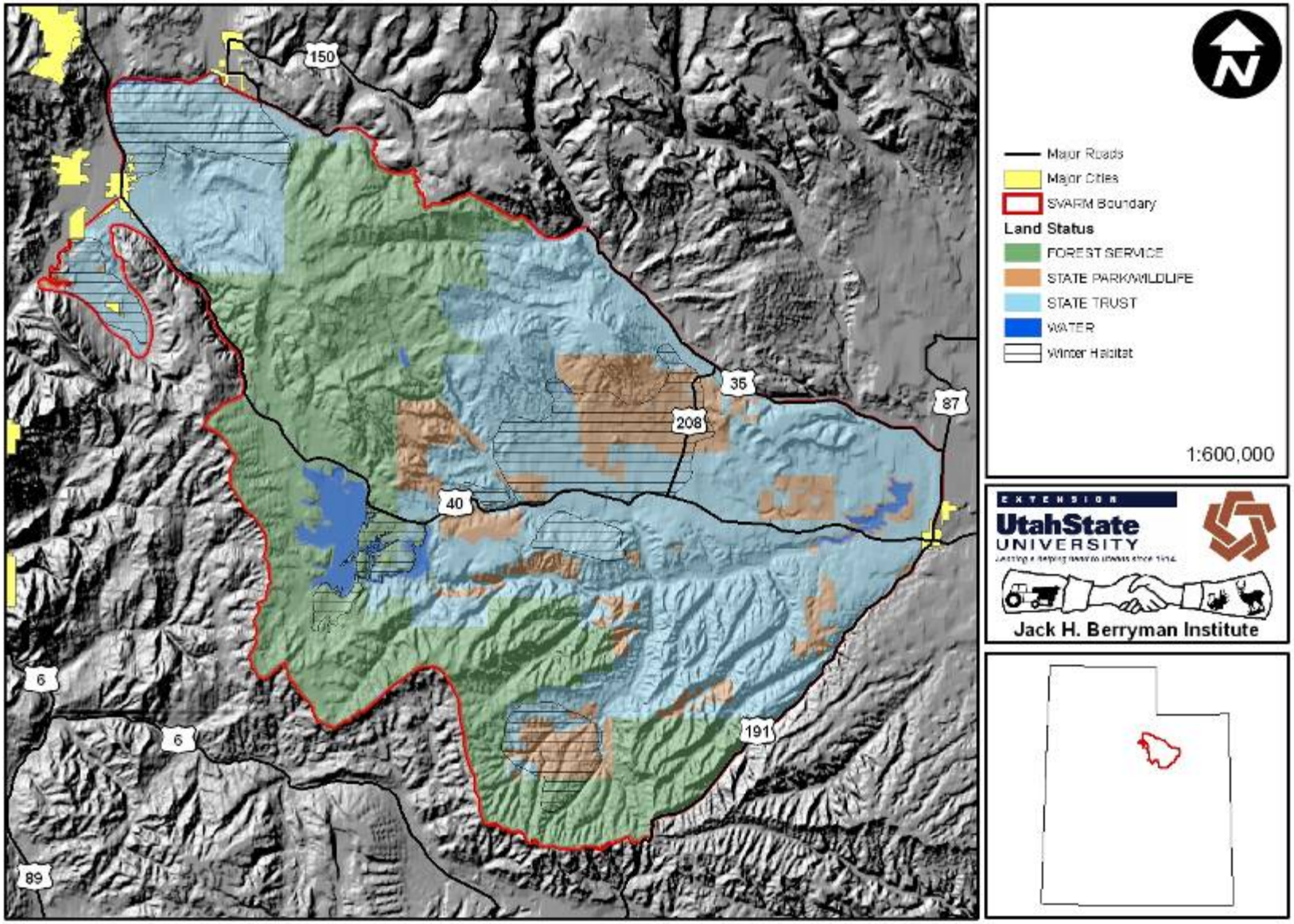

Figure 5. Location of sage-grouse winter habitat in the SVARM Resource Area, as identified by the UDWR, 1999.

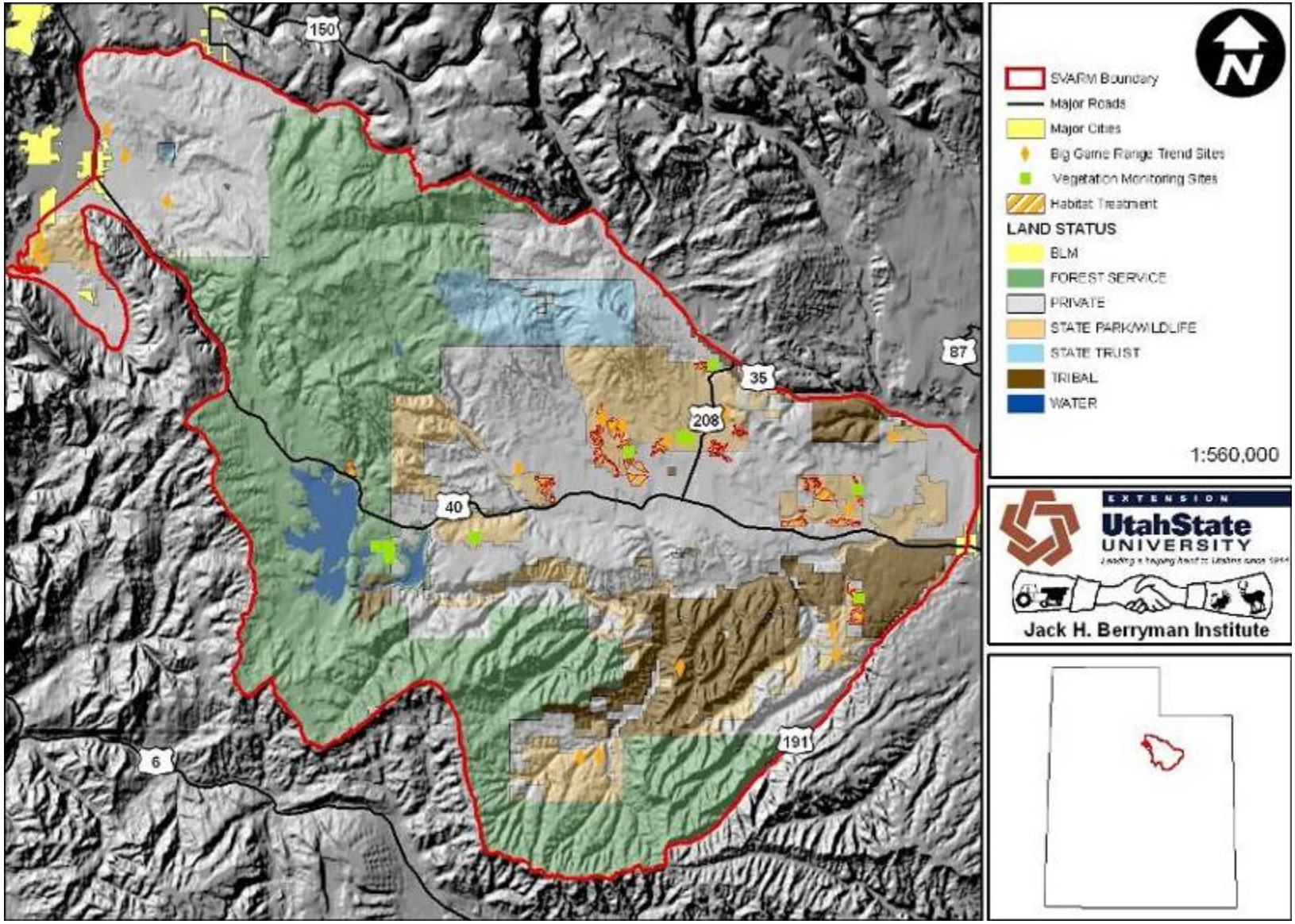

Figure 6. Location of UDWR Big Game Range Trend Sites, vegetation monitoring sites, and some habitat improvement projects in the SVARM Resource Area.

Table 3. Habitat improvement projects implemented in 2004 and 2005 and proposed for 2006 by the UDWR and USFS.

Year	**Project Name**	**Acres**
2004	Santaquin Draw brush chaining	1,500
	Mill Hollow PJ chaining	300
	Lower Red Creek sage seeding	100
	Road Hollow Lek	5+
2005	Gray Wolf Mountain PJ chaining	480
	Gray Wolf Mountain brush chaining	130
	Golden Stairs PJ chaining	185
	Allan Smith's - Dixie Harrow	325
2006 (proposed)	Coyote Draw lop and scatter	1,200
	Fruitland lop and scatter	500
	2-Bar lop and scatter	520
	East Santaquin PJ chaining	330
	Alan Smith seeding	450
	Trout Creek	Up to 300 acres, but likely not more than 170-200
	Wallsburg	500

III. 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. Keeping in mind the caveats above, we have assigned a rank of 'low', 'medium', 'high', or 'very high' to each threat with regard to its contribution in reducing population health or habitat condition, and its irreversibility. Again, given the stipulations above regarding a lack of empirical and locally-based information in many cases, we based these rankings on the best information available to us and our implicit, practical knowledge of the Resource Area. Ranking definitions are based on TNC (2005). Rankings are provided to help highlight potential priorities for subsequent strategies and actions.

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, and 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, 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 & Cabin Development

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

Growth of the human population in Wasatch and Duchesne Counties has led to increased land development. Figure 8 illustrates the trend in the number of residential building permits issued in Wasatch and Duchesne Counties between 1980 and 2005 (Bureau of Economic and Business Research 2005). In general, housing development has continued to increase in these counties since the early 1990s. In recent years, Wasatch County has experienced more growth than ever before. The historical high in growth rate was reached in Duchesne County in 1998. While it's since slowed, growth is once again approaching that rate (Bureau of Economic and Business Research 2005). Most growth in Wasatch County is centered around the towns of Midway City, Heber City, and Charleston (at the northeast end of Deer Creek Reservoir). Increasingly, however, homes are being built outside these incorporated areas on large (several acre) parcels. In Duchesne County, growth is primarily occurring outside of incorporated towns on similarly large parcels.

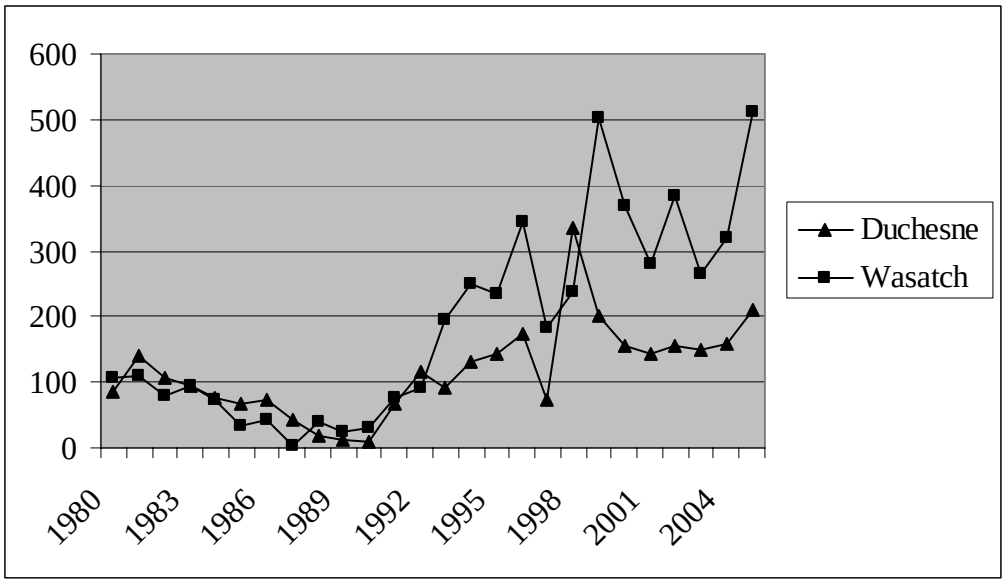

Figure 7. Number of housing permits issued in Wasatch and Duchesne Counties, 1980-2005.

Power lines, Fences, & Other Tall Structures

Sage-grouse are potentially subject to increased mortality and disturbance resulting from man-made structures including fences, power lines, and other tall structures (wind turbines, communication towers), though this threat is poorly understood. Sage-grouse may fly into these structures which can result in death or may injure them to the point where they can not effectively avoid predators. Sage-grouse mortalities due to collision with power lines, fences, and other tall structures have 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. Fragmentation may increase vulnerability to predation.

Fences have increased in number over the years, as allotments have been split and cross-fenced with the development of rural properties, and with construction of new county roads. Power lines have also increased in number and length (Figure 8), and transmission and service lines have been constructed to service mines and transfer electric power out of the area.

Renewable & Non-renewable Energy Development

Oil and gas development and exploration in the Resource Area has primarily occurred in Duchesne County. To date, no drilling has commenced in Wasatch County (Utah Division of Oil, Gas, and Mining 2006). In Duchesne County, oil and gas drilling has increased since 1991 (Figure 9) (Utah Division of Oil, Gas, and Mining 2005). The USFS is currently exploring options for oil and gas development on the Uinta National Forest and released an Environmental Impact Statement on February 2, 2006 (FR E6-1397) to determine the conditions under which leases would be issued.

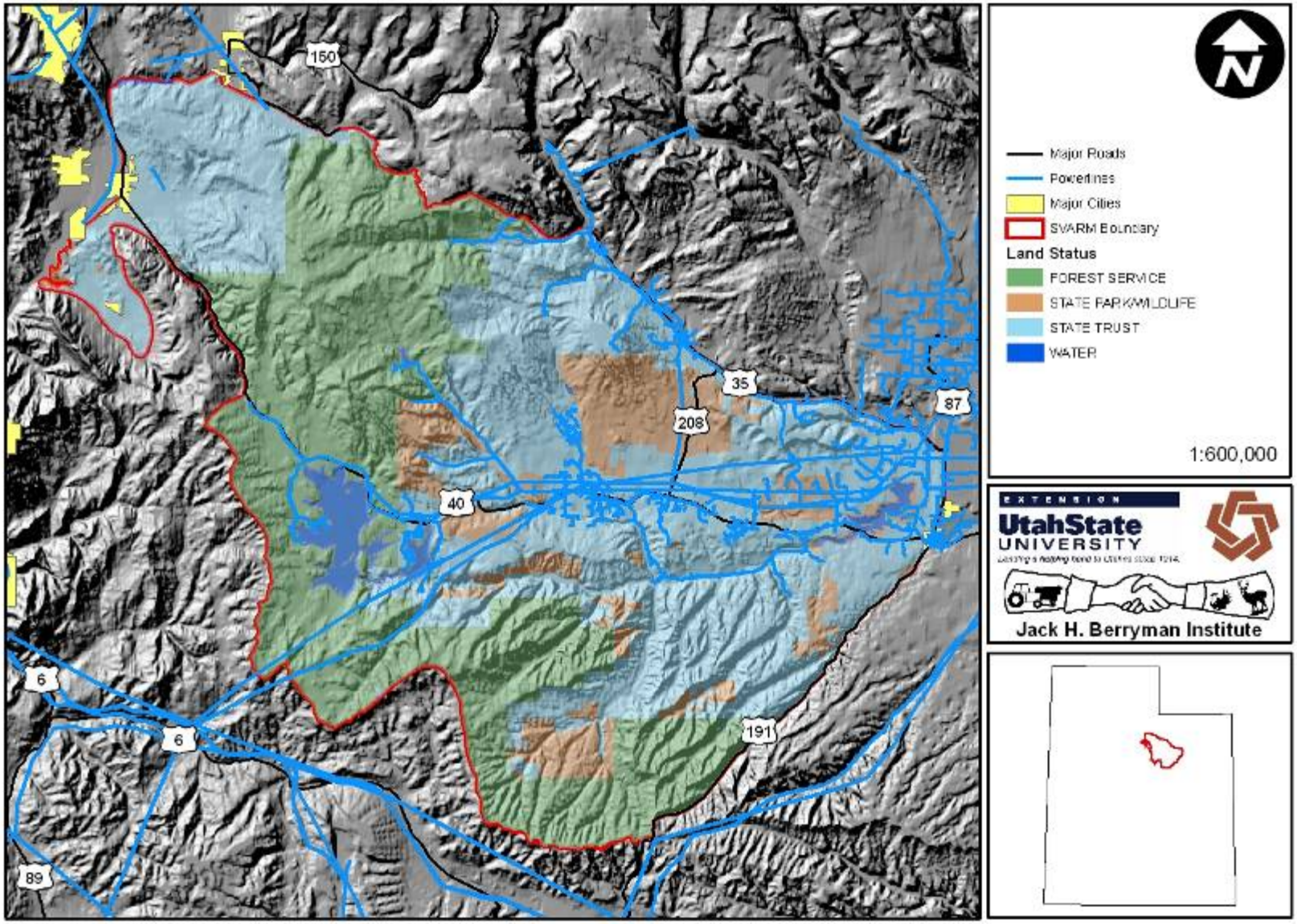

Figure 8. Location of powerlines in the SVARM Resource Area. Data from Connelly et al. (2004), obtained from http://sagemap.wr.usgs.gov/index.asp.

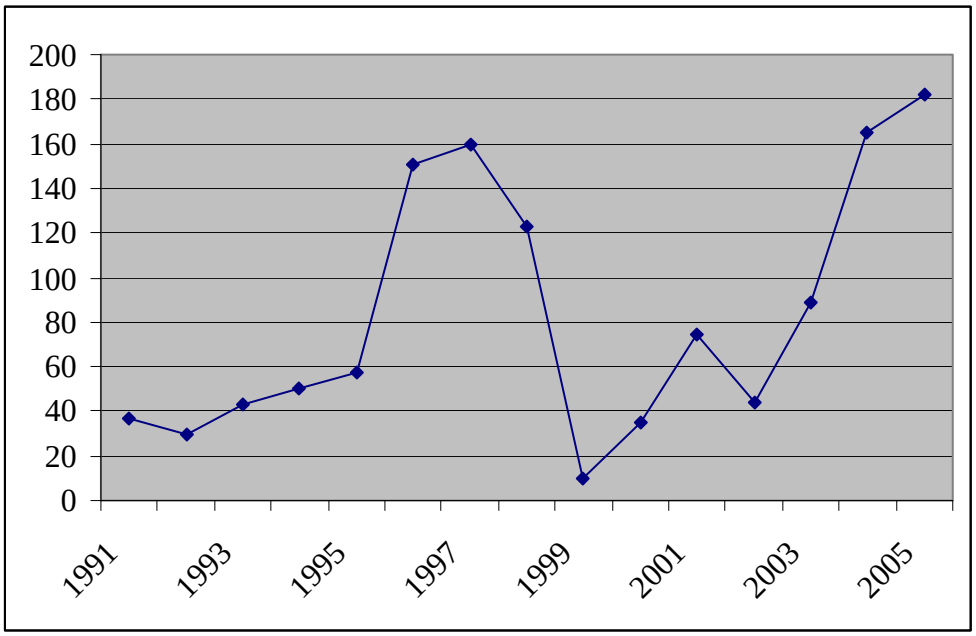

Figure 9. Number of oil and gas wells completed in Duchesne County, 1991-2005 (Utah Division of Oil, Gas, and Mining 2005).

Under the proposed action, the USFS will allow primarily controlled surface occupancy, or will restrict surface occupancy in areas near Currant Creek and areas north of Strawberry Reservoir where sage-grouse are located.

The location of drill sites in Duchesne County is depicted in Figure 10. Although drill sights only represent places where oil or gas depositions were sought, many sites were fruitful and pads now exist in those areas. Figure 11 is provided to illustrate generally, where oil and gas impacts are located in the Resource Area. Existing oil and gas impacts are generally not located in areas where sage-grouse are found.

In general, Oil and gas facilities have a small footprint, usually a few acres or less. Each pad often contains tanks and other equipment for a period of years. With depletion of the well, all facilities are removed and the pad is completely reclaimed. Some researchers believe facilities suppress sage-grouse use of habitat for some distance beyond the actual footprint of the facility (Robel et al. 2004). Compressor stations, active wells, and drilling rigs produce relatively loud and sustained noise that purportedly interferes with sage-grouse, particularly during the breeding season.

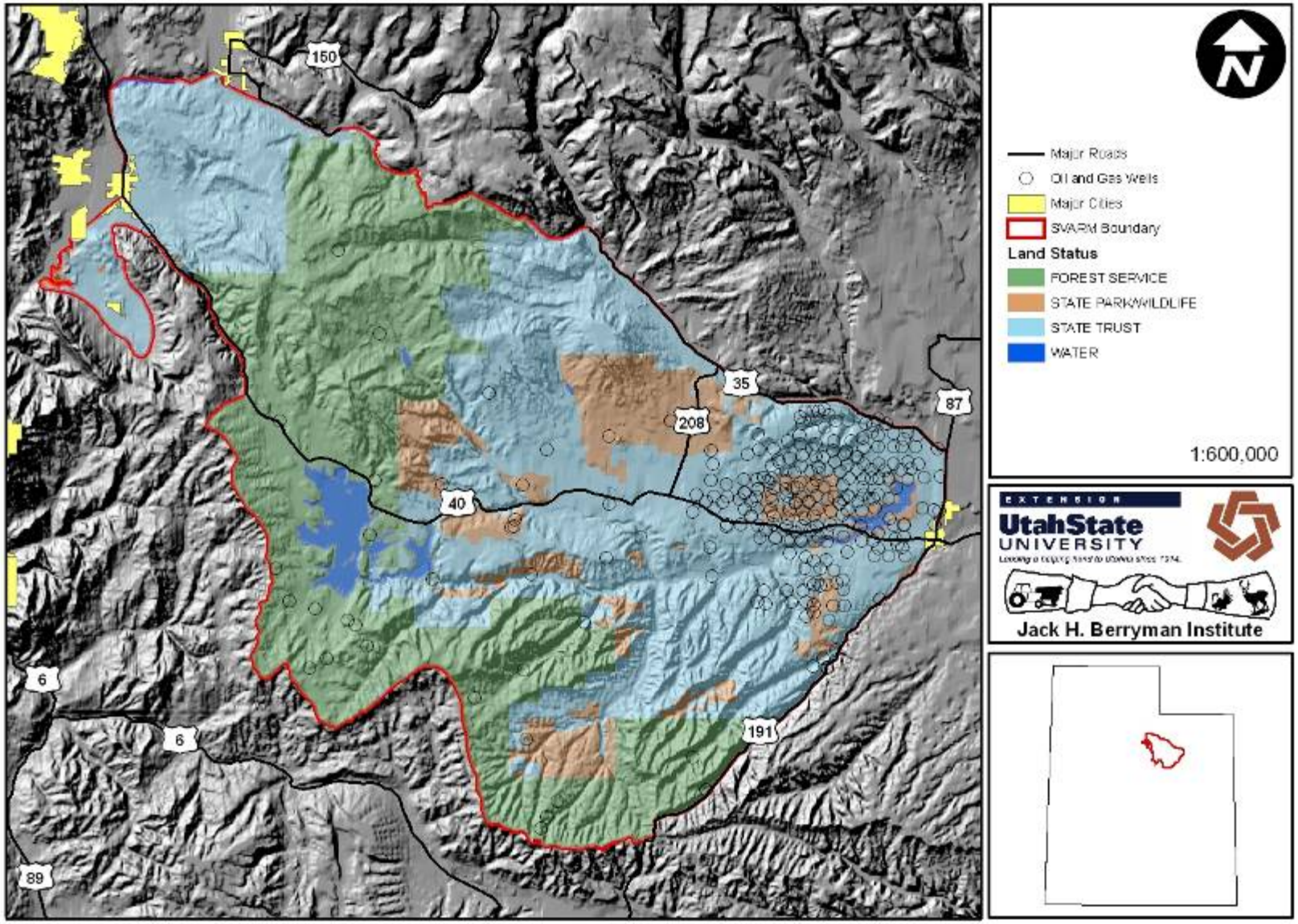

Figure 10. Location of drill sites in the SVARM Resource Area. Data obtained from http://www.ogm.utah.gov/oilgas/MAP_SEARCH/map_search.htm

Effective reclamation of oil and gas pads and other facilities, including the reestablishment of big sagebrush in some instances, is important for maintenance of sage-grouse habitat in these development areas. This can be challenging in drier portions of the Resource Area. Reclaimed pad sites have been used as leks sites in some parts of nearby Uintah Basin (B. Maxfield, UDWR, personal communication).

Roads

Collisions with motor vehicles, either while flying or while walking on or across roadways, are other 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 provide 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.

Conclusions

Development of homes and cabins and the associated human infrastructure (roads, power lines, etc) is likely one of the greatest threats to sage-grouse populations in the Resource Area at this time. Development results in loss of habitat for sage-grouse, fragments existing habitat, and creates barriers to movement, further isolating the population from surrounding areas. Wasatch County anticipates continued growth and development for the life of this plan (ten years). Further, there is the potential for oil and gas development in the Resource Area, however, the extent and severity of impacts to the sage-grouse population is unknown at this time and remains an open question for further study.

B. Drought and Weather

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

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).

Much of the west has experienced severe drought conditions during the early years of the 21st century. The Resource Area is part of the Uintah Basin. This area, and the rest of the state of Utah, has recently experienced drought conditions from 1999-2005 (Figure 11). In some parts of the state, drought conditions lead to sagebrush die-offs. Research efforts on sage-grouse and their habitat in the Resource Area have not documented any effects of drought on sage-grouse populations or sagebrush plant communities (R. Baxter, personal communication). However; UDWR biologists have documented and observed UDWR Big Game Range Trend sites changes in habitat, including sagebrush die-offs resulting from drought conditions (C. Clyde, UDWR, personal communication).

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 accumulation, forces birds to move to areas blown free of snow or areas with sagebrush large enough to extend 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. Biologists believe that sage-grouse populations declined dramatically during that winter. A far 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 implicated in influencing sage-grouse production (Connelly et al. 2000). Mild winters followed by relatively wet springs, can increase production (Wallestad 1975, Autenrieth 1981) by promoting good 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). Production in the Resource Area, as measured by brood success of radio-collared sage-grouse, has exceeded expectations and does not appear to have been limited by spring weather conditions in recent years (Baxter et al., unpublished reports, Appendix C).

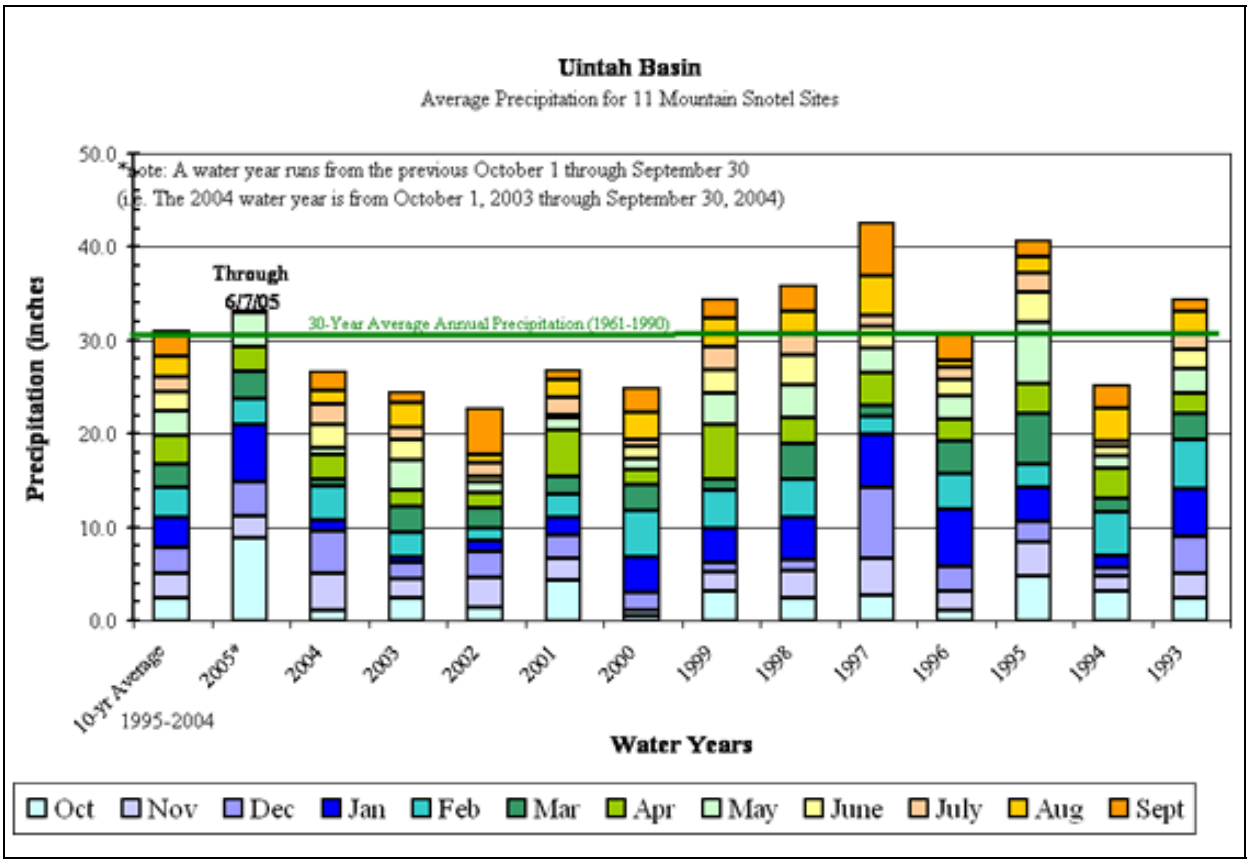

Figure 11. Precipitation in the Uintah Basin, which includes the Resource Area, from 1993-2005. From 2000-2005 precipitation fell below the 30-year average, considered drought conditions.

C. Hunting

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

The sage-grouse hunting season has been closed in the Resource Area since 1980. Prior to that, a limited season was open in the area. Illegal harvest, or poaching, of sage-grouse may occur in the Resource Area; however the extent and impacts of this is thought to be minimal. We feel that intensive research efforts that focus on radio-collared sage-grouse can help detect illegal harvest if, or when, it occurs.

D. Fire

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.

The effects of any particular fire event depend on several characteristics of the local area including dominant sagebrush species, aridity, soils, topography, and disturbance (Bunting et al. 1987, Miller and Eddleman 2000). In general, sagebrush species are fire adapted and will re-colonize 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 during the time of use (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, which has the potential of 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 fall under the purview of land management agencies like the BLM, USFS, and state and local governments. The USFS Uinta 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.

Cheatgrass and pinyon-juniper encroachment appear to be limited to small, isolated areas within the Resource Area. Fire management by the BLM and the USFS is done in close cooperation with the UDWR, which often provides a seed mix for post-burn rehabilitation. Fire planning is done carefully and cautiously in the Resource Area.

E. Livestock Grazing

Livestock grazing is an important use of sage-grouse habitat in the Resource Area and throughout the range of sage-grouse in the West. The impacts of livestock grazing on sage-grouse are not clear, yet they are often contentious and controversial, perhaps more so than any other issue. Published literature and opinions run the gamut from completely compensatory or beneficial influence on one side, to incompatible, harmful practices that should be eliminated (Connelly et al. 2004). Due to the controversy, and following a thorough review on the subject by Rowland (2004), 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. (2004).

Impacts to Sage-grouse Habitat

Rowland (2004:17-19) 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."

Rowland (2004:17-19) also 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 15cm, compared to 30 to 50cm 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 5cm during the summer."

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 (Myers 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 some sagebrush rangelands in the Resource Area. There has been a general decline in sheep numbers in the Resource Area over the last 50 to 60 years while cattle numbers increased into the 1960s, and then began a decline. On the Uinta National Forest, grazing management has shifted to a rest-rotation management scheme. Cattle numbers on the Forest are down by 18% and sheep are down by 20% from 1977 rates. Today, the earliest turn-out date has been pushed back to June 16 (USDA-FS 2004). Some incompatible grazing likely occurs within the Resource Area potentially impacting habitat, breeding behavior, and movement patterns of sage-grouse. However; the majority of livestock operations appear to be coexisting with sage-grouse, and sage-grouse populations are stable to increasing. However, no studies have been conducted in the Resource Area to directly address the issue of grazing impacts on sage-grouse and this is an area that may warrant future research.

F. OHV 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 and use has increased in recent years with the creation and expansion of Strawberry Reservoir. OHV users (ATVs and snowmobiles) frequent the area throughout the year. Specific impacts to sage-grouse populations are unknown, but thought to have potentially detrimental effects on sage-grouse movement patterns and habitat-use patterns.

G. Invasive/Noxious Weeds

The Utah Department of Agriculture (Section 4-17-2) defines noxius weeds as "…any plant the commissioner determines to be especially injurious to public health, crops, livestock, land, or other property." 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."

Noxious weeds have been 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 (RAC) 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 Secretary of the Interior approved the guidelines in 1997. Beginning in November 1998, users of BLM administered land in Utah will be required to use only certified noxious weed-free hay, straw, or mulch. Approved products for livestock feed on public lands include pellets, hay cubes, processed grains and certified hay, straw or mulch, all of which are normally available at many feed stores and producers in Utah. 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.

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). However, cheatgrass is not listed there, nor is it included in individual county lists for Uintah, Duchesne, or Daggett County. Cheatgrass is an annual grass native to Russian and parts of northern Europe. When it invades sagebrush communities, cheatgrass can increase fire frequency and has the potential to convert sagebrush communities to grasslands or annual grass rangelands. Cheatgrass has also been implicated in encouraging the establishment of other invasive species (Grahame and Sisk 2002).

Each year Duchesne County applies over $30,000 dollars in herbicides for the control of noxious weeds on right-of-ways and on private lands. Duchesne County has a cooperative agreement with other agencies such as the UDWR, SITLA, BLM, and USFS to help manage noxious weeds in the County.

Noxious weeds are believed to be a moderate problem for brood-rearing and summer habitats in the Resource Area and a severe threat for winter habitat. Existing county control programs and habitat treatment precautions should be monitored to determine if they are preventing this threat from increasing in scope and/or severity.

H. Parasitism & Disease

Several bacterial and parasitic diseases may effect 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 to be most likely to impact sage-grouse populations (Connelly et al. 2004).

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, and birds 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 sufficiently high level of the virus in the bloodstream 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 (nineteen birds), Montana (three birds), and Alberta, Canada (five birds). In that same year, WNV was detected in chickens in Price, Utah and in mosquito pools in the Resource Area. 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 Resource Area, and also in a prairie falcon in Carbon County, south of the Resource Area. Several other bird species were also confirmed to have the virus in Uintah County (B. Maxfield, UDWR, personal communication). 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), which include *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. 2004). In Wyoming, Colorado, and Idaho from 1932–1953 this disease resulted in significant losses of young sage-grouse (Honess and Post 1968), however no cases have been documented since the 1960s (Connelly et al. 2004). Cases were typically reported in areas where large numbers of birds are concentrated. The concentration led to contamination of 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 within 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 *Raillietina centrocerci* may have on sage-grouse populations. The Canadian Sage Grouse Recovery Strategy indicates that this infection may be a largely overlooked cause of mortality. 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 and here are no documented cases of *Raillietina centrocerci* in the Resource Area. This does not imply that this infection does not impact sage-grouse therein, however.

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, although 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 affect 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 impact sage-grouse populations in the Resource Area. As previously mentioned, in 2005 a dead sage-grouse was found in the Uintah Basin, approximately 150 miles to the east of the Resource Area, that was infected with WNV. Parts of Colorado and Wyoming east of the Resource Area have also detected infected birds. There is potential for disease persistence from transmission from these areas to the Resource Area. Ongoing studies of sage-grouse in the Resource Area offer a unique opportunity for early detection of this disease in sage-grouse populations in the Resource Area. All birds exhibiting symptoms of this disease, and all dead birds are tested for WNV as part of an early detection program.

Other diseases discussed in this section may have an effect on sage-grouse but only one has been observed in the Resource Area and, therefore, are considered a limited potential threat.

I. 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 golden eagle, 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 three primary ways:

1. Success of nests
2. Survival of juveniles during the first few weeks after hatch
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 warrants additional study.

Nest success varies by year, area, population density, and management strategy (Connelly et al. 1998, Schroeder et al. 1999). Connelly et al. (2000) report that nest success rates are generally >40% and suggest that nest predation does not appear to be a problem across the range of sage-grouse. In contrast, Gregg (1991) and Gregg et al. (1994) suggest that nest predation may 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 et al. 2000). Research suggests that the advancing population of a nonnative predator, the 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 verified the identity of artificial nest predators (Baxter and Flinders, unpublished).

History of Predator Management in Utah

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 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 grouse. To better 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 involving both State and Federal agencies. 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 Service districts (districts). From 1936 to 1986, the USFWS managed the program as Animal Damage Control. In 1986, it 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 on record (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 quite a lot 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 traps and apply baits. Figure 12 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 at seven to ten coyotes for each dead 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 used 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 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 specific areas for bird suppression not treated by the federal program.

It is difficult to assess the poison years in terms of population suppression 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 both. Figure 13 shows red fox take from 1972 to 2004.

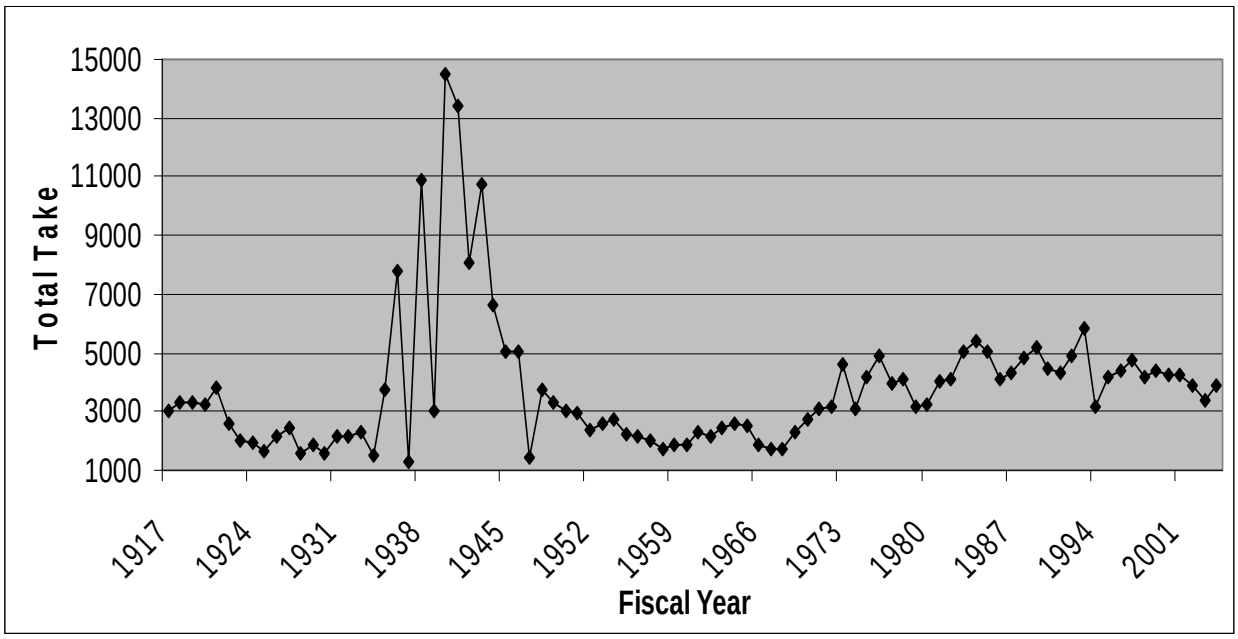

Figure 12. USDA-WS reported coyote take in Utah, 1917-2004.

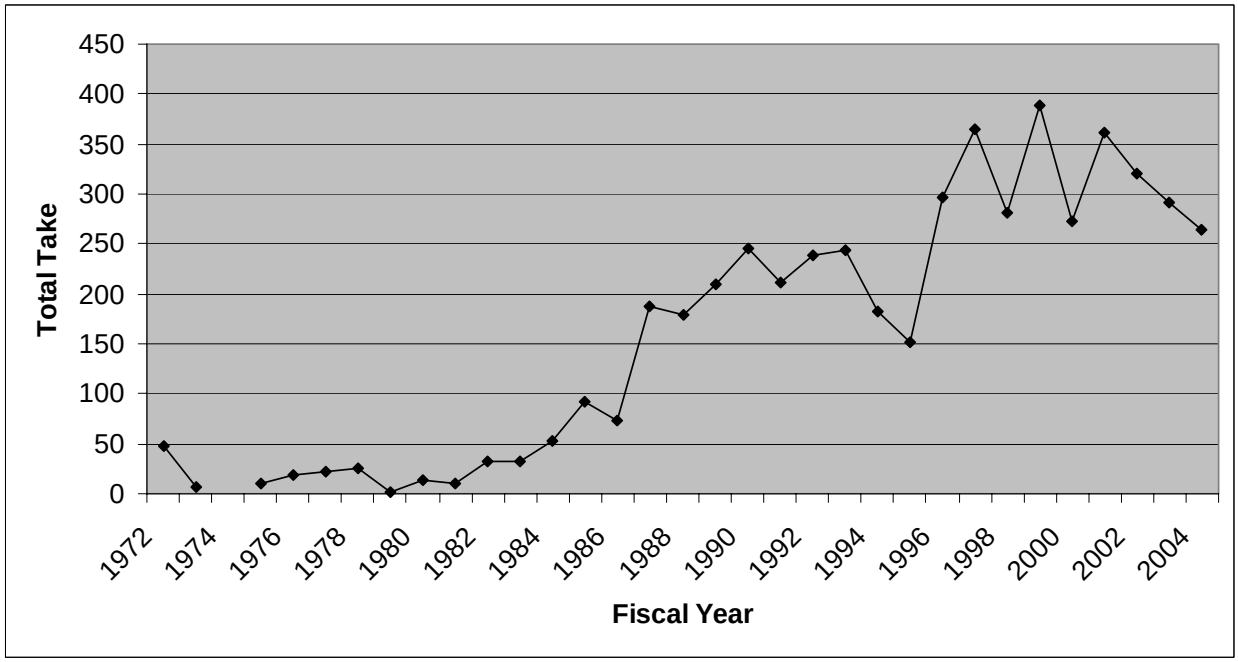

Figure 13. USDA-WS reported fox take in Utah, 1972-2004.

It is interesting to observe that the statewide increase in red fox abundance has occurred during the lowest period of coyote control. Sargeant et al. (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.

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 (1933) reported the expansion of red fox in Wisconsin, which was displacing the grey fox, while 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 40-45ºN 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 that "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 mid west 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 14 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 ten 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.

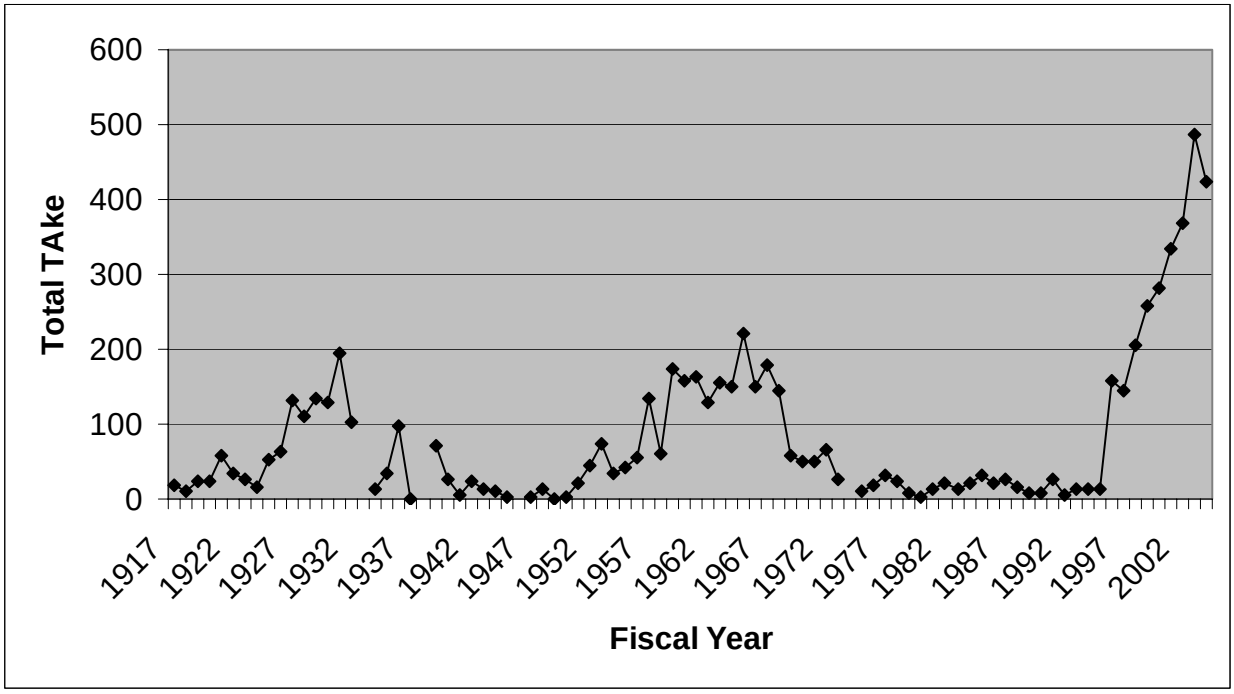

Figure 14. USDA-WS reported skunk take in Utah, 1917-2004.

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, likely keeping 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 the coyote population. 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 impact 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 that 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, which may affect populations.

Autenrieth (1981) suggested that nest predation was likely the most important population constraint on sage grouse in his study area. Here, predation on adult birds does occur and may be significant in some cases. Presnall and Wood (1953) reported tracking a coyote approximately 5 miles to its den in northern Colorado, and finding evidence along the way that the coyote had killed 3 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 (1992) documented sage-grouse remains at 4 of the 30 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 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 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 effect on sage-grouse of 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, a 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 midcontinent area appear to be suppressed by man." The authors noted an inverse relationship between red fox and coyote populations and speculated that "...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 because of the fear of being killed by coyotes. Thus, they inferred that a red fox population would increase if the coyote population were reduced, because removal of territorial coyotes would create vacant coyote territories that could then become occupied by red foxes.

Still, the presence of coyotes does not completely displace red foxes. 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 very long after the coyotes are removed. Gese and Ruff (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..." In Utah, USDA-WS removes a small percentage (2-4%) of the estimated coyote population, not enough, even at a small scale, to create the vacant territories that would theoretically allow red fox populations to increase substantially. 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 an applied management plan 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 1988, Phillips 1990). Sage-grouse also respond to 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 or 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 her first nest is destroyed by predators early in the incubation period (Patterson 1952, Eng 1963, Connelly et al. 1993, Schroeder 1997), although 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 this program is managed by USDA-WS.

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

Predator control for the protection of cattle replaced some of the reduction in control because of 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 16,719 predators in 1939, yet that figure doesn't reflect all of those which were 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 likely represents a larger percentage of the population of the day. Modern records (since 1972) show that on average, USDA-WS in Utah averages 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.

Utah's coyote population today is near 100,000 based on studies by USDA-WS research personnel (Connolly, USDA-WS, unpublished data, 1996). Predator damage management today focuses on individuals causing damage, as opposed to population reductions (or eradication in the case of the wolf) of the past. Current control is practiced on less 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 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 census 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 worked 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, which fed on the baits. Compound 1080 is highly selective to canines but 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, which arrived in the 1970s. Ravens have increased in numbers from the 1970s likely due to more favorable conditions, including human food sources (landfills, etc.). 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 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 all to expand in population numbers and range. Protections were placed at this time on ravens and magpies in the form of removing bounties and adding laws that prohibited shooting and nest destruction. The reduction in sheep numbers added to the favorable habitats for predators and raptors by the increases in prey base, and improved meadows and riparian areas. Red foxes arrived at this time and expanded in numbers because of the more favorable environments as previously discussed.

Incidentally, sage-grouse could have also benefited from the high numbers of sheep concentrated in winter areas. Properly managed 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, changes in the environment since the 1970s have 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

Studies by Bunnell et al. (2000) and Baxter et al. (unpublished reports, Appendix B) have demonstrated the detrimental effects of raven and nonnative red fox predation on sage-grouse populations in the Resource Area. Although, many sage-grouse predators occur in the Resource Area, ravens and nonnative red foxes are believed to have the greatest impact on sage-grouse populations in the Resource Area (Bunnell et al. 2000, Baxter et al., unpublished reports). USDA-WS conducts predator control in the area during sage-grouse nesting and early brood-rearing periods, and in relation to livestock operations which is likely to influence predator-prey dynamics involving sage-grouse.

Due largely to translocation of hens from other populations (Diamond Mountain, Parker Mountain), sage-grouse numbers in the Resource Area are increasing or stable. Once sage-grouse numbers reach approximately 500 breeding birds, according to lek counts, the UDWR intends to decrease predator control targeted towards nest and chick predators, to assess the populations response. Predation by nonnative predators, including domestic animals and red foxes, remains an issue of great concern, and will be continually assessed through studies of radio-collared sage-grouse in the Resource Area by BYU graduate students under the direction of Dr. Jerran Flinders. Close communication between BYU, the UDWR, USDA-WS, and other SVARM partners will ensure an adaptive management response to this issue in the future.

J. Vegetation Management

Vegetation management conducted in the past was a reflection of the priorities of the time, and on the mandates and policies of the federal government, when vegetation management was done on 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 done 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 restorative treatments designed to remove cheatgrass and other invasive/noxious weeds, removal of pinyon-juniper stands, and restoration of native species.

Several treatment types are used to manipulate sagebrush communities. Connelly et al. (2004:7-46 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 plant/wildlife community health), vegetation management is not likely to be an important negative impact to sage-grouse populations in the Resource Area. As discussed in an earlier section of this Plan, several habitat management projects have been implemented, or proposed, that 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 with regards to habitat and watershed improvements in the Resource Area. Increased focus and coordination is likely to improve project planning, implementation, and outcomes.

Several thousand acres have been treated in the Resource Area with the intent of improving sage-grouse habitat (Table 3). Studies of radio-collared sage-grouse conducted by BYU graduate students (Baxter et al. unpublished reports, Appendix B) describe the use of treated areas by radio-collared birds. We feel there is a great need to continue to 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.

III. 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 SVARM 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 SVARM 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 SVARM members. However, 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 any resources to implementing, initiating, or completing any actions. However, it provides a framework of resources and expertise.

To help prioritize implementation of the Plan, efficiently use resources, and develop and secure funding, we have also identified which threats each strategy addresses. In addition, we list the aspects of sage-grouse ecology likely to be impacted by each strategy.

A. Strategies and Actions

1. **Strategy**: Provide a system and the reasonable extent of domestic livestock grazing that maintains and improves both the long-term stability of Greater Sage-Grouse populations, and habitats and the livestock industry in the Resource Area.
   - **1.1. Action**: Coordinate grazing management with livestock operators to reduce resource and timing conflicts on leks and prime nesting habitat when possible.
   - **1.2. Action**: Apply grazing management practices to achieve desired conditions including maintenance of residual herbaceous vegetation appropriate for the site.
   - **1.3. Action**: Encourage implementation of grazing systems that provide for areas and times of deferment, while taking into consideration the resource capabilities and needs of the livestock operator.
   - **1.4. Action**: Manage livestock to enhance riparian conditions.

Partners: NRCS, UFBF, UDWR, USFS, SITLA, private partners
Threats Addressed: Livestock grazing, vegetation management
Aspects of Sage-grouse Ecology Addressed: Nesting habitat quality, brood-rearing habitat quality, population distribution

2. **Strategy:** Maintain and, where possible, improve grass/forb component in the understory in nesting and brood-rearing areas.
   - **2.1. Action**: Reclaim and/or reseed areas disturbed by treatments when necessary, using seed mixtures with appropriate grasses and desirable forbs.
   - **2.2. Action**: Restore understory vegetation in areas lacking desirable quality and quantity of herbaceous vegetation, where economically feasible.
   - **2.3. Action**: Conduct vegetation treatments to improve forb diversity (e.g., harrowing, aerating, chaining) and reclaim or reseed disturbed areas, if needed.
   - **2.4. Action**: Develop management techniques to increase forb diversity and density in sagebrush steppe, within limits of ecological sites and annual variations.

Partners: UDWR, NRCS, USFS, private partners
Threats Addressed: Livestock grazing, vegetation management, invasive/noxious weeds, pinyon/juniper encroachment
Aspects of Sage-grouse Ecology Addressed: Nesting habitat quality, brood-rearing habitat quality, population distribution, connectivity of seasonal habitat types, connectivity of populations and subpopulations.

3. **Strategy:** Enhance existing riparian areas or create small wet areas to improve nesting and brood-rearing habitat.
   - **3.1. Action**: Identify opportunities or needs to create small wet areas, implement such projects where economically feasible.
   - **3.2. Action**: Design and implement livestock grazing management practices to benefit riparian areas.
   - **3.3. Action**: Modify or adapt pipelines or developed springs, to create small wet areas.
   - **3.4. Action**: Locate projects to minimize the potential loss of water table associated with wet meadows.
   - **3.5. Action**: Protect existing wet meadows and riparian areas where necessary.
   - **3.6. Action**: Manage vegetation and artificial structures to increase water-holding capability of areas.
   - **3.7. Action**: Install catchment structures to slow run-off, hold water, and eventually raise water tables.

Partners: BYU, UDWR, USFS, NRCS, private partners
Threats Addressed: Livestock grazing, vegetation management
Aspects of Sage-grouse Ecology Addressed: Brood-rearing habitat quality, summer/fall habitat quality, connectivity of seasonal habitat types

4. **Strategy:** Manage pinyon/juniper stands to reduce encroachment into sagebrush/grass communities
   - **4.1. Action**: Remove encroaching trees and tall shrubs mechanically (chainsaws, chaining, etc.) or by other methods, to maintain visibility at lek sites and security from predation in other seasonal habitats.
   - **4.2. Action**: Brush-cut or treat with other mechanical methods specified areas and re-claim or re-seed as necessary.
   - **4.3. Action**: Coordinate with State Forester to expand defensible space programs to improve sage-grouse habitat where possible.

Partners: UDWR, DNR, USFS, private partners
Threats Addressed: Pinyon/juniper encroachment, vegetation management, fire
Aspects of Sage-grouse Ecology Addressed: Seasonal habitat quality, connectivity of seasonal habitat types

5. **Strategy:** Improve lek vegetation conditions to allow for predator recognition and visibility.
   - **5.1. Action**: Open lek areas that have been invaded by sagebrush and other shrubs.
   - **5.2. Action**: Map and inventory leks with potential for restoration.
   - **5.3. Action**: Maintain and enhance desired conditions for leks.
   - **5.4. Action**: Coordinate vegetation management to maintain desired conditions
   - **5.5. Action**: Evaluate/monitor treatment effects.

Partners: UDWR, BYU, USFS, private partners
Threats Addressed: Vegetation management, pinyon/juniper encroachment, fire,

invasive/noxious weeds
Aspects of Sage-grouse Ecology Addressed: Nesting habitat quality, population distribution

6. **Strategy:** Maintain and improve habitat conditions in winter range.
   - **6.1. Action**: Treat decadent stands of sagebrush (harrowing, aerator, brush beating, chain, spike), where appropriate, to create uneven aged stands of sagebrush across the Resource Area.
   - **6.2. Action**: Establish easements or other land protection in crucial sage-grouse use areas.
   - **6.3. Action**: Work with county planners and county council to establish zoning ordinances for crucial winter habitat that protect those areas from inappropriate development.

Partners: UDWR, NRCS, USFS, BYU, USU Extension, County Planning Department, private partners, private partners
Threats Addressed: Vegetation management, invasive/noxious weeds, home/cabin development, renewable and nonrenewable energy development, roads, power lines, fences, and other tall structures
Aspects of Sage-grouse Ecology Addressed: Seasonal habitat quality, connectivity of seasonal habitat types, population distribution

7. **Strategy**: Protect crucial habitat from inappropriate development.
   - **7.1. Action**: Work with county planners and county council to establish zoning ordinances for crucial habitat that protect those areas from inappropriate development.
   - **7.2. Action**: Establish easements or other land protection in crucial habitat.
   - **7.3. Action**: Work with USFS and other federal agencies to protect crucial sage-grouse habitat from renewable and non-renewable energy development.
   - **7.4. Action**: Maintain or reestablish sagebrush patches of sufficient size and appropriate shape, to support sage-grouse between agricultural fields.
   - **7.5. Action**: Work with NRCS and others to maintain and enroll important sage-grouse habitats involved in Farm Bill programs currently in agricultural production.
   - **7.6. Action**: Encourage use of sage-grouse friendly seed mixes, including bunchgrasses, forbs, and big sagebrush, in plantings.
   - **7.7. Action**: Encourage interest and enrollment of key sage-grouse habitats in the Farm Bill programs.

Partners: Wasatch County, BYU, USFS, UDWR, Duchesne County, private partners, NRCS
Threats Addressed: Home/cabin development, roads, power lines, fences, and other tall structures, renewable and nonrenewable energy development
Aspects of Sage-grouse Ecology Addressed: Seasonal habitat quality, population distribution, connectivity of seasonal habitat types, connectivity of populations and subpopulations

8. **Strategy:** Minimize impacts of noxious and invasive weeds.
   - **8.1. Action**: Identify areas where noxious/invasive weeds are encroaching on sage- grouse habitat.
   - **8.2. Action**: Treat areas where noxious/invasive weeds and non-desirable introduced species (e.g. smooth brome) have become, or are at risk of becoming, a factor in sage-grouse habitat loss or fragmentation.
   - **8.3. Action**: Work with existing weed management programs to incorporate sage-grouse habitat needs.
   - **8.4. Action**: Identify large areas of noxious/invasive weeds and non-desirable introduced species (e.g. smooth brome), that are not meeting sage-grouse habitat needs and reseed

where appropriate.

8.5. Action: Manage burned areas, transportation, utility, and pipeline corridors, and vegetation treatments to minimize undesirable vegetation where possible.

8.6. Action: Work with County weed board to increase awareness of weed problems in sage-grouse and other important wildlife habitat.

Partners: UDWR, USFS, County Weed Boards, NRCS, Wasatch County Coordinated Weed Management Area (CWMA), UDOT, private partners

Threats Addressed: Invasive/noxious weeds, fire, roads, power lines, fences, and other tall structures, pinyon/juniper encroachment, vegetation management

Aspects of Sage-grouse Ecology Addressed: Seasonal habitat quality, connectivity of seasonal habitat types

9. Strategy: Minimize impacts of utility lines, fences, and roads in sage-grouse habitat.

9.1. Action: Avoid new construction during important periods and re-route lines where technically and economically feasible to avoid impacts.

9.2. Action: Schedule maintenance to avoid important periods, however, maintenance in emergency situations will be unrestricted.

9.3. Action: Install raptor deterrents when applicable.

Partners: County road departments, private partners, UDWR

Threats Addressed: Roads, power lines, fences, and other tall structures

Aspects of Sage-grouse Ecology Addressed: Connectivity of seasonal habitat types, connectivity of populations and subpopulations

10. Strategy: Minimize sage-grouse habitat loss to oil and gas activities.

10.1. Action: Increase/encourage participation by private oil/gas industry in SVARM.

10.2. Action: Encourage use of central tanks and locate those in areas with least impact to sage-grouse.

10.3. Action: Use directional drilling where feasible to minimize surface disturbance, particularly where well density exceeds 1:160 acres.

10.4. Action: Minimize pad size and other facilities to the extent possible, consistent with safety.

10.5. Action: Plan and construct roads to minimize duplication.

10.6. Action: Cluster development of roads, pipelines, electric lines and other facilities.

10.7. Action: Minimize noise disturbance (directing mufflers, glass packs, etc.) in and near lek and nesting habitat.

10.8. Action: Use existing, combined corridors where possible.

10.9. Action: Use early and effective reclamation techniques, including interim reclamation, to speed return of disturbed areas to use by sage-grouse.

10.10. Action: Reduce long-term footprint of facilities to the smallest possible.

10.11. Action: Avoid aggressive, nonnative grasses (e.g. intermediate wheatgrass, pubescent wheatgrass, crested wheatgrass, smooth brome, etc) in reclamation seed mixes.

10.12. Action: Eliminate noxious weed infestations associated with oil and gas development disturbances.

10.13. Action: Minimize width of field surface roads.

10.14. Action: Avoid ridge top placement of pads and other facilities.

10.15. Action: Use low-profile, above-ground equipment, especially where well density exceeds 1:160 acres.

10.16. Action: Avoid breeding/nesting season (March 1 – June 30) construction and drilling

when possible in sage grouse habitat.

10.17. Action: Limit breeding season (March 1 – May 1) activities near sage grouse leks to portions of the day after 9:00 a.m. and before 4:00 p.m.

10.18. Action: Reduce daily visits to well pads and road travel to the extent possible in sage-grouse habitat.

10.19. Action: Utilize well telemetry to reduce daily visits to wells, particularly where well density exceeds 1:160 acres.

10.20. Action: Locate compressor stations off ridge tops and at least 2,500 feet from active sage-grouse leks, unless topography allows for closer placement.

10.21. Action: Avoid locating facilities within a quarter mile of active sage-grouse leks, unless topography allows for closer placement.

10.22. Action: Plan for and evaluate impacts to sage-grouse of entire field development rather than individual wells.

10.23. Action: Study, and attempt to quantify, impacts to sage-grouse from oil and gas development.

10.24. Action: Evaluate need for near-site and/or off-site mitigation to maintain sage- grouse populations during oil and gas development and production, especially where well density exceeds 1:160 acres.

10.25. Action: Implement near-site and/or off-site mitigation as necessary to maintain sage-grouse habitat quality.

10.26. Action: Share sage-grouse data with industry to allow planning to reduce impacts.

Partners: UDWR, USFS, private partners, BLM, Division of Oil Gas & Mining (DOGM), SITLA, BYU

Threats Addressed: Renewable and nonrenewable energy development, invasive/noxious weeds, roads, power lines, fences, and other tall structures

Aspects of Sage-grouse Ecology Addressed: Seasonal habitat quality, connectivity of seasonal habitat types, population distribution, connectivity of populations and subpopulations

11. Strategy: Minimize the impact of extraordinary predation.

11.1. Action: Modify power lines and wood fence posts (to remove raptor perches) in important sage-grouse areas, where feasible, and where predator concerns have been identified.

11.2. Action: Remove trees, remove/modify raptor perches, and maintain quality sagebrush habitat, where predation concerns on sage-grouse have been identified.

11.3. Action: Begin site-specific predation management considering all predator species (especially common ravens and red fox) where necessary and appropriate.

11.4. Action: Work with County planners and private developers to incorporate trash minimization and domestic animal control measures in CCNRs.

Partners: UDWR, County planning departments, USDA-WS, BYU, private partners

Threats Addressed: Predation, home/cabin development, power lines, fences and other tall structures

Aspects of Sage-grouse Ecology Addressed: Population size, population distribution, connectivity of populations and subpopulations

12. Strategy: Improve knowledge of diseases and parasites in sage-grouse populations.

12.1. Action: Collect sage-grouse parasite and disease organism samples while handling birds for other research, when possible.

12.2. Action: Monitor radio-collared and other sage-grouse for West Nile Virus and other

disease outbreaks.
Partners: BYU, UDWR, Health Department, UT Department of Agriculture
Threats Addressed: Parasites and disease
Aspects of Sage-grouse Ecology Addressed: Population size, population distribution

13. Strategy: Improve knowledge of genetics in sage-grouse in minimum viable populations.
- **13.1. Action**: Collect samples for genetic research from all known breeding complexes (including hunted and un-hunted areas) when possible.

Partners: UDWR, BYU
Threats Addressed: None
Aspects of Sage-grouse Ecology Addressed: Population size, connectivity of populations and subpopulations, population distribution

14. Strategy: Increase size of sage-grouse population in the Resource Area.
- **14.1. Action**: Continue translocation efforts as called for by UDWR, BYU, and other participating agencies and organizations
- **14.2. Action**: Continue existing predator management activities as called for by UDWR, USDA-WS, BYU, and other participating agencies and organizations.

Partners: UDWR, USDA-WS, BYU, other participating local working groups
Threats Addressed: Predation
Aspects of Sage-grouse Ecology Addressed: Population size, population distribution, connectivity of populations and subpopulations

15. Strategy: Maintain and increase long-term habitat and population monitoring and research.
- **15.1. Action**: Maintain long-term habitat monitoring sites on the Resource Area (as monitored by the Utah Big Game Range Trend Studies program).
- **15.2. Action**: Maintain and increase radio-monitoring of translocated sage-grouse.
- **15.3. Action**: Work with agency partners to maintain and increase funding for research and monitoring.
- **15.4. Action**: Continue to monitor sage-grouse populations through use of lek counts.
- **15.5. Action**: Increase lek search activities to find new lek sites in the Resource Area.
- **15.6. Action**: Work with USDA-WS to monitor populations of sage-grouse predators.

Partners: UDWR, BYU, USDA-WS, URMCC, USFS, USU
Threats Addressed: Vegetation management
Aspects of Sage-grouse Ecology Addressed: Seasonal habitat quality, population distribution, population size, connectivity of populations and subpopulations

16. Strategy: Increase public education about sage-grouse ecology, conservation, and management.
- **16.1. Action**: Work with Audubon Society to increase educational opportunities regarding sage-grouse in the Resource Area.
- **16.2. Action**: Develop educational materials (brochures, presentations, etc.) and deliver to Friends of Strawberry Valley, Strawberry Anglers Association, Daniels Summit Lodge, Strawberry Water Users and other potential stakeholders to increase awareness.
- **16.3. Action**: Encourage use of signage in appropriate areas to increase awareness of crucial sage-grouse habitats.
- **16.4. Action**: Develop sage-grouse identification materials for distribution to recreationists, bird watchers, and other stakeholders.

Partners: UDWR, USFS, BYU, USU Extension, NRCS, County Council
Threats Addressed: OHV recreation
Aspects of Sage-grouse Ecology Addressed: Seasonal habitat quality, population size, population distribution

17. Strategy: Minimize negative impacts of incompatible OHV (ATVs, snowmobiles, 4WD trucks, etc.) recreation and other recreation on sage-grouse populations and habitats.
- **17.1. Actions**: Work with County planners and other agencies to restrict seasonal OHV access to crucial sage-grouse use areas.
- **17.2. Actions**: Coordinate with enforcement agencies (Sheriff, parks, USFS, COs) to increase awareness of negative impacts to sage-grouse.
- **17.3. Action**: Create opportunities and use existing avenues to increase awareness in participating public about negative impacts of OHV use in crucial sage-grouse areas.
- **17.4. Action**: Coordinate with enforcement agencies to increase awareness of poaching and to minimize sage-grouse poaching opportunities.
- **17.5. Action**: Encourage use of signage to identify areas closed to hunting; language in proclamation that specifies closed areas.

Partners: UDWR, USFS, BYU, USU Extension, County Council
Threats Addressed: OHV recreation, hunting
Aspects of Sage-grouse Ecology Addressed: Breeding habitat quality, population distribution

18. Strategy: Maintain and increase coordination and communication between state and federal agencies and private partners.
- **18.1. Action**: When possible, present all brush management projects at regional UPCD meetings in advance, to facilitate information sharing and coordination.
- **18.2. Action**: Annually provide maps of crucial sage-grouse habitat to SVARM partners.
- **18.3. Action**: Meet annually to visit habitat projects in the field.
- **18.4. Action**: Hold annual coordination meeting prior to the start of spring field season.
- **18.5. Action**: SVARM representative to report on UDWR-USFS coordination meetings.
- **18.6. Action**: Coordinate with the County through public lands coordinator and committee.
- **18.7. Action**: When possible, comment, as a group, on proposed actions that may impact sage-grouse or their habitats.

Partners: UDWR, NRCS, USFS, UFBBF, USU Extension, BYU, Wasatch County Public Lands Committee
Threats Addressed: Livestock grazing, vegetation management, fire, home/cabin development, roads, power lines, fences, and other tall structures, renewable and nonrenewable energy development, pinyon/juniper encroachment
Aspects of Sage-grouse Ecology Addressed: Seasonal habitat quality, population distribution, connectivity of seasonal habitat types

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.

SVARM 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 SVARM Resource Area. Threats are described in the "Threat Analysis" section of this Plan. Rankings are as follows: L=low; M=medium; H=high; and VH=very high. Ranks are defined according to TNC (2005).

	Aspects of Sage-grouse population in the SVARM Resource Area							
Threat	Reduced Population Size	Population Distribution	Reduced Nesting Habitat Quality	Reduced Brood-rearing Habitat Quality	Reduced Summer/Fall Habitat Quality	Reduced Winter Habitat Quality	Reduced Connectivity of Seasonal Habitat Types	Reduced Connectivity of Populations & Sub-populations
Drought and Weather	M	M	H	H	H	L	M	L
Existing and New Fences	L	L	L	L	L	L	L	L
Home and Cabin Development	H	H	M	M	M	M	H	VH
Power lines & Other Tall Structures	M	H	H	H	H	M	H	H
Renewable & Non-renewable Energy Development	M	M	M	M	M	M	M	M
Roads	M	H	H	H	H	M	H	H
Historic Vegetation Treatments	M	H	M	M	M	H	M	L
Hunting	L	L	-	-	-	-	-	-
Fire	L	L	L	L	L	L	L	L
Livestock Grazing	L	L	L	L	L	L	L	L
OHV Recreation	M	M	H	H	H	VH	M	M
Invasive/Noxious Weeds	-	-	L	M	M	H	L	-
Parasites and Disease	M	M	-	-	-	-	-	-
Predation	VH	VH	H	H	M	M	M	M
Pinyon-Juniper Encroachment	M	M	M	L	L	M	M	M

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Appendix A
Strawberry Valley Adaptive Resource Management Local Working Group
Standard Operating Procedures

Appendix B
Strawberry Valley Sage-grouse Research
Progress Reports