# PARKER MOUNTAIN
# GREATER SAGE-GROUSE
# (*CENTROCERCUS UROPHASIANUS*)
# LOCAL CONSERVATION PLAN

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**Parker Mountain Adaptive Resource Management Local Working Group**

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# Parker Mountain Greater Sage-grouse (*Centrocercus urophasianus*) Local Conservation Plan

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## I. Executive Summary

The Parker Mountain Greater Sage-grouse Conservation Plan (Plan) is the culmination of over eight years of effort by the Parker Mountain Adaptive Resource Management Local Working Group (PARM). PARM members include representatives from state and federal land management and resource agencies, non-governmental organizations, private industry, and private landowners. PARM was formed in 1998 to proactively manage Greater Sage-grouse (*Centrocercus urophasianus*) populations and their habitats in the local area in response to increasing concern about the status of sage-grouse populations range wide. 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. This Statewide plan went through the public process and was passed by the Utah Wildlife Board in 2002.

This Plan will provide an assessment of the status of the Parker Mountain sage-grouse population. The intent of this 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 Parker Mountain area. The Plan is designed to meet the guidelines set forth by the USFWS in their Policy for Evaluation of Conservation Efforts (PECE) standards.

This Plan directly and indirectly addresses the five USFWS listing factors as they apply to Greater Sage-grouse within the Parker Mountain area. Recommendations and guidance suggested within this Plan can be adopted by all PARM partners on a voluntary basis. PARM encourages participation and adoption of these practices, where applicable, by private landowners in the 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 in meeting the goals of this Plan. This Plan provides an opportunity to promote ecologically sound management of private and public lands for sage-grouse without impinging on private property or individual 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 in general on the intimate, local knowledge possessed by PARM partners who live and work within the greater Parker Mountain area. Because a wealth of general information exists about sage-grouse and is available in published documents (Connelly et al. 2000, Connelly et al. 2005), we only provide a brief overview of general sage-grouse ecology and tried to focus on conditions and issues specific to the Parker Mountain area. Knowledge gaps are also identified.

The PARM group spent many hours and much discussion analyzing threats currently or potentially affecting sage-grouse and sagebrush habitats in the Parker Mountain area. The Threat Analysis, combined with recommended strategies and actions provides a general framework for implementation of the Plan for the next ten years by PARM partners. Implementation of this Plan will be conducted within an adaptive resource management framework; as relevant information from a local and rangewide perspective become available, it will be used to modify and refine management strategies, priorities, and general understanding of sage-grouse ecology in the area. Annual evaluation and reporting will be conducted by PARM to track progress on the objectives outlined in this Plan.

## II. Introduction

### A. Purpose

The mission of the Parker Mountain Adaptive Resource Management Sage-grouse Conservation Plan is to help reach the goal of maintaining and improving current abundance and viability of Greater Sage-grouse (*Centrocercus urophasianus*) populations and their habitat in the Parker Mountain area while taking into consideration historical land uses and long term socioeconomic issues. This Plan will help meet these goals by providing local management solutions based on local or compatible data and research to the extent practical. In addition, PARM 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. This 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 this Plan as a continuously evolving document. In addition, this Plan will coordinate development of project proposals within the Parker Mountain area with the Utah Partners for Conservation and Development Regional Team to maintain and enhance sage-grouse habitat.

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

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

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

The Plan directly and indirectly address the five USFWS listing factors as they apply to Greater Sage-grouse (hereafter referred to as sage-grouse) in the Parker Mountain 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 this Plan, but will include the NEPA process. Use and implementation of this Plan by agencies, private enterprise, and private individuals is strictly on a voluntary basis. 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 those state and federal agencies to maintain and enhance sage-grouse habitat and sage-grouse populations in the Parker Mountain area. Participation by private landowners and consideration of landowner needs are critical for management of sage-grouse populations within the Parker Mountain area. Addressing habitat located on private lands is of great importance to meet the goals of this Plan as well. This Plan provides an opportunity to promote ecologically sound management of private and public lands for sage-grouse without impinging on private property or individual rights.

## B. Goals and Scope

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

Assessment Goals:

This Plan will provide an assessment of the status of the Parker Mountain area sage-grouse population by accomplishing the following goals:

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

Strategy Goals:

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

1. Incorporate management strategies from state and federal agency partners, local governments, as they are applicable and practical to the Resource area (Connelly et al. 2000, Connelly et al. 2004).
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 making informed 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 through implementation of this adaptive plan, specific conservation issues will be addressed, implemented, and monitored across geographic and political boundaries to increase the consistency of practices implemented and information collected. The assessment and strategies described herein are specific to the Parker Mountain area and were developed with the unique ecological, social, and economic concerns of that area in mind. A detailed description of the Parker Mountain Resource Area is defined later in the Plan.

## C. Plan Duration

This Plan was designed and written to be a dynamic and adaptive document to change with the needs of the local sage-grouse population, habitats, and local community as necessary. PARM will reevaluate sage-grouse populations and habitats and will review progress on strategies listed in this Plan as per the Standard Operating Procedures (SOP, Appendix A). This Plan was written to support conservation actions over the next ten years. Early termination of this Plan would occur if the sage-grouse were to be 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 those that are federally listed, are candidates for federal listing, or for which there is "credible scientific evidence to substantiate a threat to continued population viability" (Utah Division of Wildlife Resources 2005). However, if this were to occur it is hoped that this Plan or a modification of this Plan would be used as a guideline to create a recovery plan.

## D. Parker Mountain Adaptive Resource Management Local Working Group

As a result of the Strategic Plan, PARM was formed in 1998 and has worked consistently and cooperatively toward the completion and implementation of the Plan since that time. PARM was organized and facilitated by Todd A. Black 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. Sarah Lupis has served as the technical writer and compiler of the Plan itself. PARM 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 PARM are listed in Table 1. When 'we' or 'our' is used in this Plan, it refers to PARM members.

The role of PARM participants was to guide the development of this Plan and to represent their agencies throughout the planning process. After completion of this plan, PARM participants will continue to meet quarterly, or as needed, to update this Plan, incorporate the results of research and monitoring efforts, report new information, and discuss lessons learned through an adaptive management process. Guidance for continued operation of PARM can be found in the SOP (Appendix A).

PARM and the CBCP reviewed several local, statewide, and rangewide sage-grouse conservation 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 this Plan contained the most recent information available on sage-grouse ecology, life history, and habitat requirements. Annual quarterly working group meetings, work plans, and accomplishment reports will monitor progress toward meeting the goals of this Plan. This Plan is intended to be an evolving document. Incorporating principles of adaptive management and changing as new information arises will help to ensure success of this Plan and PARM.

Table 1. Parker Mountain Adaptive Resource Management (PARM) Local Working Group agency, industry, and private partners.

| |
|---|
| Local Grazing Associations |
| Wayne, Piute, and Sevier County Commissions |
| 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) |
| Jack H. Berryman Institute |
| Utah Department of Natural Resources |
| Utah Farm Bureau Federation and local County Boards |
| Fremont River Soil Conservation District |

Management strategies and recommendations described in this Plan will be reviewed and reported on annually, and updated as needed to incorporate results of research efforts, new information, and the results of management actions through annual reviews and progress reports.

PARM operates through an open public process based on consensus decision making. For decisions regarding this Plan, consensus was reached by participating members and/or those present at the time the decisions were 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, ultimately decisions are limited to them. However, all agencies felt that it was important to involve the public in the decision-making and planning process to the greatest extent possible. The importance of public-private partnerships was highlighted in the Statewide Strategic Management Plan (UDWR 2002):

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

PARM provided regular opportunities for public involvement, participation, and comment on this Plan. Regular meetings were scheduled to meet the needs of the greatest number of PARM participants possible. Meetings were announced through direct mailings, on the CBCP web site (www.extension.usu.edu/cbcp), via email, and through personal phone calls and invitations. During the planning process, PARM met at least every other month and often every month. Meeting minutes and critical updates were provided via email, direct mailing, and on the CBCP web site. 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 PARM's activities and the Plan's progress. The final draft of this Plan was made available to all potential stakeholders that PARM was aware of and comments were encouraged throughout the process.

**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 or bust local 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 and concerns.

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 ensure that recommendations and guidelines presented in this Plan will meet the needs of the local community. In many instances, cooperation between landowners and agencies results in more effective, cost-effective, and efficient habitat improvement projects that ultimately benefit both sage-grouse and local interests.

Listing the sage-grouse under the provisions of ESA could have an assortment of local impacts. Activities that could be affected include noxious weed control, maintenance of rights-of-way, natural resource exploration, livestock grazing management, big game wildlife management, and recreational land use. Broadly applying 'take' regulations under the ESA would 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 and strategies, will be used by the USFWS to develop a federal recovery plan. Should these events transpire, the USFWS will also strive to consider social and economic needs to the maximum extent possible. In the July 1, 1994 Federal Register (59 FR 34272) the USFWS issued a policy to involve stakeholders in the preparation of federal recovery plans to help minimize the social and economic impacts of implementing recovery actions.

## F. Management and Legal Authorities

Existing state and federal guidelines offer protection to sage-grouse in the Parker Mountain 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.

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 ten-year (2005-2015) CWCS was approved in 2005 to address species and habitat of greatest conservation need, priorities for conservation, and actions and future implementation opportunities through partnerships. Further, the CWCS calls for focusing efforts toward increasing the abundance, distribution, and range for species of conservation by sustaining and restoring habitat functions.

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

Counties

Commissions for Wayne, Piute, and Sevier counties serve as the executive and legislative branches of local government. They have the authority to:

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

In addition, these counties promote county-to-community, community-to-community, and

agency-to-county coordination, cooperation, and communication.

Natural Resources Conservation Service (NRCS)

The 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 implement 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 Farm Bill programs to improve their range and pasture land for improvement of sage-grouse habitat. These efforts include watershed practices on private lands such as water developments and fencing for prescribed grazing to improve livestock distribution, and vegetative or brush management practices with the seeding of introduced and native species of grasses and forbs for forage improvement to benefit both wild life and domestic animals. Other Farm Bill programs include wildlife enhancement, conservation easements, watershed and riparian programs and programs to reduce soil erosion.

Bureau of Land Management (BLM)

The United Sates Department of Interior (USDI) BLM has authority for conservation of sage-grouse through:
1. 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
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 that will protect the quality of scientific, scenic, historical, ecological, and environmental, air, and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals…(43 U.S.C. 1701 Sec. 102 (a) (8))."

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

BLM lands for multiple uses, including the conservation of fish and wildlife populations. Finally, the BLM provides conservation guidelines for management of sage-grouse on BLM lands in the National Sage-grouse Habitat Conservation Strategy (BLM 2004).

School and Institutional Trust Lands Administration (SITLA)

SITLA was created in 1994 to manage 12 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 any revenues generated from the lands, in the most prudent and profitable manner possible, and not for any purpose inconsistent with the best interest of the trust beneficiaries. The trust principles impose fiduciary duties upon the state, including a duty of undivided loyalty to, and a strict requirement to administer the trust corpus for the exclusive benefit of, the trust beneficiaries. The beneficiaries do not include other governmental institutions or agencies, the public at large, or the general welfare of the state. SITLA must be concerned with both incomes for the current beneficiaries, and the preservation of the trust corpus for future beneficiaries, 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 Understandings (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 range wide strategy to direct conservation of sage-grouse and their sagebrush habitats.

A MOU between state and federal agencies within the state of Utah is currently being developed. This 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 the listing of 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 effort will be effective. Conservation efforts included under this policy are 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, or combinations 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 on 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. Signature of this Plan by the USFWS does not constitute a PECE review of any conservation efforts in 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 and in recent years, others have published summaries. For the purposes of this document, we have included the summary of sage-grouse biology/ecology from the Statewide Strategic Plan (UDWR 2002) and would also recommend the Conservation of Sage-grouse and Sagebrush Habitats by Connelly et al. (2005) for a thorough discussion.

Physical Description

The sage-grouse is the largest grouse species in North America. Adult males are larger than adult females. Adult males weigh 4-7 pounds (1.7-2.9kg) and are 27-32 inches (65-75cm) long. Adult females, in comparison, weigh 2-4 pounds (1.0-1.8kg) and measure 20-25 inches (50-60cm) long. Both sexes have narrow, pointed tails, 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. Seasonal movements between seasonal ranges can exceed 45 miles (75km; Connelly et al. 1993).

Home range of 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 $mi^2$ (11-31 $km^2$). 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 one to two weeks after mating and may continue as late as early June (Wallestad 1975). Sage-grouse generally have lower reproductive rates and higher survival rates than other species of upland game birds (Connelly and Braun 1997). Nesting rates vary from year to year and from area to area (Bergerud 1988, Connelly et al. 1993, Schroeder 1997, Coggins 1998,). Connelly et al. (1993) reported that in Idaho up to 45% of yearling and 22% of adult female sage-grouse do not nest each year. Schroeder (1997) found that essentially all female sage-grouse in Washington nested. The variation is most likely a result of the quality of nutrition available and the health of pre-laying females (Barnett and Crawford 1994). Re-nesting by sage-grouse varies regionally from 20% (Hulet 1983, Connelly et al. 1993) to greater than 80% (Schroeder 1997). In summary, sage-grouse have the lowest reproduction rate of any North American game bird and as a result, populations are not able to recover from low numbers as quickly as those of 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 to 9.5 throughout the species range (Schroeder 1997, Sveum 1998). These differences may be related to habitat quality and overall health of pre-laying females (Coggins 1998).

Survival Rates

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

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

Little information has been published on mortality of juvenile sage-grouse or the level of production necessary to maintain a stable population. Among western states, long-term juvenile

to hen ratios have varied from 1.40 to 2.96 juveniles per hen in the fall. In recent years, this ratio has declined to 1.2 to 2.19 juveniles per hen (Connelly and Braun 1997). It is believed that a minimum of 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 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 (1.1-6.2km), however, some females may nest >12.5 miles (20km) 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% percent 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. 1994a, 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 and Markham 1983, Connelly et al. 1988, Fischer et al. 1996, Bunnell et al. 2000). Sage-grouse broods occupy a variety of habitats during summer including sagebrush, relatively small, burned areas within

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

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

Winter Habitat

Sage-grouse winter habitats are relatively similar throughout most of their range. Because their winter diet consists almost exclusively of sagebrush, winter habitats must provide adequate sagebrush that 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 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 (25cm) 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 & Abundance

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

Several techniques have historically been utilized in Utah and in the Parker Mountain 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 Parker Mountain 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 the 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 (UDWR 2002).

The Rangewide Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats (hereafter referred to as the Rangewide Assessment; Connelly et al. 2004) analyzed the past 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.

### Lek Counts

During the breeding season, sage-grouse congregate on a relatively small number of sites, called leks, to display and breed. Because sage-grouse demonstrate high fidelity to lek sites, they offer the best opportunity for monitoring populations (Jenni and Hartzler 1978, Beck and Braun 1980, Connelly et al. 2000, 2003, 2004). Lek count methodology was first described by Patterson (1952), who studied sage-grouse in Wyoming, and was based on a count of the maximum number of males observed on a lek over a series of 3 to 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). The shortcomings of this type of sampling were described by Anderson (2001) whose primary criticism was that they fail to lead to defensible estimates of population size or status. 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 patterns of adult and yearling males, inter-lek movement 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 means for assessing population trends, and estimating population size and status available (Autenrieth et al. 1982, Connelly et al. 2000). Throughout Utah, including the Resource Area, 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 3 to 4 times during this period and counts are made between 30 minutes before and 1 hour after sunrise. An estimate of population size is calculated based on the following assumptions: 1) 75 % of all males were counted on strutting grounds, and 2) that the male:female ratio in the population is 1:2 (UDWR 2002).

The number of active leks in an area can also be used as an indicator of population size. Cannon and Knoph (1981) noted that lek numbers seem to increase roughly in proportion to population size. There is evidence that as population size increases, 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 by male sage-grouse. Leks are considered 'active' when at least two males have been observed for at least three years. Conversely, leks are considered 'inactive' when birds have been absent from a traditional site for more than three years. 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 Parker Mountain Resource Area (Resource Area) is located in South/Central Utah in Wayne, Piute, and Sevier counties. The Resource Area encompasses 1,789,644 acres (3,226.3 miles$^2$) managed by the USFS, BLM, SITLA, and private landowners. The Resource Area is defined by the Aquarius Plateau to the south, the Fish Lake area to the north, and the Grass Valley Koosharem Valley area to the west. The Resource Area has been subdivided into three subunits, corresponding to sage-grouse breeding complexes (Figure 1). These breeding complexes are based on geographic boundaries and groupings of leks. Although movement between complexes is likely, the complexes represent discrete subpopulations of sage-grouse in the Resource Area.

The Resource Area is characterized by hot summers and cold winters. According to National Climate Data Center records collected in Loa from 1948 to 2005, July is the hottest month with an average high temperature of 82.5ºF while winter lows reach 7.5ºF in January. The Resource Area is a primarily a dry area, receiving an average of only 7.5 inches of precipitation annually.

*Landownership*

Most of the Resource Area is public land rather than in private ownership (Table 2). The majority of the private land is located primarily in the Parker Mountain sub unit of the Resource Area and owned by SITLA (Figure 1). Land managed by the USFS are located in Fish Lake and Parker Mountain sub units of the Resource Area, encompassing the Fish Lake National. The BLM manages land throughout the Resource Area and additional small parcels of land managed by SITLA are scattered throughout the Resource Area.

Table 2. Landownership in the PARM Resource Area.

| **Landowner*** | **Area (acres)** | **Area (Miles$^2$)** | **% of Resource Area** |
|---|---|---|---|
| Bureau of Land Management | 644,996.2 | 1007.8 | 36.1 |
| Native American Tribes | 668.6 | 1.0 | <1 |
| National Park Service | 123,401.3 | 192.8 | 6.9 |
| Private | 130,182.9 | 203.4 | 7.3 |
| State Parks/Wildlife | 1,539.1 | 2.4 | <1 |
| State Trust Lands Administration | 194,170.2 | 303.4 | 10.9 |
| US Forest Service | 687,337 | 1,704 | 38.4 |
| Total | 1,789,644 | 3,427.2 | |
| * Water adds and additional 7,349.9 acres (11.5 mi2) and represents 0.4% of the Resource Area. | | | |

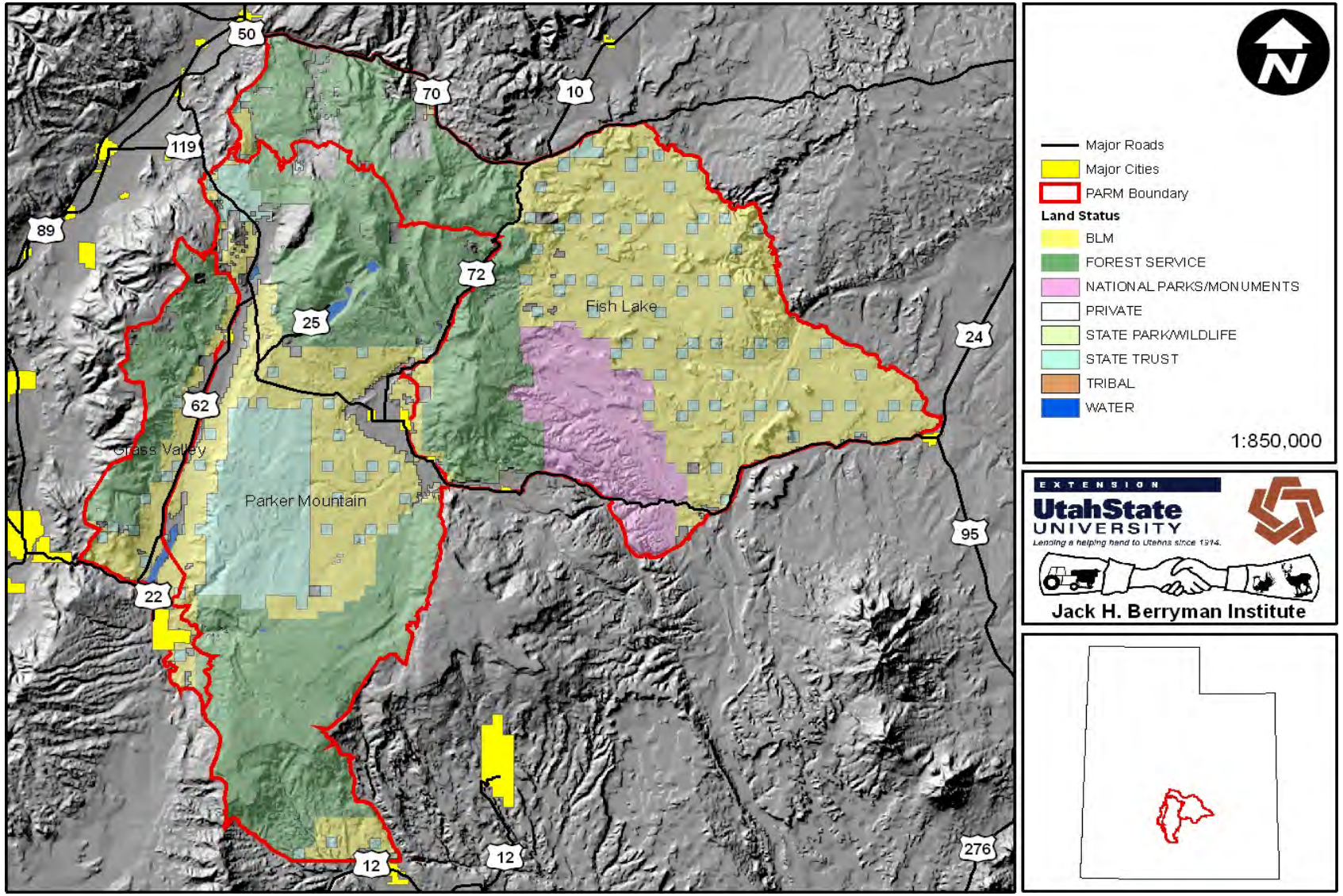


Figure 1. The PARM Resource Area and subunits with land management and landownership designated.

*Wildlife Populations*

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

While sage-grouse populations in the Resource Area have been counted and studied, little or nothing is known about the local status of these other wildlife species 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 these other sagebrush obligate species to thrive in Resource Area.

*Human Populations*

Settlement of the area lagged behind most of Utah. Early accounts of settlement of the Parker Mountain area are summarized here from three separate local histories. The earliest confirmed settlement occurred at the current Otter Creek Reservoir location and at Box Creek in 1874. In current day Tidwell, Wayne County, one settler or family had taken up land prior to 1875. All of these settlers abandoned their holdings and permanent settlers began arriving in 1875. These settlers and latter arrivals became the nucleus for the current communities within the PARM resource area (Grass Valley History 2005). The Parker Mountain area has experienced little growth throughout its history.

*Livestock Grazing*

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 1870s (Fuller 1994). Grazing was unregulated in the Resource Area until the formation of the USFS in 1903 and the formation of the Grazing Service in the 1930s. Historic numbers of livestock in the Resource Area have varied and, like other areas in the west, were affected by weather, markets, regulation, among other factors. There has been a general decline in sheep numbers in the Resource Area over the last 50 to 60 years while cattle numbers have increased slightly over time (Figure 2). Today, cattle remain the top agricultural commodity produced in the Resource Area.

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

(1996) questioned the often-held assumption that Intermountain plant communities evolved without the presence of large herbivores (i.e. bison, elk). Burkhardt presented a rather large body of research indicating 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.

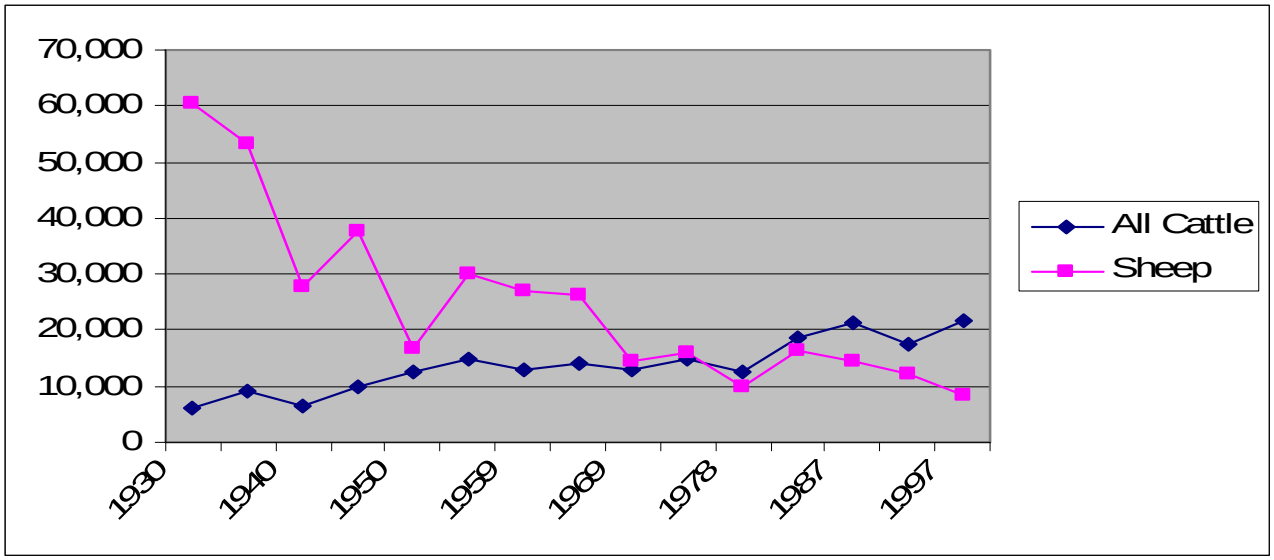


Figure 2. Cattle and sheep numbers in Wayne and Piute Counties from the early 1930s until the turn of the century (source http://www.nass.usda.gov/Statistics_by_State/Utah/index.asp).

*Farming*

Agricultural production in the Resource Area began with homesteading in the late 1800s. Areas used for farming are located in lower elevation areas along the rivers and creeks. Hay crops are the largest commodity in Wayne and Piute County. Although some of the farming area was historically sage-grouse habitat, most areas used for farming were not inhabited by sage-grouse (G. Hallows, V. Bagley personal communication).

Population Status and Distribution

Accounts from pioneers, trappers, and explorers of the Resource Area indicate that sage-grouse were historically abundant in the area. Stories range from sage-grouse darkening the sky to dwindling sage-grouse numbers are fairly common when talking to older, local residents. One common thread among locals is the report that during the winter of 1982-83, many sage-grouse died due to starvation or were easily predated upon by eagles because of the significant snow fall during that winter.

The UDWR began using lek counts to monitor sage-grouse populations in the Resource Area in 1967 (Figure 3). That year, a total of 302 male sage-grouse were counted on eight leks. During these early census years, UDWR biologists knew the locations of only a few leks. According to

Connelly et al. (2004), a minimum of ten leks must be counted before making a reasonably accurate population estimate. In 1972, twelve leks in the Resource Area were counted for a total of 311 males. The estimated spring population size in 1972 was 3415 adult birds. Sage-grouse population data varied from year-to-year for the next 25 years mainly due to work force and snow levels. With these inconsistencies and the need for data collection, in 1998 participants of the PARM group put a more concerted effort forth. This effort has lead to the discovery of several new leks in the Resource Area and much better consistency in counting known leks. Since 2004, the PARM group as a unit has conducted lek surveys over a two-day period counting all known leks on each of the two census days. The total number of males counted on leks during the past four years has averaged 830 total males (Figure 4).

The number of active leks can also be used to index sage-grouse population trends. In an attempt to avoid bias due to monitoring effort, only years when >12 leks were counted were included in this analysis (Figure 3). The historical population high in year 2006 appears to reflect the current trend of increasing population. This indicates that while the number of males counted on leks in the Resource Area is increasing, more leks have been found. In fact, 24 total leks were counted in 2006, more than had ever been counted previously in the Resource Area (range of data below = 12-17).

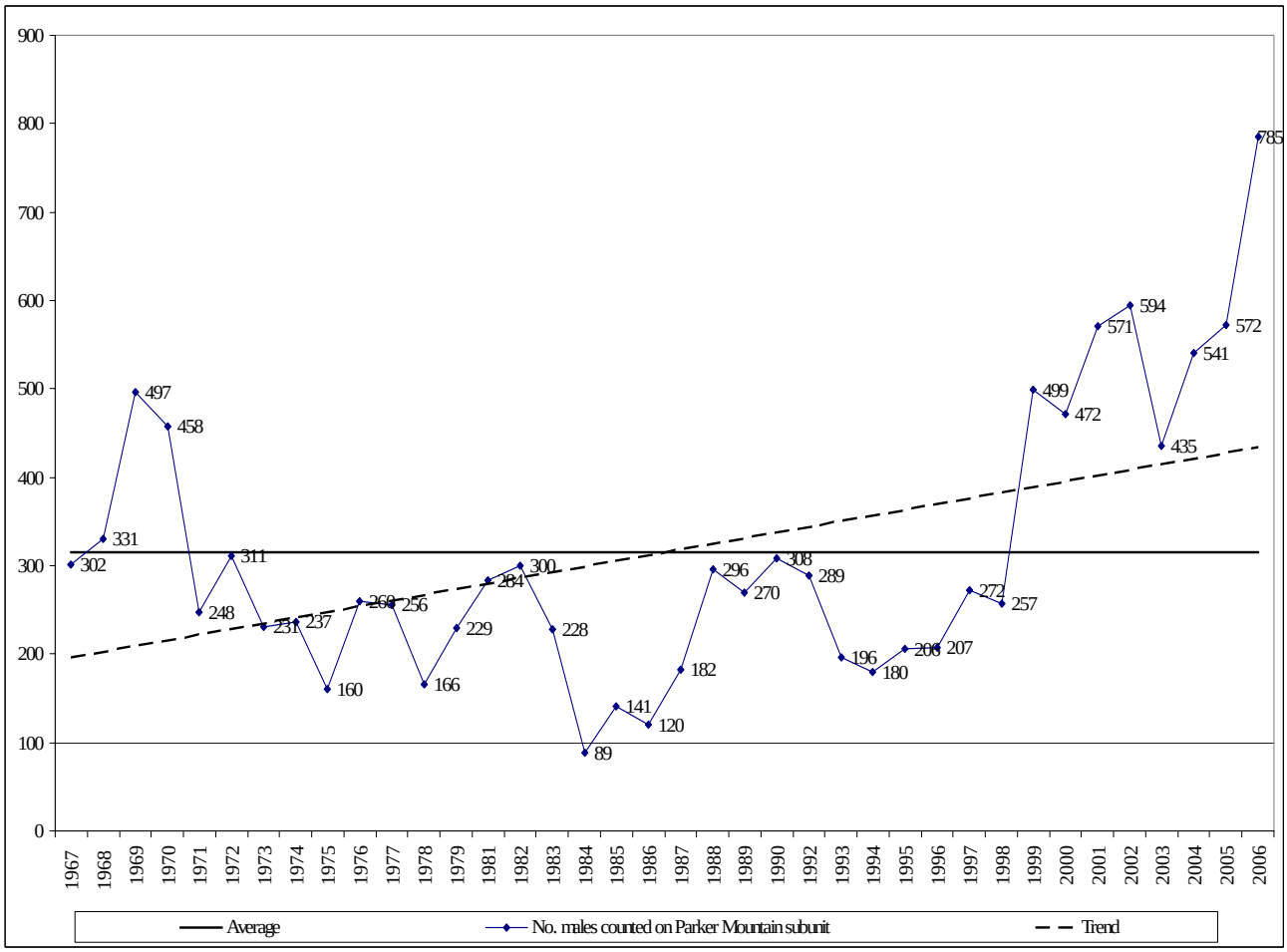


Figure 3. Maximum total number of males counted on the Parker Mountain subunit and the average number of males attending leks in the PARM Resource Area, 1972-2006.

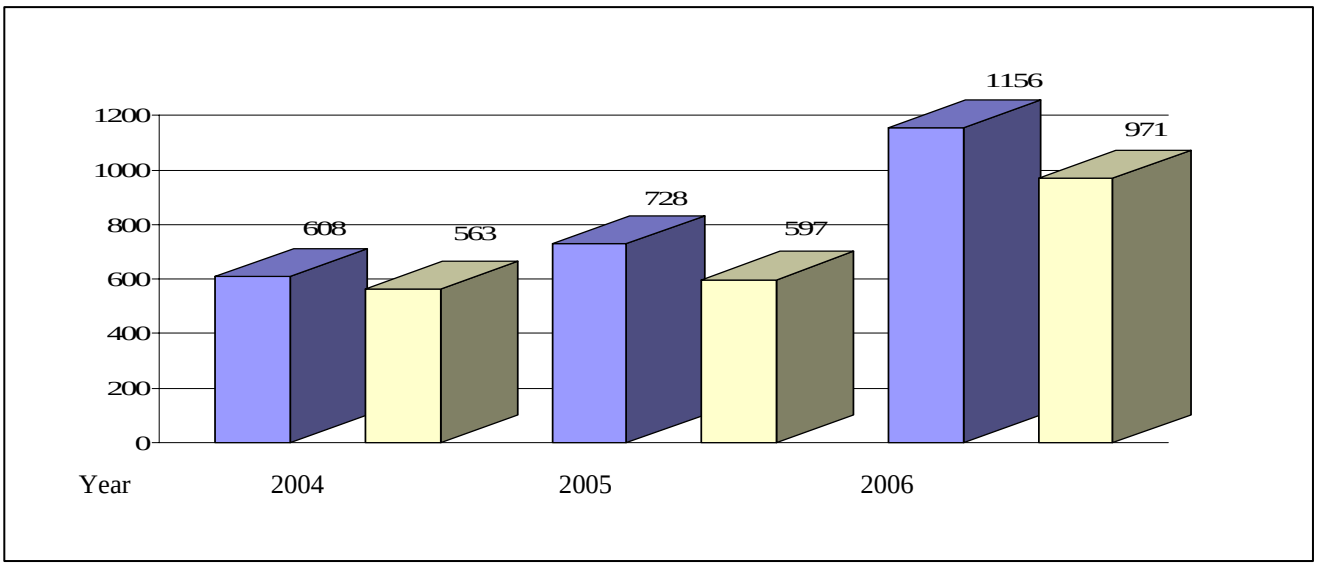


Figure 4. The total number of males counted on all known leks since the PARM group started a combined counting effort. The light color shows the number of males on leks counted in the Parker Mountain subunit, the darker color shows the total number of males counted on all leks.

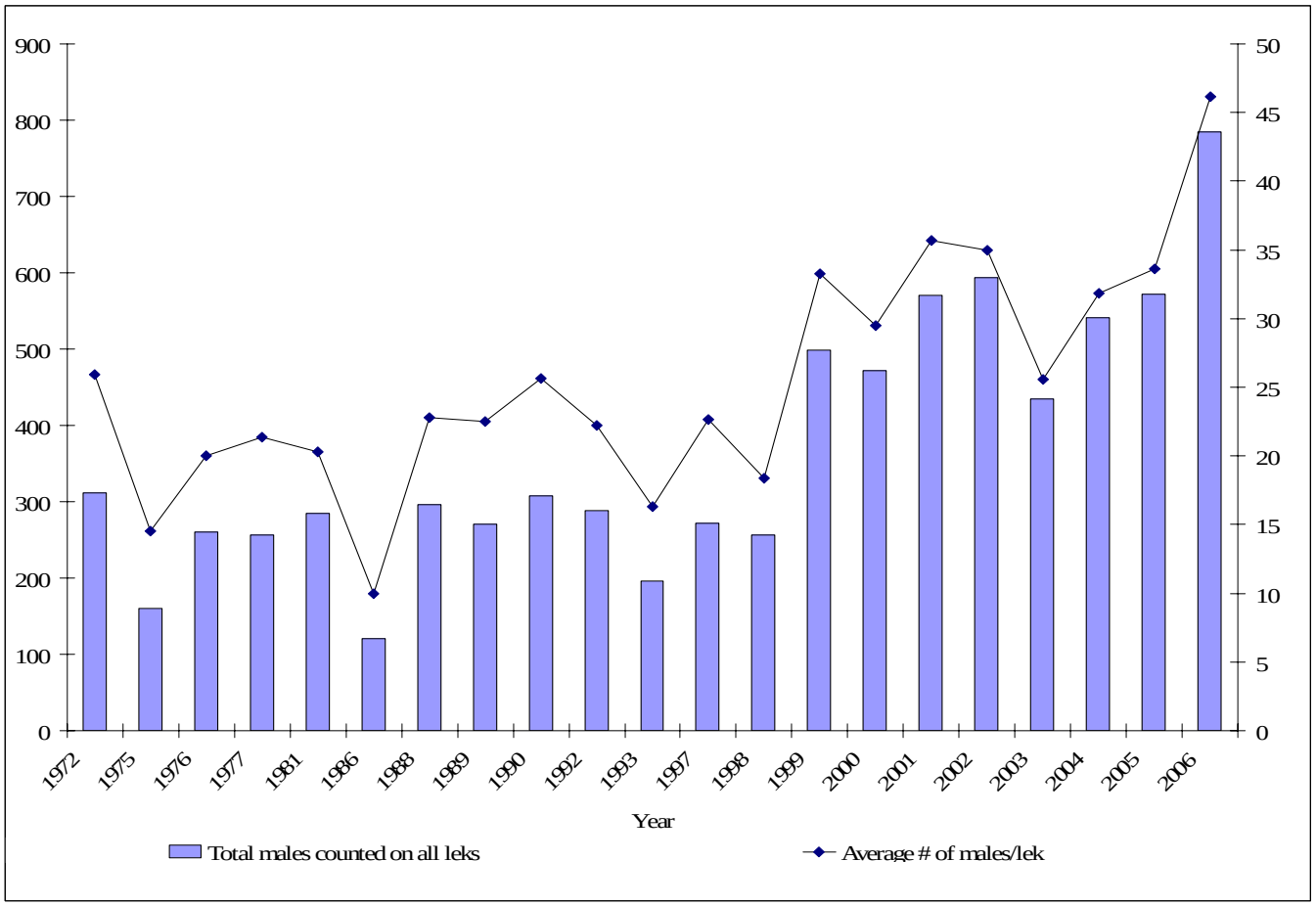


Figure 4. The number of males per lek in the Parker Mountain, 1972-2005 in years where >11 leks were counted. Also shown is the average number of males attending these leks.

Local Ecology and Life History

In 1998, data collection from radio-collared greater sage-grouse hens began in the Parker Mountain area and has continued to present day. This research includes the assessment of nest initiation, nest success, nest site vegetation, clutch size, brood fate, brood site vegetation, and adult mortality. From 1998 to 2003, between 19 and 33 collared hens were monitored each year. In 2004, the sample size was 9 and in 2005 it increased to 55.

Nest initiation ranged between 50 and 95% by year, and averaged 67% between all years. Adult hens had higher initiation rates compared to yearling hens. Nest depredation ranged between 15 and 53% yearly, and averaged 29% between all years. Each year hens abandoned nests either naturally or due to observer error in causing nest abandonment, but only one or two nests a year. Nest success has been high (>50%) each year. Clutch sizes average six to eight eggs. Additionally, adult mortality has been low, ranging between 9 and 36% from 2000 to 2005.

In 2005, research was initiated to monitor sage-grouse broods. Within two days of hatching, the brood hen was approached in the morning or evening when she was most likely brooding. The hen was flushed from the nest, and the one to two day-old chicks were collected. Each chick was weighed (most weighing ~ 30 grams) and a 1.5-gram radio was attached to the backs of random chicks using sutures. Some broods had all chicks marked, in other broods approximately half were marked. Through this effort, researchers have been able to document mortality of marked chicks, overall brood mortality, and document brood hopping. Brood hopping is defined as a chick leaving its mother hen to join the brood of another hen.

Of the 24 broods marked in 2005, 22 were consistently monitored over the next 60 days. Of the 22 marked broods, fourteen (64%) were successful ($\geq$ 1 marked chick survived 42 days after hatch), the fates of seven (32%) broods was unknown as contact with the chick was lost (most likely due to brood hopping), and in one brood all marked chicks died. Ten (46%) broods exhibited brood hopping. Brood hopping was documented as early as the first week and as late as the sixth week. Researchers also documented unmarked chicks brood hopping into monitored broods. The number of recruited (at least 60 days old) marked chicks in each successful brood ranged from one to four, and averaged 2.71 per brood.

This study showed brood success on the Parker Mountain subunit to be very high, with more brood hopping than anticipated. Additionally, the average number of recruited chicks was higher than anticipated. Based on the first year of this more intensive brood monitoring, Parker Mountain sage-grouse are considered to have good to excellent brood success.

Nest site vegetation within the Resource Area is similar to other existing sage-grouse research. Most nests are found under big sagebrush (*A. tridentata spp.)* at an elevation gradient of 8200 feet. There are also some hens that use black sagebrush (*Artemisia nova*), which has a much smaller structure than big sagebrush. Black sagebrush is the dominant shrub type on Parker Mountain. The majority of nests occur in big sagebrush upward of roughly 8200 ft elevation.

Vegetation in the brood sites appeared to have similar shrub cover as that of other research sites, but the forb content has been consistently lower than other study areas and the guidelines of Connelly et al. 2000. To address the lack of herbaceous cover, actions have been initiated to

reduce shrub canopy in hopes of increasing herbaceous forb content in brood-rearing areas where shrub canopy cover has exceeded (> 25% cover) brood-rearing habitat guidelines (Dahlgren 2006).

Local Habitat

The extent of seasonal habitat types in the Resource Area was mapped by the UDWR in 1999. Figure 5 illustrates where nesting and brood-rearing occur, and Figure 6 indicates winter habitat 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, the overlap with seasonal habitat used by sage-grouse (Figure 7) provides useful 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/.

Habitat Improvements & Completed Conservation Actions

All of the land management partners have implemented or completed large habitat projects within the Resource Area. SITLA has implemented several habitat improvement projects in the Parker Mountain subunit which target dense stands of big sagebrush in sage-grouse brood rearing habitat. In 2001, with a NRCS grant and as part of a research project with Utah State University, 300 acres were Dixie harrowed, 300 acres received a Lawson Aerator treatment, and 300 acres were chemically treated. From 2002 to 2004, approximately 1,000 acres of habitat were treated with a Dixie harrow and tebuthiron (spike). In 2005, in partnership with the NRCS, 750 acres were spiked in Nicks pasture. The goal of treatment was to reduce sagebrush canopy and enhance the native grass and forb composition of the understory. Additionally, the NRCS thinned approximately 30 acres of aspen stands as part of a research project with Utah State University. In 2006, SITLA anticipates treating 1,500 acres of sagebrush with spike in the Parker knoll and cedar grove areas.

The locations of several habitat improvement projects recently completed or scheduled are listed in Figure 8. Table 3 lists the acreage and general location of habitat improvement projects implemented in 2004 and 2005 and proposed for 2006 by the PARM partners.

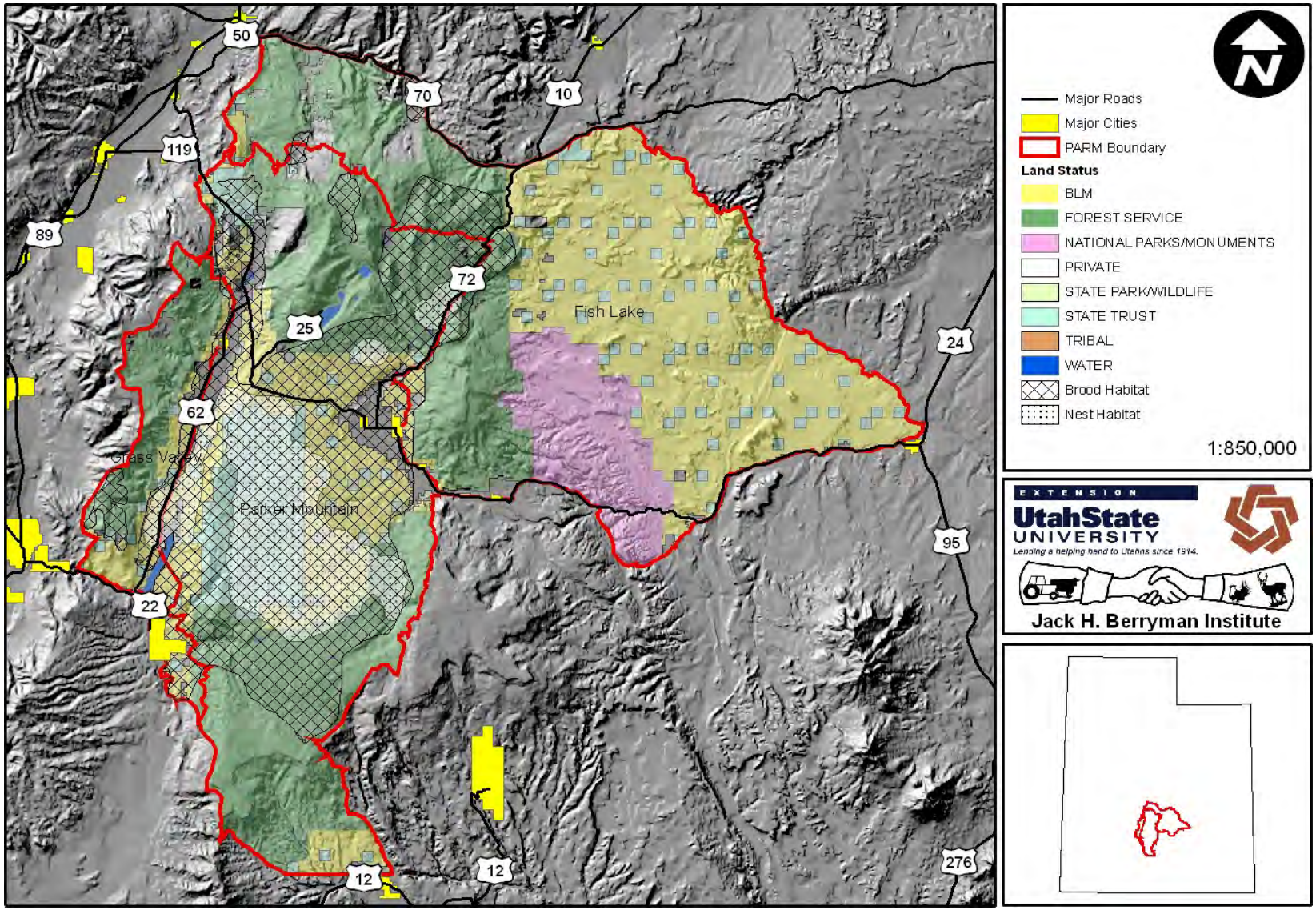


Figure5. Location of sage-grouse nesting and brood-rearing habitat in the PARM Resource Area, as identified by the UDWR, 1999.

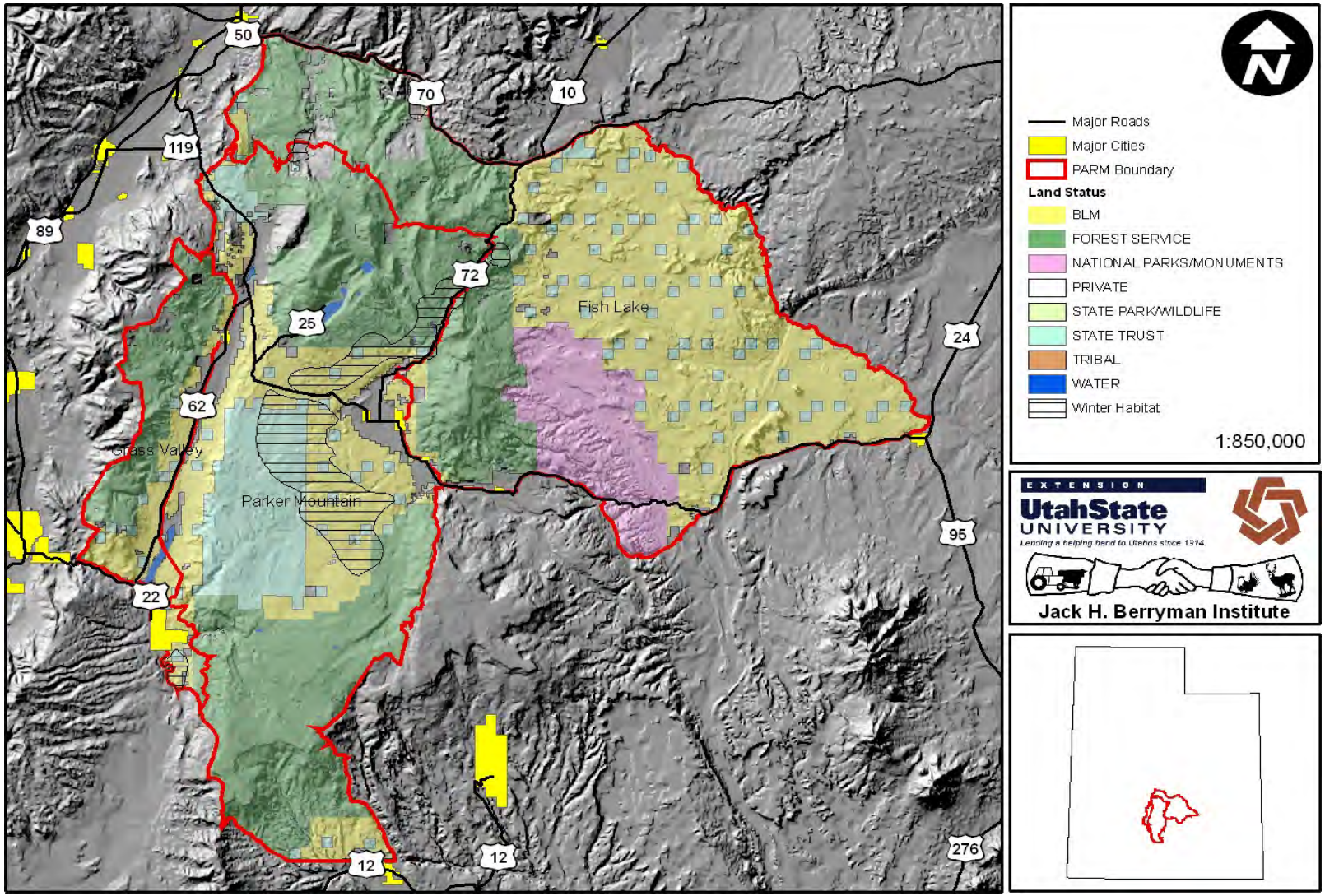


Figure 6. Location of sage-grouse winter habitat in the PARM Resource Area, as identified by the UDWR, 1999.

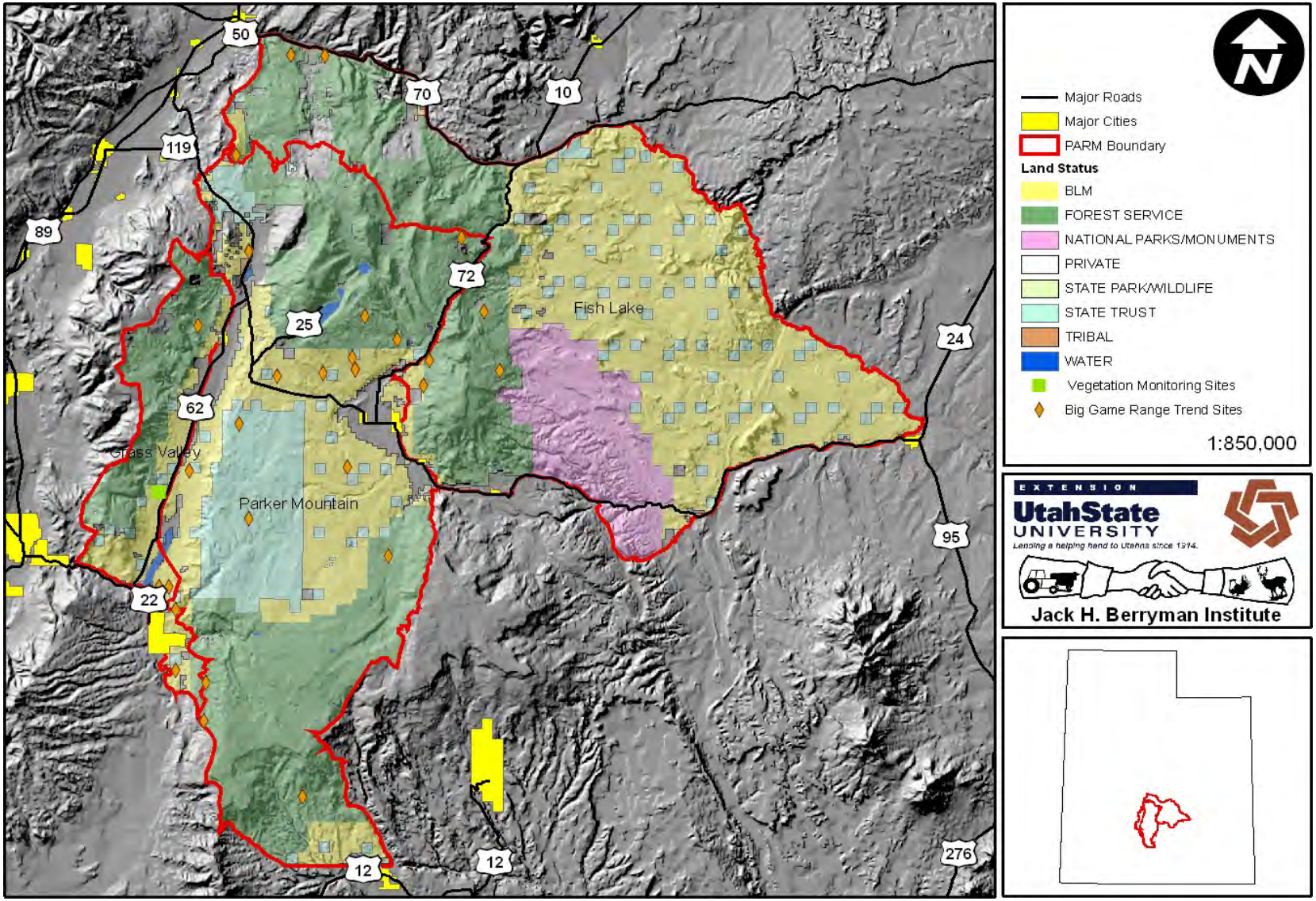


Figure 7. Location of Utah Big Game Range Trend Sites that fall within sage-grouse seasonal habitat identified by the UDWR, 1999.

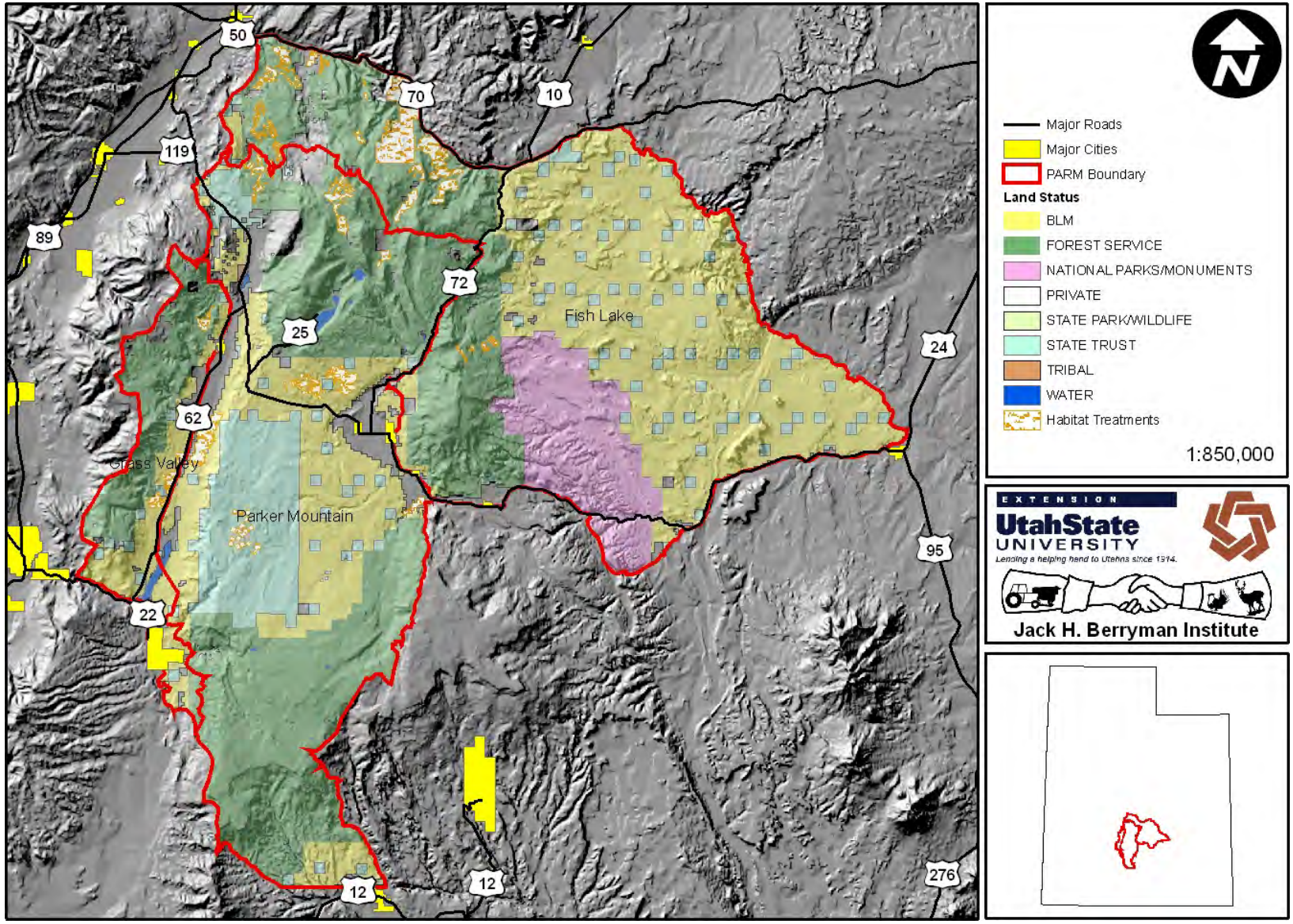


Figure 8. Location of some habitat improvement projects in the PARM Resource Area.

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

| Year | Project Name | Acres |
|---|---|---|
| 2004 | BLM North narrows West side Dixie harrow treatment | 2,500 |
| | BLM South narrows East side Dixie harrow treatment | 1,200 |
| | SITLA Pine peaks and red knoll pastures spike treatment | 500 |
| | | |
| 2005 | BLM South Narrows West Side Dixie Harrow Treatment | 2,300 |
| | SITLA Nick's pasture spike treatment | 250 |
| | NRCS Nick's pasture spike treatment | 750 |
| | NRCS Parker pasture aspen thin—research project | 30 |
| | | |
| 2006 (proposed) | BLM Box Creek Dixie Harrow Treatment | 1,000 |
| | SITLA/NRCS Parker knoll and cedar grove area spike treatment | 1,500 |
| | | |
| | | |

## 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. Due to a lack of empirical information regarding many of the threats described, however, 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 regards to its contribution to reduction in population health or habitat condition, and its irreversibility. Given the stipulations above regarding a lack of empirical locally-based information in many cases, we based these rankings on the best information available to us and our implicit, experiential knowledge of the Resource Area. Ranking definitions are based on The Nature Conservancy (TNC; 2005). Rankings are provided to help highlight potential priorities for subsequent strategies and actions.

### A. Human Development

In this section, we summarize the potential effects of development and human infrastructure including 1) residential, commercial, and recreational buildings; 2) power lines, fences, and other tall structures; 3) renewable and non-renewable energy development; 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, and increased predator pressure). There is little empirical evidence available regarding the direct or indirect impacts of most of the threats reviewed in this section, especially those specific to the Resource Area.

*Residential, Commercial, and Recreational Development*

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

Increases in the human population in the Wayne County area have led to corresponding increases in the amount of land being developed. Figure 9 illustrates the trend in the number of residential building permits issued in Wayne County between 1999 and 2005 (Wayne County Clerks Office). Housing development in Wayne and Piute Counties has been minimal in the past, and in more recent years has stabilized with about 100 new building permits issued each year (Bureau of Business and Economic Research, University of Utah 2004).

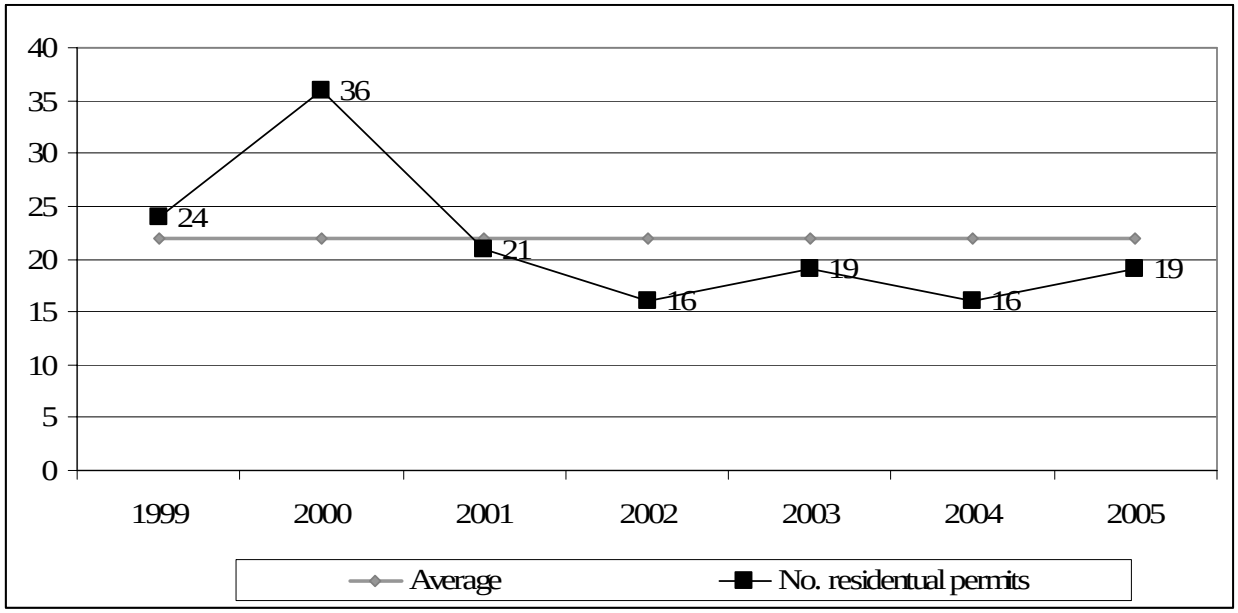


Figure 9. Number of housing permits issued in Wayne County, 1999-2005. (Source Wayne County Recorders office 2006)

*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, as rural properties are developed, and new county roads are put in. Aged interior fences on private property are often lacking maintenance and allowed to deteriorate. This reduces the threat of collision with barbed wire for sage-grouse. Power lines have also increased in number and length (Figure 10), and transmission and service lines have been constructed to service mines and transfer electric power out of the area.

*Renewable & Non-renewable Energy Development*

An industry that could potentially be on the rise in the Resource Area is oil/gas exploration and development. When looking at adjacent Sevier County as an example, no oil and gas wells were operating prior to 2003. Currently in 2006, six active oil wells exist in Sevier County. Although no active oil and gas wells have been established in the Resource Area, exploration activity has increased significantly in just the past three years. In 2005, exploration efforts on the Parker Mountain subunit suggest that there is the possibility of these activities in the future..

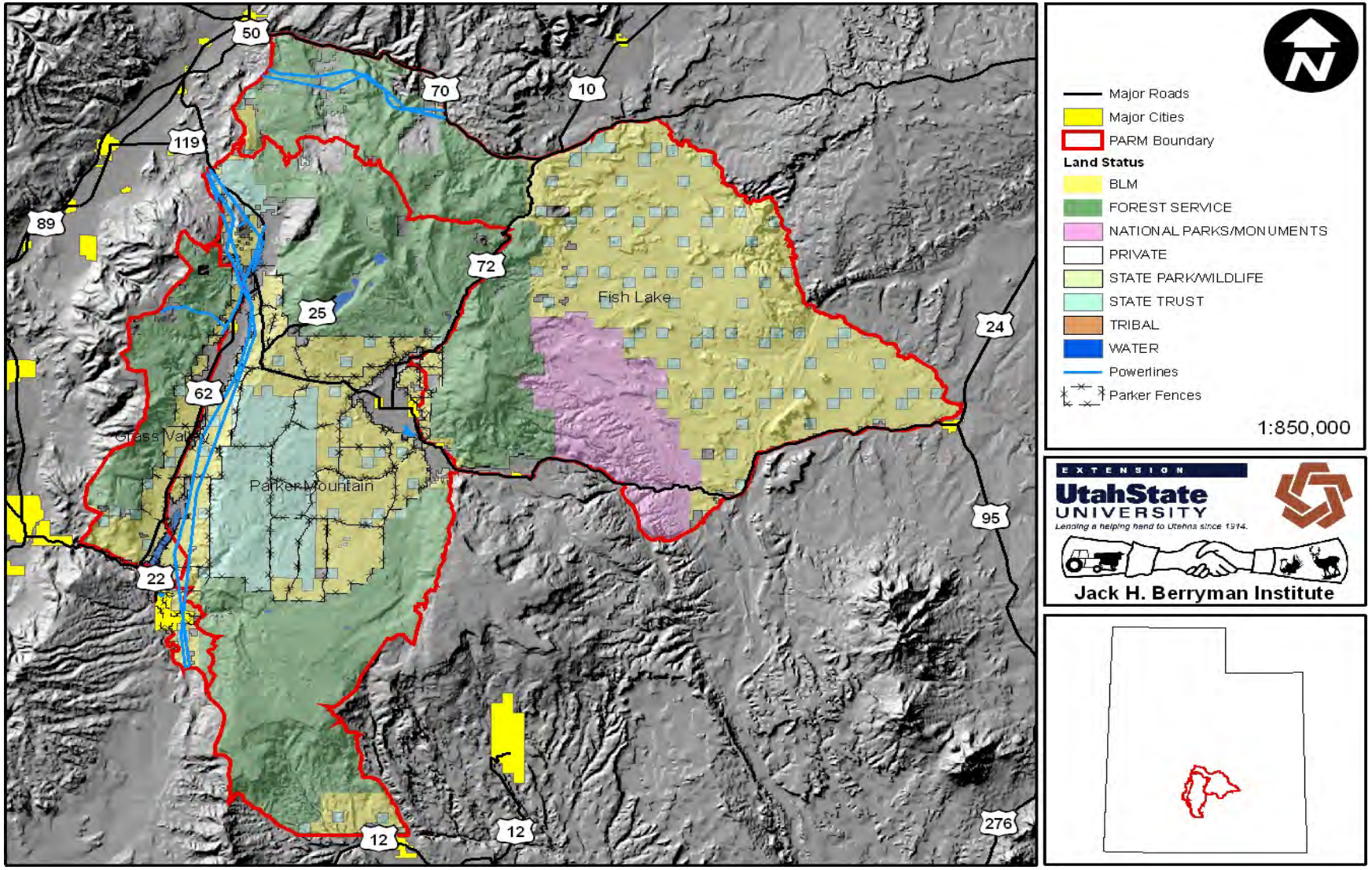


Figure 10. Location of power lines and known fences in the Resource Area. Data from Connelly et al. (2005), obtained from http://sagemap.wr.usgs.gov/index.asp.

Oil and gas facilities generally have a small footprint, usually a few acres or less. Each pad will often contain tanks and other equipment for a period of years. When the well is depleted, all facilities are removed and the pad is reclaimed. Some researchers believe the existence of these facilities suppresses sage-grouse use of the habitat for some distance beyond the actual footprint of the facility (Robel et al. 2004, Holloran et al. 2005). Compressor stations, active wells, and drilling rigs produce relatively loud and sustained noise that may interfere with sage-grouse, particularly during the breeding season (Crompton et al. 2006).

*Roads*

Collisions with motor vehicles, either while flying or while walking on or across roadways are Collisions with motor vehicles, either while flying or while walking on or across roadways, are also potential causes of direct mortality or severe injury for sage-grouse. Road construction can cause an increase in dust on plants, spread of invasive/alien species, and increased access for predators and incompatible recreation activities (Gunnison Sage-grouse Rangewide Steering Committee 2005). Roads also increase fragmentation of habitat. New and expanded highways, roads, and rail sidings have been built to service energy development, ranches, and residential properties throughout the Resource Area.

## B. Drought and Weather

Long periods of below average precipitation, above average summer temperatures, above average snowfall, or below average winter temperatures can have adverse effects on sage-grouse reproductive success and survival. In fact, prolonged drought during the 1930s and in the latter part of the 20$^{th}$ century coincided with decline of 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 adversely affect food quality and/or abundance and 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 et al. 1996a).

The Resource Area experienced drought conditions from 2000-2004 and is currently considered to be emerging from drought conditions (Figure 12). Between 2002 and 2004, significant areas (approximately 217,700 acres) of big sagebrush defoliation and mortality were recorded across the Uinta Basin (Figure 13). Several of those areas are believed to be important sage-grouse habitat. The UDWR and cooperating federal agencies are addressing this die-off with their habitat restoration initiative.

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

The winter of 1983-84 was particularly severe, bringing extreme cold and heavy snow to Utah (and many parts of the western United States) for an extended period. It is believed that sage-grouse populations declined dramatically during this winter. A 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 during the spring are also suspected of influencing sage-grouse production (Connelly et al. 2000). Good winters followed by relatively wet springs can increase production (Wallestad 1975, Autenrieth 1981) by promoting good insect and forb production. In contrast, severe spring weather (cold temperatures combined with rain and wind) that coincides with hatching can decrease production (Wallestad 1975).

## C. Hunting

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

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

The UDWR reduced the number of sage-grouse hunting units in 2000 due to declining populations. In 2000, four areas in Utah were open for sage-grouse hunting, including areas within the Resource Area (Figure 11). Beginning in fall 2000, a free permit was required to hunt sage-grouse in Utah. This requirement may have decreased the hunter participation in the sage-grouse hunt; subsequently reducing the overall harvest. Since 2000, Parker Mountain has seen a decrease in the number of sage-grouse hunters and an overall decrease in the number of birds harvested (Table 4).

Illegal harvest, or poaching, of sage-grouse does occur in the Resource Area but its impact is not known or well understood.

Table 4. Sage-grouse harvest information for the PARM Resource Area, 2000-2003.

| Year | Hunters Afield* | Hunter-days Afield | Sage-grouse Harvested | Sage-grouse per Hunter-day |
|---|---|---|---|---|
| 2000 | 461 | 937 | 485 | 0.52 |
| 2001 | 349 | 786 | 310 | 0.39 |
| 2002 | 106 | 287 | 85 | 0.30 |
| 2003 | 155 | 383 | 207 | 0.54 |

* Harvest information obtained from UDWR hunter questionnaires and telephone surveys.

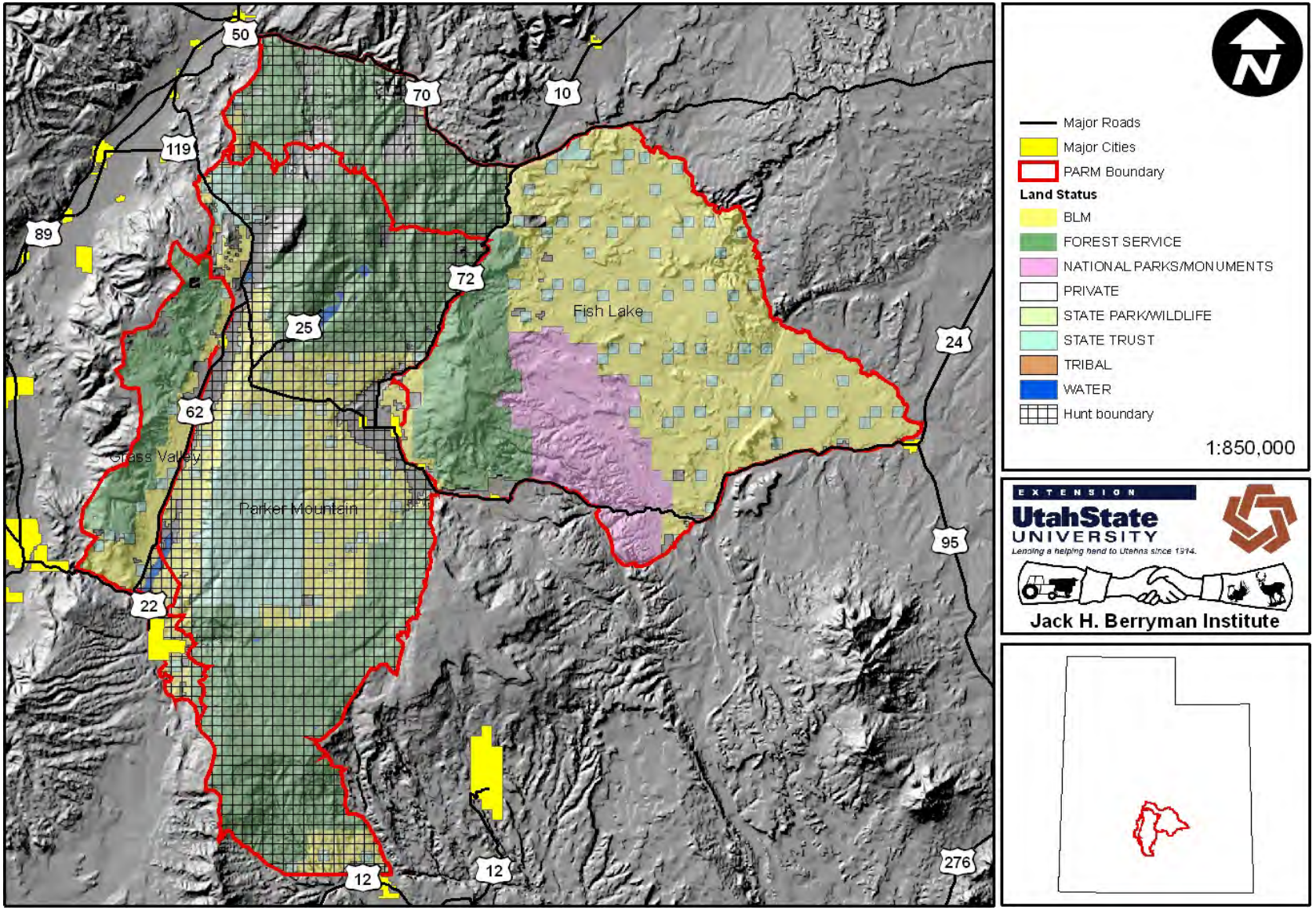


Figure 11. Areas open for sage-grouse hunting in the PARM Resource Area as of 2000.

## D. Fire Management

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

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. (2005).

*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 reducing 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)

"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)."

*Conclusions*

Livestock grazing is an important use of sagebrush rangelands in the Resource Area. The majority of livestock operations appear to be coexisting with sage-grouse as recent counts show populations of sage-grouse to be on the increase over the past six years despite years of drought from 2001–2004. This could indicate that the current grazing regimes and stocking rates are compatible with sage-grouse populations. Many of the wet meadow areas have been fenced off to exclude grazing. Research is under way to look at grazing intensities in areas of recent sagebrush treatments and native sagebrush stands.

## F. Recreation

The effects of off highway vehicle (OHV) recreation and other forms of recreation (snowmobiles, bird-watching, shed hunters, 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 individuals or flock behavior. Disturbance during nesting season may result in nest abandonment or failure. Disturbance during any time of year may increase sage-grouse vulnerability 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 have been designated for OHV use. When confined to specific use areas, impacts are likely reduced. While OHV recreation is increasing in the Resource Area, specific impacts to sage-grouse populations are unknown, but thought to be minimal at this time.

## F. Invasive plant species

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

Russian knapweed (*Centaurea repens*), dyers woad (*Isatis tinctoria* L), and several other species of thistle, grasses, and knapweed are listed on the Utah Noxious Weed List (Section 4-17-3, Utah Noxious Weed Act).

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

Cheatgrass is an annual grass native to Russian and parts of northern Europe. When it invades sagebrush communities, cheatgrass is known to increase fire frequency and has the potential to convert sagebrush communities to annual grass rangelands. Cheatgrass is also believed to encourage establishment of other invasive species (Grahame and Sisk 2002). Although not listed as a noxious weed, cheatgrass is found throughout the resource area and has been particularly invasive in lower elevation areas subsequent to fire events.

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 developed a guideline requiring certified weed free forage to be used on BLM lands by anyone having the need to take forage with them when using BLM public lands. Both the Utah State Director and the Secretary of the Interior approved the guidelines in 1997. Since 2002, users of all federal lands and trust lands in Utah are required to use only certified noxious weed free (cheatgrass is not listed as a noxious weed) hay, straw, or mulch. The USFS is also committed to a campaign against the spread of invasive species. Working with agency and local government partners the USFS aims to create Cooperative Weed Management Area (CWMA) Participative Agreements for all USFS lands.

## H. Parasitism & Disease

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

*West Nile Virus*

West Nile virus (WNV) is an arbovirus, or arthropod-borne virus, of the flavivirus family, which also includes Dengue and Yellow Fever. WNV is one of many mosquito-borne viral infections. Mosquitoes of the Culex family primarily transmit West Nile Virus during normal blood feeding. Some species in this family feed primarily on birds, 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. In 2004, sage-grouse in Wyoming, Montana, Colorado, and California tested positive for the virus. In 2005, the virus was confirmed in a dead sage-grouse in the Uintah Basin, approximately 160 miles to the east of the Resource Area. WNV was also detected in a prairie falcon in Carbon County, to the southeast of the Resource Area. 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/Micro-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. (2004) 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, 160 miles to the east of the Resource Area, that was infected with WNV. Parts of Wyoming relatively near to the Resource Area have also detected infected birds. There is potential for disease persistence from transmission between these areas.

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, is 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/or management strategy (Connelly et al. 1998, Schroeder et al. 1999). Connelly et al. (2000) suggested that several studies on nest success have illustrated success >40% and that nest predation does not appear to be a problem across the range of the grouse. In contrast, Gregg (1991) and Gregg et al. (1994) suggested 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). Researchers suggest that the advancing population of a nonnative predator, red fox, is responsible for preying upon a large portion of the population in that area (Flinders 1999). In artificial nest studies conducted in Strawberry Valley, ravens depredated 98% of artificial nests within 48 hours of their placement; remote cameras were used to verify the identity of artificial nest predators (Baxter and Flinders, unpublished).

*History of Predator Management in Utah*

Understanding the impact of predation on sage-grouse is difficult, as the primary effects (the number of sage-grouse killed by predators) is affected by habitat variables, variables associated with the predator population and variables within the sage-grouse population itself. Secondary effects of predation exist and are indicated when habitat choices are dictated by the risk of predation. What we currently know about habitat needs of sage-grouse is developed from

studies of core sage grouse range. However, if predation or the risk of predation is effecting habitat selection, then otherwise good habitat is made unavailable to 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, but have appeared 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 1972-2004.

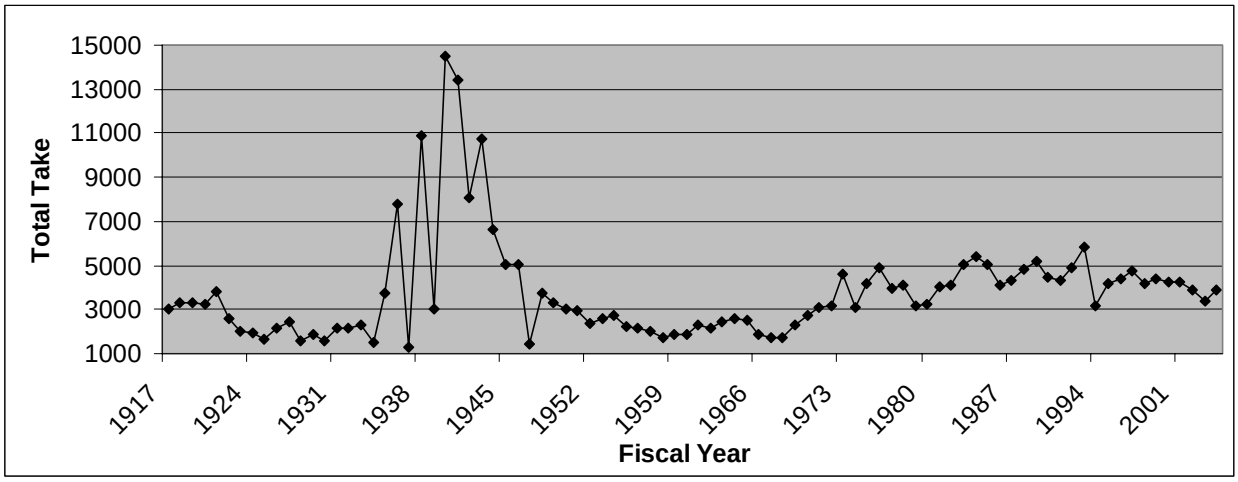


Figure 12. USDA-WS reported coyote take in Utah, 1917-2004. Data reported by USDA-WS.

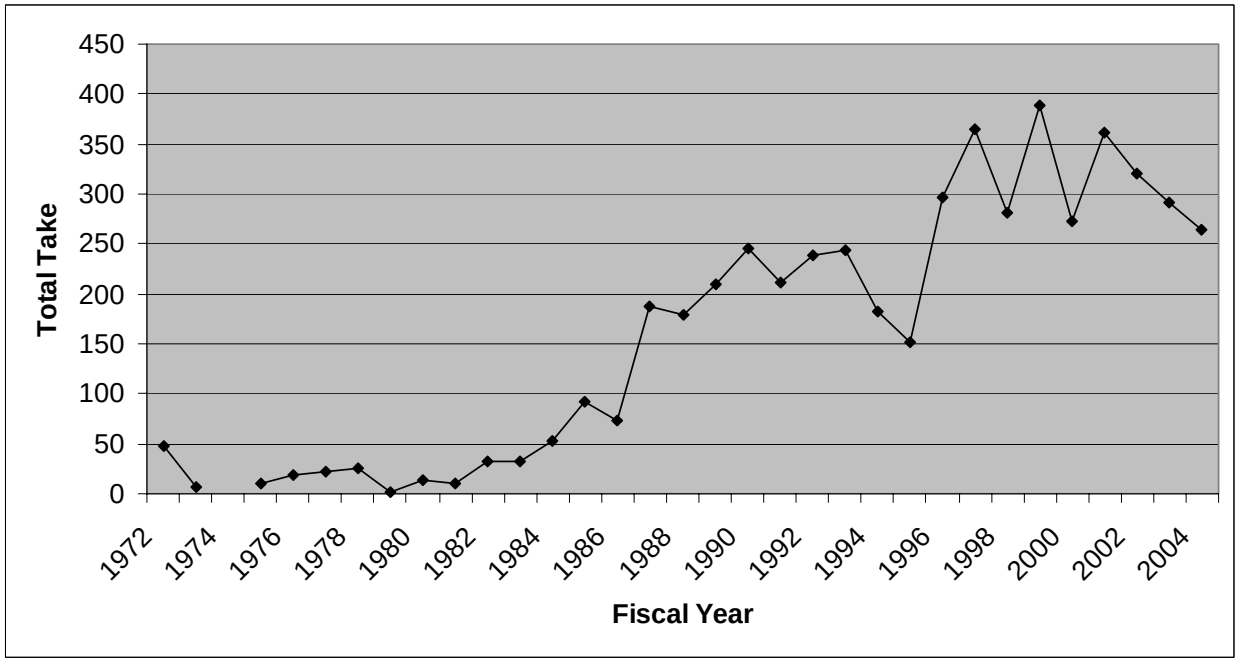


Figure 13. USDA-WS reported fox take in Utah, 1972-2004. Data reported by USDA-WS.

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, "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.

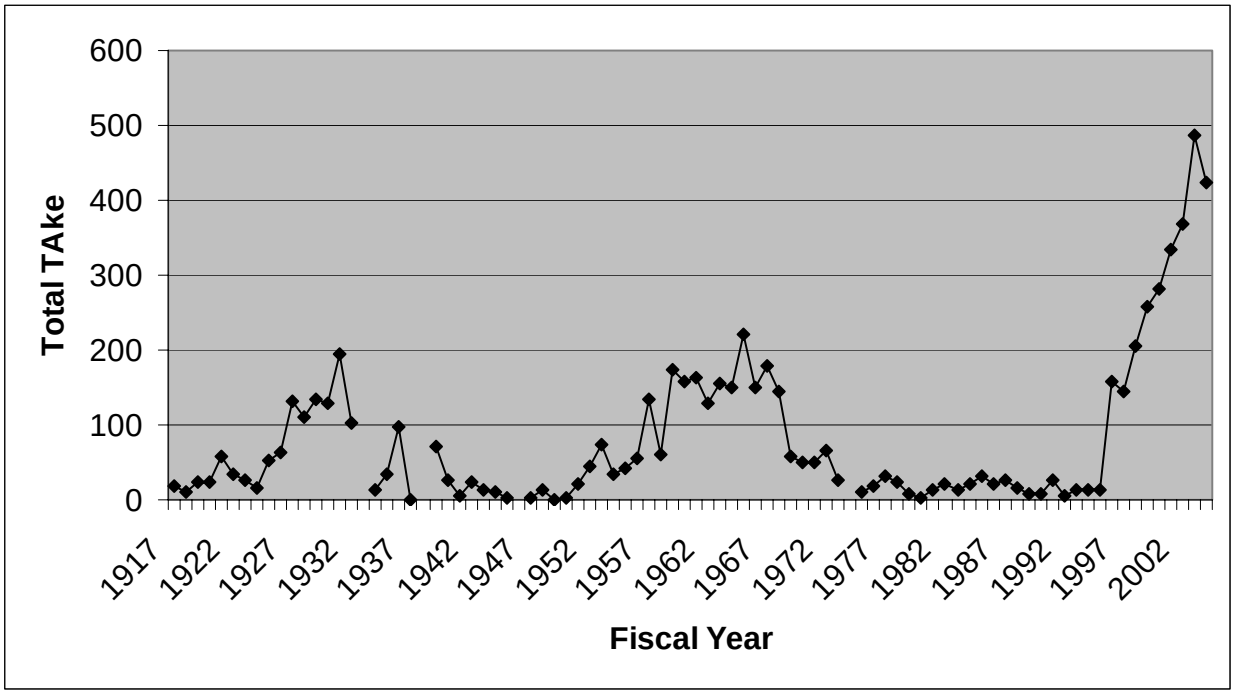


Figure 14. USDA-WS reported skunk take in Utah, 1917-2004. Data reported by USDA-WS.

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 influencing populations. Analyses by Connolly and Longhurst (1975) and Pitt et al. (2002) indicate that the current level of exploitation does not affect coyote populations. It seems likely that coyote populations have never been higher than in modern times.

*Impacts of Predation on Sage-grouse*

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

Secondary effects of predation include biological effects 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 sub optimal 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 was 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 effects 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, "...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, "...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 (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, 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*

No empirical evidence is available specifically related to the effects of predation on sage-grouse in the Resource Area. However, studies done over the past eight years on the Parker Mountain subunit has shown that annually about 30% of radio-collard hens are lost to predation mainly by avian predators.

Many sage-grouse predators are known to occur in the Resource Area and USDA-WS does conduct predator control annually in the area primarily related to livestock operations, which is likely to influence predator–prey dynamics involving sage-grouse. Additionally since 2003, WS has laid out baited eggs to address increasing corvid populations. While some recent data has been collected from the Parker Mountain subunit on radio-collared hens and chicks, this data is preliminary and further work is needed to determine what effects predation may have on sage-grouse in the resource area at varying times of the year, and with and without WS intervention. While predation efforts continue, sage-grouse numbers in the Resource Area are increasing or stable and, given current circumstances and management actions, predation by native predators is

not considered a serious threat to sage-grouse populations. Predation by non-native predators, including domestic animals and red foxes, is an issue of greater concern. Non-native red fox populations have decimated relatively isolated populations of sage-grouse in nearby Strawberry Valley (Bunnell et al 2000) and there is some concern that increasing populations of red foxes in the Resource Area could eventually have a negative impact on sage-grouse populations.

## J. Vegetation Management

Vegetation management conducted in the past was a reflection of the priorities of the time and also on the mandates and policies of the federal government, when vegetation management was done on federal land. In the past, many vegetation treatments were conducted to increase forage for livestock.

Recently, vegetation management has increasingly focused on proactively restoring health to sagebrush rangelands. For example, seeding controlled burns to prevent the establishment of non-desirable species, 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 the restoration of desirable species.

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

Given the current climate of vegetation management (i.e. restore/maintain the health of the plant/wildlife community), vegetation management is not likely to have a 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 and are proposed for 2006 which were 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.

Present research suggest that while habitat treatments can and do increase desirable vegetative plant species for sage-grouse, caution should be used in the extent, size, and shape of these treatments. Research in the Resource Area showed that the majority of sage-grouse use occurs within 30m of the edge of adjacent sagebrush cover and that sage-grouse rarely use habitat outside of these areas (Dahlgren 2006). Several thousand acres have been treated in the Resource Area with the intent of improving sage-grouse brood rearing habitat (Table 3). Many of these treatments particularly on the Parker Mountain subunit have been, and will continue to be, closely monitored over time.

## III. Conservation Strategy

One of the main purposes of this Plan is to suggest 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 PARM 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 PARM 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 PARM partners, although we have designated for each strategy the public and private partners who might be involved in implementation. Designation does not imply responsibility or commitment of resources of any sort to implementing, initiating, or completing any actions, however, it provides a framework of resources and expertise.

### A. Strategies and Actions

1. **Strategy**: By 2011, assess pinyon-juniper stands in the Fish Lake subunit.
   - **1.1. Action**: As a PARM group revisit and make recommendations to treat as needed pinyon/juniper sites (North Mytoge Mountain and North of the Fish Lake turn off).

**Partners**: USU Extension, UDWR, USFS, BLM, SITLA, NRCS, UFBF.
**Threats Addresse**d: Vegetation management, incompatible livestock grazing management, drought and weather, pinyon-juniper encroachment
**Aspects of Sage-grouse Ecology Addressed:** winter habitat quality, summer/late brood rearing habitat quality, connectivity of seasonal habitat types

2. **Strategy**: By 2011, make an assessment of non-desirable/invasive vegetation in sage-grouse habitats.
   - **2.1. Action**: Review and monitor all vegetative sampling by all partners, and more specifically with UDWR range trend data.
   - **2.2. Action**: Avoid using fire in sage-grouse habitats prone to invasion by cheatgrass or other non-desirable species.
   - **2.3. Action**: Evaluate all wildfires and prescribed burns and reseed with forage kochia or other fire-resistant species where appropriate to prevent establishment of cheatgrass.
   - **2.4. Action:** Identify areas where undesirable vegetation is encroaching on sage-grouse habitat.
   - **2.5. Action:** Treat areas where undesirable vegetation has become, or is at risk of becoming, a factor in sage-grouse habitat loss or fragmentation.
   - **2.6. Action:** Work with existing weed management programs to control noxious weeds in the Resource Area.
   - **2.7. Action:** Identify large areas of introduced plant species that are not meeting sage-grouse habitat needs and reseed with native species where appropriate.
   - **2.8. Action:** Identify areas where pinyon or juniper trees are encroaching on good quality sagebrush habitat and treat as needed.
   - **2.9. Action:** Manage fire, transportation, and vegetation treatments to minimize undesirable vegetation where possible.

**Partners**: NRCS, UDWR, USFS, BLM, SITLA, USU Extension, private partners.
**Threats Addressed**: Vegetation management, incompatible livestock grazing, drought invasive/noxious weeds, lack of proper range management, incompatible fire management practices
**Aspects of Sage-grouse Ecology Addressed**: Nesting/early brood rearing habitat quality, summer/late brood rearing habitat quality, connectivity of seasonal habitat types

3. **Strategy**: By 2011, complete an assessment on the condition of available water sources and identify potential new water improvement/development projects.
   - **3.1. Action:** Manage vegetation and artificial structures to increase water-holding capabilities of likely habitat.
   - **3.2. Action:** Install catchment structures to slow run-off, hold water, and eventually raise water tables.
   - **3.3. Action:** Modify or adapt pipelines or developed springs to create small wet areas.
   - **3.4. Action:** Locate projects to minimize potential loss of water table associated with wet meadows.
   - **3.5. Action**: Identify key elements of various water projects by developing partners to work cooperatively to maintain existing water sources.

**Partners**: NRCS, UDWR, USFS, BLM, SITLA, USU Extension, private partners.
**Threats addressed**: Vegetation management, drought and weather, water distribution
**Aspects of Sage-grouse Ecology Addressed**: Nesting/early brood rearing habitat quality, summer/late brood rearing habitat quality, connectivity of seasonal habitat types

4. **Strategy:** By 2011, identify key public, SITLA, and private lands in the Resource Area (specific locations to be selected) that are managed so as to conserve/improve sage-grouse nesting habitat.
   - **4.1. Action:** Encourage use of PARM defined conditions for state and federal lands to influence management actions to move toward improved conditions for sage-grouse.
   - **4.2. Action:** Support partner efforts that manage sage-grouse nesting habitat on public, SITLA, and private lands.
   - **4.3. Action:** Use available grouse and brood telemetry data to identify key nesting habitat areas within the Parker Mountain subunit.
   - **4.4. Action:** Pursue habitat improvement projects (to meet PARM defined conditions) on SITLA lands in areas used by sage-grouse for nesting habitat.
   - **4.5. Action:** Identify research needs to address sagebrush treatments at 'lower' elevations where the majority of these nesting activities occur.
   - **4.6. Action:** Use mechanical or chemical treatments to reclaim and/or reseed areas (when necessary) using suitable seed mixtures.
   - **4.7. Action:** Where economically feasible, restore understory vegetation in areas lacking desirable quality and quantity of herbaceous vegetation.
   - **4.8. Action:** Conduct vegetation treatments to improve forb diversity (e.g., harrowing, aerating, chaining) and reclaim or reseed disturbed area, if needed.
   - **4.9. Action:** Develop management techniques to increase forb diversity and density in sagebrush steppe, within limits of ecological sites and annual variations.

   **Partners**: NRCS, UDWR, USFS, BLM, SITLA, USU Extension, private partners
   **Threats Addressed**: Vegetation management, livestock grazing, drought and weather, invasive/noxious weeds, pinyon-juniper encroachment

**Aspects of Sage-grouse Ecology Addressed**: Nesting/early brood rearing habitat quality, summer/late brood rearing habitat quality, connectivity of seasonal habitat types

5. **Strategy**: By 2011, identify key public, SITLA, and private lands in the Resource Area (specific locations to be selected) that are managed so as to conserve/improve sage-grouse leking habitat.
   - **5.1. Action:** Open lek areas that have been invaded by sagebrush and other shrubs.
   - **5.2. Action:** Encourage use of PARM defined conditions for state and federal lands to influence management actions to move toward improved conditions for sage-grouse.
   - **5.3. Action**: Support partner efforts that manage sage-grouse leking habitat on key public, SITLA, an d private lands
   - **5.4. Action**: Pursue habitat improvement projects (to meet PARM defined conditions) on SITLA lands in areas used by sage-grouse for leking habitat.

**Partners**: NRCS, UDWR, USFS, BLM, SITLA, USU Extension, private partners.
**Threats Addressed**: Vegetation management, livestock grazing, drought and weather, invasive/noxious weeds, pinyon-juniper encroachment
**Aspects of Sage-grouse Ecology Addressed**: Nesting/early brood rearing habitat quality, summer/late brood rearing habitat quality, connectivity of seasonal habitat types

6. **Strategy**: Through 2011, avoid natural resource development (oil/gas exploration and development) within important sage-grouse use areas. If development does occur, work with private industry to minimize impacts and follow recommended actions below.
   - **6.1. Action:** Reduce fragmentation of sage-grouse habitat by oil and gas development activities.
   - **6.2. Action:** Locate compressor stations off ridge tops and at least 2,500 feet from active sage-grouse leks, unless topography allows for closer placement.
   - **6.3. Action:** Avoid locating facilities within ¼ mile of active sage-grouse leks, unless topography allows for closer placement.
   - **6.4. Action:** Plan for and evaluate impacts to sage-grouse of entire field development rather than individual wells.
   - **6.5. Action:** Implement near-site and/or off-site mitigation as necessary to maintain sage-grouse populations.
   - **6.6. Action:** Share sage-grouse data with industry to allow planning to reduce impacts.
   - **6.7. Action:** Minimize disturbance to sage-grouse associated with oil and gas development.
   - **6.8. Action:** Reduce cumulative impacts of oil and gas development.
   - **6.9. Action:** Plan and construct roads to minimize duplication.
   - **6.10. Action:** Cluster development of roads, pipelines, electric lines and other facilities.
   - **6.11. Action:** Use existing, combined corridors where possible.
   - **6.12. Action:** Use early and effective reclamation techniques, including interim reclamation, to speed return of disturbed areas to use by sage-grouse.
   - **6.13. Action:** Avoid construction during the breeding/nesting season (March 1 – June 30) when possible in sage-grouse habitat.
   - **6.14. Action:** Limit activities during breeding season (March 1 – May 1) near sage-grouse leks to portions of the day after 9:00 a.m. and before 4:00 p.m.
   - **6.15. Action:** Reduce daily visits to well pads and road travel to the extent possible in sage-grouse habitat.
   - **6.16. Action:** Reduce long-term footprint of facilities to the smallest possible.

**6.17. Action:** Avoid persistent, nonnative grasses (e.g. intermediate wheatgrass, pubescent wheatgrass, crested wheatgrass, smooth brome, etc) in reclamation seed mixes.
**6.18. Action:** Eliminate noxious weed infestations associated with oil and gas development disturbances.
**6.19. Action:** Minimize width of field surface roads.
**6.20. Action:** Participate in county planning efforts for natural resource exploration and development to ensure that biodiversity impacts are minimized.
**6.21. Action**: Cooperate with partners (NRCS, UDWR, USFS, BLM, SITLA) planning efforts to minimize impacts on sage-grouse brood rearing habitat.

**Partners**: NRCS, UDWR, USFS, BLM, USU Extension, County Planning departments, private partners, Wildlife Services.
**Threats Addressed**: Power lines, fences, and other tall structures, predation, renewable and non renewable energy development, roads
**Aspects of Sage-grouse Ecology Addressed**: Population size, population distribution, connectivity of populations and subpopulations.

7. **Strategy**: Through 2011, identify high use areas available to sage-grouse during the late summer and early fall brood rearing time period.
   **7.1. Action**: Use available grouse and brood telemetry data and remote sensing data to identify key brood rearing habitat areas within the Parker Mountain subunit.
   **7.2. Action**: Work with public and private partners to maintain areas use by sage-grouse during late summer and early fall.

**Partners**: NRCS, UDWR, USFS, BLM, SITLA, USU Extension, private partners
**Threats addressed**: Vegetation management, drought and weather, water distribution
**Aspects of Sage-grouse Ecology Addressed**: Nesting/early brood rearing habitat quality, summer/late brood rearing habitat quality, connectivity of seasonal habitat types.

8. **Strategy:** Through 2016, identify measures to manage key wintering areas available for sage-grouse.
   **8.1. Action:** Use available winter grouse telemetry data and local knowledge to map these areas.
   **8.2. Action:** Work with public and private partners to identify winter locations.
   **8.3. Action:** Use UDWR aerial winter big game surveys to identify and map these areas.

**Partners**: NRCS, UDWR, USFS, BLM, SITLA, USU Extension, private partners
**Threats addressed**: Vegetation management
**Aspects of Sage-grouse Ecology Addressed**: winter habitat quality, connectivity of seasonal habitat types.

9. **Strategy**: By 2009, maintain or increase populations of sage-grouse in the Resource Area.
   **9.1. Action**: Support and encourage the prevention of illegal harvest of sage-grouse on public lands throughout the year.
   **9.2. Action**: Support continued sport hunting within current UDWR models.
   **9.3. Action**: PARM group will review and determine support of any translocation of sage-grouse hens from the resource area based on population status.
   **9.4. Action**: Continue with annual PARM group counting/classification efforts with sage-grouse lek surveys.

**Partners**: NRCS, UDWR, USFS, BLM, SITLA, USU Extension, private partners

**Threats Addressed**: Parasites/disease, vegetation management
**Aspects of Sage-Grouse Ecology Addressed**: Population size, population distribution, connectivity of populations and subpopulations

**10. Strategy:** Through 2009, search additional areas (TBD by PARM) for new/previously undiscovered sage-grouse leking sites
- **10.1. Action:** Coordinate with UDWR to conduct aerial surveys in areas (Bear Valley, north of Koosharem reservoir, north/Mytoge Mountain, Greenwich) suspected to be undiscovered leking areas
- **10.2. Action:** Coordinate with UDWR, public and private partners to conduct terrestrial like searches in areas (Bear Valley, north of Koosharem Reservoir, north/Mytoge Mountain, Greenwich) suspected to be undiscovered leking areas.
- **10.3. Action:** Continue with and expand annual PARM group counting/classification efforts to include the entire Resource Area.

**Partners**: NRCS, UDWR, USFS, BLM, SITLA, USU Extension, private partners
**Threats Addressed**: Inability to maintain local control and have local input on sage-grouse conservation issues.
**Aspects of Sage-grouse Ecology Addressed**: Population size, population distribution, connectivity of populations and subpopulations

**11. Strategy**: Increase cooperation and coordination between PARM members and other public and private partners.
- **11.1. Action**: Continue with quarterly PARM meetings.
- **11.2. Action**: Annual review and assessment of PARM plan.
- **11.3. Action**: Review and amend the MOU
- **11.4. Action**: Develop means to inform, involve, and educate the local communities as to the efforts of PARM and sage-grouse.

**Partners**: NRCS, UDWR, USFS, BLM, SITLA, USU Extension, private partners
**Threats Addressed**: Inability to maintain local control and have local input on sage-grouse conservation issues, OHV Recreation.
**Aspects of Sage-grouse Ecology Addressed**: Population size, population distribution, connectivity of populations and subpopulations.

**12. Strategy:** By 2016, work to decrease the populations of sage-grouse predators, especially in areas used for nesting and/or brood-rearing.
- **12.1. 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.
- **12.2. Action:** Remove trees, remove/modify raptor perches, and maintain quality sagebrush habitat, where predation concerns on sage-grouse have been identified.
- **12.3. Action:** Begin site-specific predation management considering all predator species (especially common ravens and red fox) where necessary and appropriate.
- **12.4. Action:** Support efforts of USDA-WS to remove red foxes and ravens in areas used by sage-grouse for nesting and brood-rearing during spring and early summer.
- **12.5. Action:** Identify research needs to look at wildlife herbivory issues and treatment sites and the removal of predators.
- **12.6. Action:** Identify additional sources of funding to continue with the current predator

removal efforts.

**Partners**: NRCS, UDWR, USFS, BLM, WS, SITLA, USU Extension, private partners, Wildlife Services.

**Threats addressed**: Vegetation management, predation, in ability to maintain local control.

**Aspects of Sage-grouse ecology addressed**: population size, population distribution, seasonal habitat quality

**13. Strategy:** Provide an appropriate level and system for domestic livestock grazing that maintains and improves both the long-term stability of sage-grouse populations and habitats and the livestock industry in the Resource Area.

- **13.1. Action:** Coordinate grazing management with livestock operators to reduce resource and timing conflicts on leks and prime nesting habitat when possible.
- **13.2. Action:** Apply grazing management practices to achieve desired conditions including maintenance of residual herbaceous vegetation appropriate for the site.
- **13.3. 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.

**Partners**: NRCS, UDWR, USFS, BLM, SITLA, USU Extension, UFBF, private partners

**Threats Addressed**: Livestock grazing

**Aspects of Sage-grouse Ecology Addressed**: Seasonal habitat quality

**14. Strategy:** Minimize impacts of utilities lines in sage-grouse habitat.

- **14.1. Action:** Avoid new construction during important periods and reroute lines where technically and economically feasible to avoid impacts.
- **14.2. Action:** Schedule maintenance to minimize impacts during biologically important time-periods (i.e. breeding), however, maintenance in emergency situations will be unrestricted.
- **14.3. Action:** Install raptor deterrents when applicable.

**Partners**: UDWR, USFS, BLM, SITLA, private partners, Wildlife Services.

**Threats Addressed**: Power lines, fences, and other tall structures, predation, renewable and non renewable energy development, roads

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

**15. Strategy:** Improve knowledge of disease in sage-grouse populations.

- **15.1. Action:** Collect grouse parasite and disease organism samples while handling birds for other research.
- **15.2. Action:** Monitor radio-collared and other sage-grouse for West Nile Virus and other disease outbreaks.

**Partners**: UDWR, USFS

**Threats addressed**: disease

**Aspects of Sage-grouse ecology addressed**: population size, population distribution

**16. Strategy**: By 2016 work to begin to improve understanding of the relationship between livestock grazing and sage-grouse in the Resource Area.

**16.1. Action:** Conduct study on the affects of different types of livestock use, time of use, and intensity of use on sage-grouse populations.

**Partners**: UDWR, USFS, BLM, SITLA, USU Extension, Grazers, Wildlife Services.
**Threats Addressed**: Livestock grazing
**Aspects of Sage-grouse Ecology Addressed**: Seasonal habitat quality

**17. Strategy:** By 2016 implement a study to better understand of the predator/prey dynamics specific to sage-grouse in the Resource Area.

**17.1. Action:** Conduct study of the effects of predation on sage-grouse populations.

## B. Priority Evaluation

A summary of the importance of threats reviewed in the "Threat Analysis" is provided in Table 5. PARM partners and others can use the rankings in Table 5, 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 5. Relative importance/contribution of individual threats to reducing or degrading aspects of sage-grouse populations in the PARM 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 PARM Resource Area** | | | | | | |
|---|---|---|---|---|---|---|---|
| **Threat** | **Reduced Population Size** | **Population Distribution** | **Reduced Lek Habitat Quality** | **Reduced Brood-rearing Habitat Quality** | **Reduced Winter Habitat Quality** | **Reduced Connectivity of Seasonal Habitat Types** | **Reduced Connectivity of Populations & Sub-populations** |
| Powerlines, Fences, & Other Tall Structures | M | M | M | L | M | H | H |
| Natural resource exploration and development | H | H | M | H | H | VH | VH |
| Grazing practices the are detrimental to the habitat (domestic/wild) | H | H | L | H | H | M | M |
| Drought & Weather | H | H | L | H | M | M | M |
| Lack of proper range management | L | M | L | H | M | M | M |
| Hunting Pressure | L | L | L | L | L | L | L |
| Altered Fire Regimes | L | L | M | M | L | H | M |
| Livestock Grazing | L | L | L | H | L | L | L |
| Incompatible OHV Recreation | L | M | L | L | L | M | M |
| Invasive/Noxious Weeds | M | M | M | VH | H | M | L |
| Parasites & Disease | VH | VH | L | L | L | L | H |
| Extraordinary Predation | VH | H | L | L | L | L | M |
| Vegetation Management | H | M | H | H | H | H | M |
| Pinyon-Juniper Encroachment | M | M | M | M | M | M | M |
| Inability to maintain local control and input | H | H | H | H | H | H | H |

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