UINTA BASIN
GREATER SAGE-GROUSE
(*CENTROCERCUS UROPHASIANUS*)
LOCAL CONSERVATION PLAN

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Uinta Basin Adaptive Resource Management Local Working Group

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Uinta Basin Greater Sage-grouse (*Centrocercus urophasianus*)
Local Conservation Plan

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I. Executive Summary

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

The Plan provides an assessment of the status of the Uinta Basin Resource Area sage-grouse population. The intent of the Plan is to provide guidance and recommendations to meet the overall goal of maintaining and, where possible, increasing sage-grouse populations and improving habitat conditions in the Uinta Basin. Conservation and management strategies outlined in the Plan are designed to meet the guidelines set forth by the US Fish and Wildlife Service (USFWS) in their Policy for Evaluation of Conservation Efforts (PECE) standards.

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

Information contained in the Plan is based on a thorough review of the published and unpublished literature relevant to sage-grouse and sagebrush habitats as well as an in-depth, local knowledge possessed by UBARM partners who live and work in the local area. Given the wealth of general information about sage-grouse available in published documents (Connelly et al. 2000, Connelly et al. 2004), we provide only a brief overview of general sage-grouse ecology and try to focus on conditions and issues specific to the Uinta Basin. Knowledge gaps are also identified.

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

II. Introduction

A. Purpose

The Uinta Basin Adaptive Resource Management Local Working Group (UBARM) consists of stakeholders who are committed to managing local conservation issues through education, dialogue, adaptive management, and cooperation. Stakeholders include representatives of the local community, as well as public natural resource management and conservation agencies and private organizations. More specifically, UBARM was organized to prepare the Uinta Basin Greater Sage-grouse (*Centrocercus urophasianus*) Conservation Plan (Plan). The Plan provides a mechanism for maintaining and improving the abundance and viability of Greater Sage-grouse (hereafter referred to as sage-grouse) populations and their habitat in the Uintah Basin, with consideration for historical land uses and long-term socio-economic issues. Although we recognize the wildlife management authority of the Utah Division of Wildlife Resources (UDWR), we believe the Plan will help the UDWR by providing local management solutions based on available information, experimentation, research, and monitoring. In addition, UBARM seeks to identify, develop, implement, and evaluate management actions that will sustain sage-grouse populations and healthy sagebrush habitats that are valuable to the existence of other species. The Plan identifies management areas, key local issues, conservation strategies, population information, research and monitoring needs, and long-term funding needs. Because of the dynamic nature of natural systems, we place a high priority on using an adaptive management process to revise and update the Plan. In this regard, we will coordinate development of project proposals designed to achieve the goals of the Plan with the Uinta Basin Utah Partners for Conservation and Development Regional Team.

This Plan builds on the Utah Greater Sage-grouse Strategic Management Plan (Strategic Plan) that was approved by the Utah Wildlife Board in 2002 (UDWR 2002). The Strategic Plan was developed by the Utah 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 sage-grouse and sagebrush-steppe ecosystems throughout Utah. The primary purpose of the Strategic Plan was to provide a framework for agencies to work within to achieve statewide and local sage-grouse conservation goals. Further, the Strategic Plan identified specific management units throughout Utah in which local working groups could be organized to identify issues and implement adaptive resource management plans to address impacts to sage-grouse populations and sagebrush habitats.

The Plan contains conservation and management strategies and actions designed to meet the guidelines promulgated 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 efforts will be considered when making listing decisions. The Plan was also written to address the USFWS five Listing Factors which are:

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

The Plan directly and indirectly addresses the five USFWS listing factors as they apply to sage-grouse in the Uinta Basin Resource Area (hereafter referred to as the Resource Area and described in detail in Section III of the Plan). 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 may be based on the Plan, but will include the NEPA process. Compliance with this plan by agencies, private enterprise, and private individuals is strictly voluntary. State and federal resource management agencies involved with sage-grouse management 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 conserve sage-grouse in the Resource Area. We believe the participation of private landowners and consideration of landowner needs is critical for management of sage-grouse populations and habitat, and will be of great importance to meet the overall goals of the Plan. True success will only be achieved by managing on a landscape scale. The Plan provides an opportunity to promote ecologically sound management of private and public lands for sage-grouse, without impinging on private property rights.

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

B. Goals and Scope

The goals of the Plan are separated into two categories: Assessment Goals and Strategy Goals. The goals are not listed based on priority.

<u>Assessment Goals:</u>

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

1. Estimate current population size and evaluate population trends; estimate amount and condition of habitat
2. Identify research and monitoring needs and knowledge gaps
3. Determine population and habitat needs for the future
4. Identify and discuss threats that have potential impact sage-grouse in the Resource Area

<u>Strategy Goals:</u>

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

1. Implement appropriate management strategies to conserve sage-grouse and their habitats
2. Increase effective communication with all potential stakeholders in the Resource Area and the state of Utah through outreach, information distribution, and education
3. Address and prioritize threats to aid in prioritizing management solutions
4. Identify and pursue funding sources, or support partners in their pursuance of funding for

projects that will help achieve specific strategies and actions

Scope

This Plan is designed to span multiple land ownerships and land uses throughout its geographic area. Specific conservation issues will be addressed, implemented, and monitored across geographic and political boundaries to increase management and monitoring consistency. The assessment and strategies described herein are specific to the Resource Area and were developed with the unique ecological, social, and economic concerns of that area in mind.

C. Plan Duration

The Plan was designed and written to be a dynamic document that can be adapted to incorporate new information regarding local sage-grouse populations, habitats, and the local community. We will annually re-evaluate the status of sage-grouse populations and habitats in the Resource Area and review progress of the strategies listed in the Plan as per the Standard Operating Procedures (SOP) (Appendix A). The Plan was written to recommend and support conservation actions over a ten-year period. Early termination of the Plan would occur if the sage-grouse was listed under the Endangered Species Act (ESA), or if sage-grouse were removed from the UDWRs Sensitive Species list. Species on the Sensitive Species list include species that are federally listed, are candidates for federal listing, or for which there is "credible scientific evidence to substantiate a threat to continued population viability" (UDWR 2006).

D. Uinta Basin Adaptive Resource Management Local Working Group (UBARM)

The Uinta Basin Adaptive Resource Management Local Working Group was formed in 2004 and has worked consistently and cooperatively toward completion and implementation of the Plan. The group was organized and facilitated by Todd A. Black and Sarah G. Lupis of Utah's Community-Based Conservation Program (CBCP), a collaborative partnership between the UDWR and Utah State University Extension Services, with support from the Jack H. Berryman Institute. Ms. Lupis also serves as the technical writer and compiler of the Plan itself. UBARM is comprised of state and federal agency personnel, representatives from local government, non-profit organizations, academic institutions, private industry, and private individuals. Agencies, organizations, and individuals who contributed to the Plan through their participation in UBARM are listed in Table 1. When 'we' or 'our' is used in the Plan it refers to UBARM.

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

Prior to writing the Plan, we reviewed several local sage-grouse conservation plans, statewide plans, and rangewide plans and assessments (UDWR 2002, Armentrout et al. 2004, Lincoln County Sage-grouse Technical Review Team 2004), to determine the most appropriate structure and content. In addition, a thorough literature review was conducted to ensure that the Plan contained the most recent information available on sage-grouse ecology, life history, and habitat

requirements. Annual working group meetings, work plans, and accomplishment reports will monitor progress toward meeting the goals of the Plan. The Plan is intended to be an evolving document. Incorporating principles of adaptive management as new information arises will help to ensure success of the Plan and UBARM.

Table 1. Uinta Basin Adaptive Resource Management Local Working Group partners.

Blue Mountain Landowners
Diamond Mountain Landowners
Uintah-Daggett-Duchesne County Commissions
Questar Exploration and Production Company
Intermountain Petroleum Association of Mountain States (IPAMS)
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)
Kerr McGee Oil and Gas Company LP
Newfield Production Company
The Nature Conservancy (TNC)
Utah Farm Bureau Federation

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

We operate through a public process based on consensus decision making. For decisions regarding the Plan, consensus was reached by participating members and/or those present at the time the decision was made. 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."

We provided regular opportunities for public involvement, participation, and comment on the Plan. Planning and scoping meetings were scheduled to meet the needs of the greatest number of UBARM participants possible. Meetings were announced by direct mailings, on the CBCP

website (www.extension.usu.edu/cbcp), via email, and through personal phone calls and invitations. During the planning process, we met at least every other month and often monthly. Meeting minutes and critical updates were provided via email, direct mailing, and on the CBCP website. In addition, an annual community forum was held to update the local community on UBARMs activities and solicit participation and comment from local stakeholders. Annual forums were announced in a similar fashion as planning and scoping meetings. The CBCP staff provided information to County Extension offices for display and distribution to the local community. The CBCP also met regularly with County governments (commissions and councils) to update them on UBARMs activities and progress of the Plan. We provided final drafts of the Plan to all potential stakeholders and comments were encouraged. The final draft was posted on the CBCP website to facilitate public access to the document.

E. Planning Process

UBARM engaged in a strategic planning process based on The Nature Conservancy's (TNC) Conservation Action Planning (CAP) process (TNC 2005), modified for single-species (sage-grouse) conservation planning. This process relied on the collective knowledge of UBARM partners, literature reviews, and data collected in the UBARM area. In a step-wise fashion, UBARM partners identified key ecological aspects (KEAs) of sage-grouse ecology and biology and associated indicators (to measure KEAs), determined and ranked the range of variation for each KEA, and assessed the current and desired conditions for each KEA. They then identified and ranked potential threats and listed potential strategies and actions that would abate threats and enhance viability of sage-grouse populations and habitats. KEAs identified included: population size, population distribution, lek habitat quality, nesting/early brood rearing habitat quality, summer/late brood rearing habitat quality, winter habitat quality, connectivity of populations and subpopulation, and connectivity of key habitat types. These KEAs were chosen because they are critical aspects of sage-grouse biology and ecology that, if missing or altered, would lead to the loss of the species over time. Indicators, variability, current, and desired conditions for each KEA are listed periodically throughout this document to demonstrate the results of the planning process and the aspirations of the group.

F. Socio-economic 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 affected by cyclic (boom/bust) economies and global economics that drive commodity prices. To achieve success, management recommendations and solutions designed to improve sage-grouse populations and habitats must be sensitive to local socio-economic issues.

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

Listing the sage-grouse under the provisions of ESA could have a variety of local impacts. Activities that could be affected include noxious weed control, maintenance of rights of way, subdivisions and land development, livestock grazing management, big game wildlife management, natural resource exploration, and recreational land use. Broadly applying 'take' regulations under the ESA could have a significant local impact. There would likely be an increase in legal compliance. Increased cost of environmental permitting and compliance could have an effect on development rates.

In the event of listing, this Plan, along with other local conservation plans, statewide conservation plans, and rangewide conservation assessments and strategies may be used by the USFWS to develop a federal recovery plan. Should these events transpire, the USFWS would 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.

G. Management and Legal Authorities

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

<u>Utah Division of Wildlife Resources (UDWR)</u>

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

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

Counties

The Board of Commissions for Duchesne, Uintah, and Daggett 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 Duchesne, Uintah, and Daggett counties, 2) regulate land use, land planning, and quality and protection of natural resources, and 3) have duly adopted regulations and policies to exercise such authorities (Duchesne County Commission 1997, Daggett County Commission 2004, Uintah County Commission 2005a and 2005b**)**.

The Uintah County Public Lands Implementation Plan (Uintah County Board of Commissioners 2005a) makes the following statements relevant to sage-grouse management:

- Wildlife populations, such as sage-grouse or prairie dog, determined to be in need of special protection must be protected from sport shooting prior to determining the need for implementation or restrictions on livestock grazing or development

- Sage-grouse management in Northeastern Utah must follow the Strategic Management Plan for Sage Grouse 2002 (Publication 02-20 State of Utah Department of Natural Resources Division of Wildlife resources, June 11, 2002). This is to insure that management guidelines for the grouse are compatible with local sage-grouse population and habitat

- Guidelines to manage sage-grouse populations and their habitat (John W. Connelly, Michael A. Schroeder, Alan R. Sands, and Clait E. Braun), represent definitive work on sage-grouse and their habitat. This publication should be the basis for creation of any state or local sage-grouse management plan

- The following buffers must be implemented to insure required protection is provided to sage-grouse during the critical stages of breeding, nesting, and rearing young. These buffers or requirements may be adjusted where natural barriers exist, impacts can be mitigated, or sage-grouse are determined not to be present during the proposed disturbance

    - Avoid significant human disturbances within 0.6 miles (1 km) of a lek during the breeding season (March 1-May 31) from one hour before sunrise to three hours after sunrise.
    - Avoid developing roads, fences, poles, and utility lines within 1300 feet (400 meters) of a lek. Any such developments within the 1300 feet must be designed to minimize to the extent possible, bird structure collision and to prevent raptor perching.

In addition, the Uintah County General Plan (Uintah County Board of Commissioners 2005b) promotes County-to-community, community-to-community and agency-to-County coordination, cooperation, and communication.

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

- Wildlife management agencies, public land management agencies, and the County shall work together to manage big game populations
- Wildlife agencies shall find effective ways to mitigate and compensate landowners for damage caused by big-game animals on private property. Duchesne County recognizes that the Utah Division of Wildlife Resources is mandated by Utah Code to mitigate damage to agricultural crops, equipment, and improvements and that a process to do so is in place
- Wildlife populations shall not be increased, nor shall new species be introduced, until forage allocations have been provided and an impact analysis completed for the effects on other wildlife species and livestock
- Reduction in forage allocation resulting from forage studies, drought, or other natural disasters will be shared proportionately by wildlife, livestock, and other uses
- Increases in forage allocation resulting from improved range conditions shall be shared proportionally by wildlife, livestock, and other uses.
- Wildlife target levels and/or populations must not exceed the forage assigned in the Resource Management Plan (RMP) forage allocations
- Predator and wildlife numbers must be controlled to protect livestock and other private property, and to prevent population decline in other wildlife species
- Resource-use and management decisions by federal land management and regulatory agencies, should support state-sponsored initiatives or programs designed to stabilize wildlife populations that may be experiencing a scientifically-proven decline in numbers.

Portions of Daggett County are zoned to provide some measure of protection to wildlife habitat, including wetlands, wildlands, and open spaces. The zoning requirement (Daggett County Commission 2004, amended 2006) specifically states:

> The Multiple Use (MU-40) District is formulated to protect mountain, hillside, wetland areas subject to flooding, plus agricultural and farmlands from incompatible land uses and the inefficient or costly provision of services while allowing activities that recognize the environmental and physical sensitivity of these areas and the public health, safety and welfare.

<u>Natural Resources Conservation Service (NRCS)</u>

The United States Department of Agriculture (USDA) NRCS has authority to conserve sage-grouse through:

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

The NRCS and Farm Service Agency (FSA) jointly 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 land owners, through the 2002 Farm Bill programs, to improve their range and pastureland to improve sage-grouse habitat. These include watershed practices on private lands, such as water developments and fencing for prescribed grazing to improve livestock distribution. Vegetative or brush management practices include seeding of introduced and native species of grasses and forbs for forage improvement to benefit both wildlife and domestic animals. Other Farm Bill programs include wildlife enhancement, conservation easements, watershed and riparian programs, and programs to reduce soil erosion.

Bureau of Land Management (BLM)

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

1. 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 2 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.

H. 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.

III. Conservation Assessment

A. General Sage-grouse Biology/Ecology

Numerous authors have described various aspects of sage-grouse biology, ecology, and life history. In recent years, several more have published summaries. For the purposes of this document, we have included the summary from the Statewide Strategic Plan (UDWR 2002) and would also recommend the Conservation of Sage-grouse and Sagebrush Habitats by Connelly et al. (2004) for a thorough discussion.

Physical Description

The sage-grouse is the largest grouse species in North America. Adult males are larger than adult females. Adult males weigh 4-7 pounds (1.7-2.9kg) 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 size for migratory sage-grouse populations can exceed 540mi^2 (1,500km^2) (Hulet 1983). For non-migratory sage-grouse populations, home range size varies from 4-11mi^2 (11 to 31km^2). Sage-grouse exhibit high fidelity to seasonal ranges (Fischer et al. 1993). Females return to the same area to nest each year and may nest near their previous year's nesting site (Bunnell et al. 2000, Gates 1983).

Breeding

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

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

Nesting/Reproduction

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

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

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

Survival Rates

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

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

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

has declined to 1.2-2.19 juveniles per hen (Connelly and Braun 1997). It is thought that at least 2.25 juveniles per hen should be present in the fall population, to allow for stable to increasing sage-grouse populations (Connelly and Braun 1997, Edelmann et al. 1998).

B. Habitat Requirements

Breeding/Nesting Habitat

Leks, or strutting grounds, tend to be traditional. In general, the same areas are used year after year. Leks typically occur in open areas surrounded by sagebrush (Patterson 1952, Gill 1965). Examples of lek sites include landing strips, old lakebeds or playas, low sagebrush flats, openings on ridges, roads, cropland, and burned areas (Connelly et al. 1981, Gates 1985). Sage-grouse males appear to form leks opportunistically at sites within or adjacent to potential nesting habitat. The lek is considered to be the center of year-round activity for non-migratory grouse populations (Eng and Schladweiler 1972, Wallestad and Pyrah 1974, Wallestad and Schladweiler 1974), but this may not be the case for migratory populations (Connelly et al. 1988, Wakkinen et al. 1992). Average distances between nests and the nearest leks vary from 0.6-3.9 miles (1.1-6.2km), 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% 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 1981, 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 1981, Gates 1983, Connelly et al. 1988, Pyle and Crawford 1996).

Late brood-rearing habitats are highly variable. Patterson (1952) reported that grouse move from summer to winter range in October, but during mild weather in late fall some birds may still use summer range. 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 and Abundance

Populations of sage-grouse have been declining for the past 25 years (Braun 1995, Connelly and Braun 1997, Beck et al. 2003, Connelly et al. 2004). Recent 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, MOUs signed by WAFWA representatives in 1999 and with federal agencies in 2000, call for consistent monitoring and data collection.

Several techniques have historically been utilized in Utah and in the Resource Area to assess sage-grouse population trends, status, and distribution including lek counts, brood surveys, field bag checks, wing barrels, and hunter surveys. Currently, the primary technique employed by biologists in Utah and in the Uinta Basin is lek counts. This method is described in detail later in this section.

Historic Distribution of Sage-grouse

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

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

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

Lek Counts

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

(1952), who studied sage-grouse in Wyoming, and was based on a count of the maximum number of males observed on a lek over a series of 3-4 visits. The method described by Patterson (1952) results in an index of the population. Population indices, commonly used by wildlife managers, involve a count or measurement of some aspect of the population that is both convenient to measure and thought to be related to abundance (e.g. bird calls, pellet counts, roadside observations, track surveys). 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 3-4 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.

Section on wing-barrel data similar to lek counts above.

D. Assessment of Local Population

Plan Area

The Uinta Basin Resource Area (Resource Area) is located in eastern Utah in Uintah, Duchesne, and Daggett counties. The Resource Area encompasses 5,375,423 acres (24,024mi^2) managed by the USFS, BLM, SITLA, Tribal, and private landowners. The Resource Area is defined by the Utah-Wyoming border to the north, the Utah-Colorado border to the east, the Book Cliffs Divide to the south, and Highway 35 and Wolf Creek to the west. The Resource Area has been subdivided into nine 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 at the Vernal Municipal Airport from 1961 to 1995, July is the hottest month with an average high temperature of 90.0°F; winter lows reach 5°F in January. The Resource Area is a primarily a dry area, receiving an average of only 8.0 inches of rain annually. The Resource Area contains a diverse array of microclimates from low elevation, desert-like conditions to high-elevation forested areas. Recorded climate information does not entirely reflect conditions over the entire Resource Area; however, it does provide an indication of relative conditions.

Landownership

Approximately 56% of the Resource Area is public land. The remaining lands are private, Tribal, and State Institutional Trust Lands Administration ownership (Table 2). The distribution of landownership in the Resource Area is depicted in Figure 1.

Table 2. Landownership in the UBARM Resource Area.

Landowner*	Area (acres)	Area (Miles^2)	% of Resource Area
Bureau of Land Management	1,745,787	2,727	32.74
Northern Ute Tribe	989,500	1,546	18.56
National Park Service	51,324	80	0.96
Private	867,786	1,355	16.28
State of Utah	47,410	74	0.89
School Institutional Trust Lands Administration	414,853	648	7.78
US Fish & Wildlife Service	8,975	14	0.17
US Forest Service	1,182,271	1,847	22.17
* Water adds an additional 23,729 acres (30 mi^2) and represents 0.45% of the Resource Area			

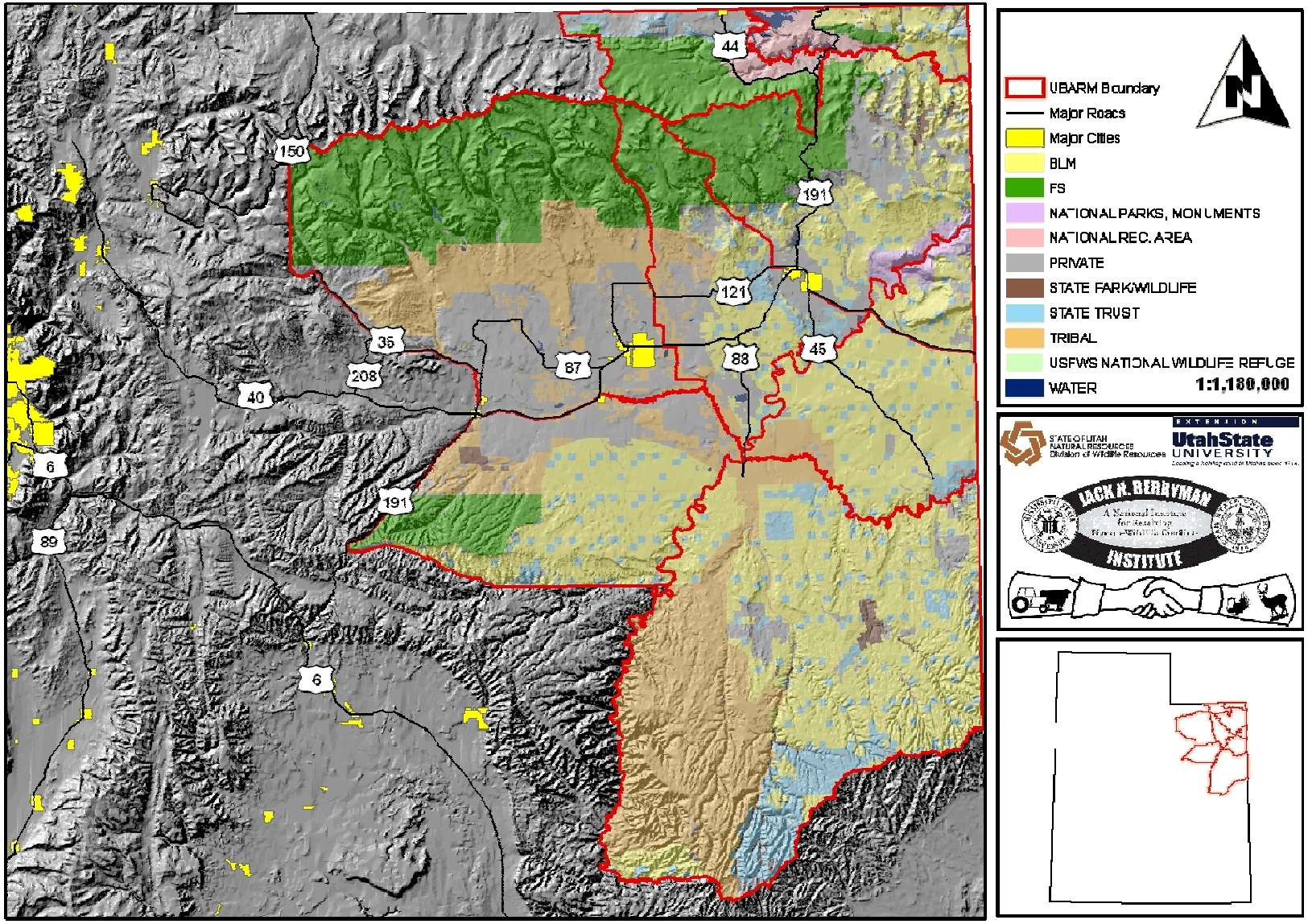

Figure 1. The UBARM Resource Area and subunits with land management and landownership designated.

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 the wildlife species listed above. It is theorized that their numbers and geographic range 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 within the Resource Area. However, we also acknowledge that each species maintains different sage-brush habitat requirements, and that management practices intended to benefit one species may not necessarily benefit other species. Therefore, management prescriptions should consider other species needs on a site-specific and landscape level to ensure an ecosystem approach across the Resource Area.

Human Populations

Settlement of the Uinta Basin lagged behind most of Utah. Early accounts of settlement of the Uinta Basin are summarized from the Utah History Encyclopedia (Fuller 1994). The first settlers came to the Uinta Basin in 1861 when the first Indian Agent, Pardon Dodds, set up an agency near Tabiona. In 1868, he moved the agency to Whiterocks. After completing his term as Indian Agent, he settled in the Ashley Valley in 1873. Soon thereafter, other men, mostly single, joined him there. In 1877, families began to move into the region settling those areas which would later become known as Dry Fork, Deep Creek, Vernal, Naples, and Jensen. Several settlements were established in association with the Ute Indian Reservation starting in 1886, including the towns of Ft. Duchesne, Ouray, and Randlett.

Some areas of the Basin were settled as a result of mining and the railroad during the 1880s. These included Gusher, Dragon, Watson, Rainbow, Bonanza, and White River. These areas were centered near coal and gilsonite mines. In addition, gold and copper mining camps sprang up in the Uinta Mountains, but were deserted by 1901.

In 1905, President Roosevelt opened much of the Ute Reservation to white homesteading. Of the original three-million acres set aside for the Ute Tribe, a million were made available to white settlers. The area included all of what are now Duchesne County and the western part of Uintah County. Soon after they arrived, homesteaders began to construct irrigation systems to make the land more productive and farming became widespread in much of the Basin.

The Uinta Basin is known for boom–bust population cycles. In 1970, the resident population in the Resource Area began a 14-year increase. In 1999, the combined population in Daggett,

Uintah, and Duchesne Counties was just over 40,000 people, but this number is expected to increase as employment opportunities in the resource extraction industry increase in the area.

Livestock Grazing

The history and place of herbivory in the Intermountain West often leads to debate about the appropriateness of domestic livestock grazing on federal lands (Vavra, et al. 1994, Clifford 2002). Young (1994), Young et al. (1976), Vale (1975), and Daubermine (1970) have all indicated our current plant communities are different than those present 'pre-European contact'. All have listed numerous reasons for this difference including grazing, fire, introduced plants, agriculture and more recently, climatic change. In response to this assumption, land management practices (livestock grazing) were often developed with an additional assumption that livestock grazing had 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). A rather large body of research was presented by Burkhardt that indicates plant communities in the Intermountain West did evolve in the presence of grazing by large herbivores, and paleontological/geological records indicate that Pleistocene-era plant communities were similar to the present native flora of the Intermountain West.

Livestock grazing was introduced into the Intermountain West in the mid to late 1800s. Records indicate livestock grazing was introduced to the 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. Historically, numbers of livestock in the Resource Area have varied and, like other areas in the west, were affected by weather, markets, regulation, etc. There has been a general decline in sheep numbers in the Resource Area over the last 50 to 60 years while cattle numbers increased into the 1960s and then began to decline and have been relatively constant for the last 20-30 years. Today cattle and calves remain the top agricultural commodity produced in the Resource Area.

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 Green River tributaries. Although some of the areas used for farming were historically used by sage-grouse, most areas used for farming were not in areas inhabited by sage-grouse (B. Maxfield, UDWR and S. Chew, private landowner, personal communication). In recent years, there has been a decrease in large farms and an increase in small, hobby farms throughout the Resource Area.

Hay crops are the largest commodity in Uintah County. Agricultural practices have trended toward farming of native grasses in some areas, especially in the Altamont and Neola area, with less alfalfa being produced. There is some speculation that this shift has reduced the amount of alfalfa available for sage-grouse use during the late summer months (B. Maxfield, UDWR, personal communication). Finally, use of faster, more efficient farming machinery may lead to increased mortality for sage-grouse that utilize agricultural fields.

Population Status and Distribution

Accounts from pioneers, trappers, and explorers of the Resource Area indicate that sage-grouse were historically abundant in the area. Paul McCoy, whose family came to the Uinta Basin in 1889, recounted that homesteaders coming to the area in 1916 reported an abundance of 'sage chickens'. Another long-time resident of the area, Morgan Hall, reported that during the 1920s, "… the crickets and the sage chickens were so numerous that my horse would almost step on sage chickens during the day..." Somewhat contradictory statements have also been found from the same era. For example, in a 1898 Report of the State Fish and Game Warden (Sharp 1898), "…the sage hen, [does] not seem to thrive well with civilization, and are surely becoming fewer and more difficult to get as the years go by, and bid fair to become extinct before long." In addition, Rulon Hacking, Senior High First Prize, The Protection and Conservation of Game, Animal and Bird Life of the Uinta Basin, was quoted in the Vernal Express in 1924, "The game birds of the Basin are on the decrease. There are a number of reasons for this. First, the illegal hunter…is greatly responsible for this decrease. It is estimated that each coyote kills one hundred and fifty sage chickens per year, either by killing the bird or destroying the egg. A greater effort should be made to get rid of this roamer." These accounts illustrate that sage-grouse populations in the Uinta Basin may have been declining 80 years ago.

The UDWR began using lek counts to monitor sage-grouse populations in the Resource Area in 1967 (Figure 2). That year, a total of 134 male sage-grouse were counted on 3 leks. During these initial counts, the locations of only a few leks were known. According to Connelly et al. (2004), a minimum of 10 leks must be counted before a reasonably accurate population estimate can be made. In 1971, 10 leks in the Resource Area were counted for a total of 121 males. The estimated spring population size in 1971 was 484 adult birds. Sage-grouse populations in the Resource Area reached a peak in 1978 when 748 males were counted on 26 leks. This represents a total estimated spring population of 2,992 adult birds.

Since 2000, the total number of males counted on leks has fluctuated around the 30-year average of 477 total males (Figure 2). The number of males counted fell slightly below the average during 2001 and 2002, likely due to drought conditions, and was slightly above the average in 2003 and 2004. In 2005, more sage-grouse males were counted on leks in the Uinta Basin than ever recorded. A total of 788 males were counted on 51 leks for an estimated total spring population of 3,158 adult birds.

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 >10 leks were counted were included in this analysis (Figure 3). The historical population high of 1978 is still apparent, however, recent increases do not appear as significant, and the population appears to be stable, rather than increasing. This indicates that while the number of males counted on leks in the Resource Area is increasing, increases in total males counted could be attributed to increased counting and lek-searching efforts. In fact, 51 leks were counted in 2005, more than were ever counted in the Resource Area (range = 1-51).

Paragraph on wing-barrel data/information and how it compares to Braun/state guidelines.

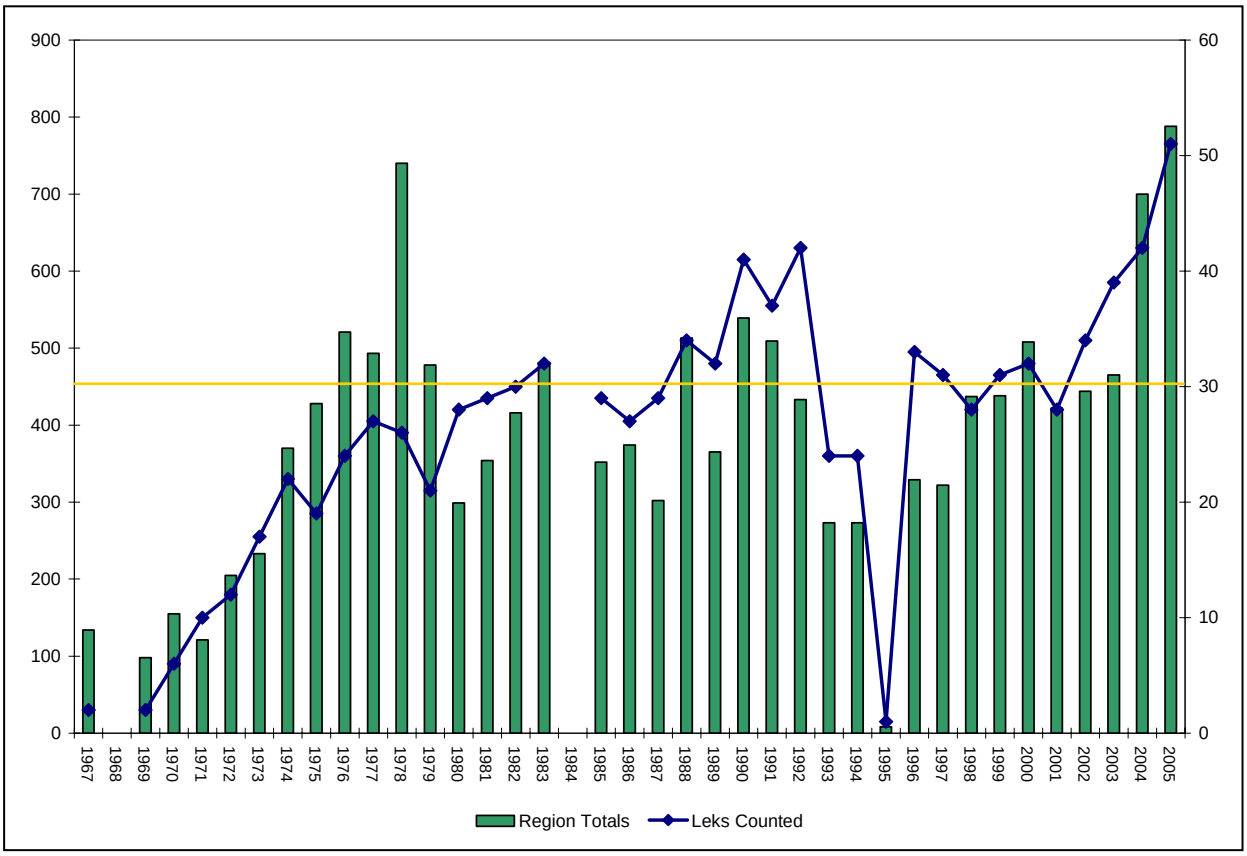

Figure 2. Maximum total number of males counted, number of leks counted, and 30-year average maximum total males counted on leks in the UBARM Resource Area, 1967-2005.

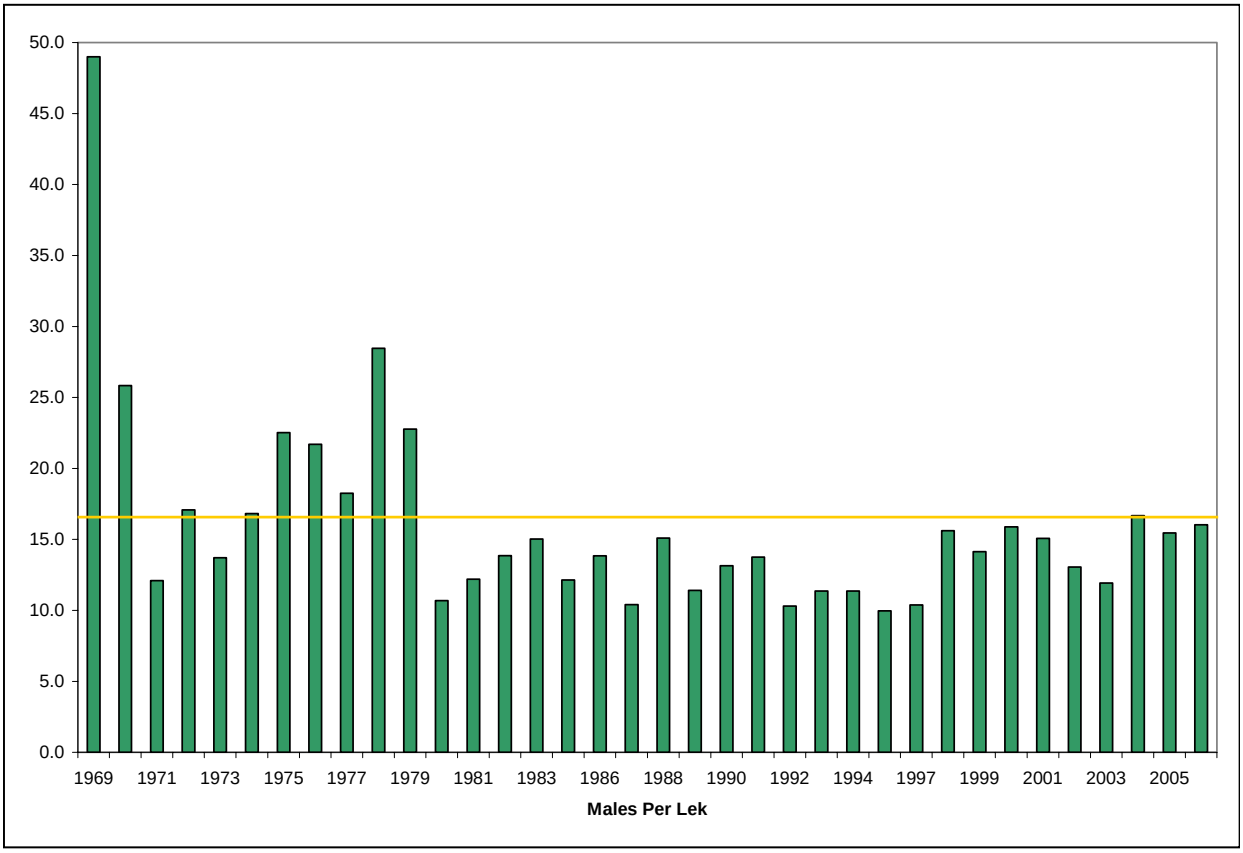

Figure 3. The number of males per lek in the UBARM Resource Area, 1969-2006; only years when >10 leks were counted included.

Conservation Action Planning: Population Size and Distribution

Results of UBARMs CAP process related to population size, distribution, and connectivity are summarized in Table 3. As mentioned before, KEAs, associated indicators, variation, and current and desired conditions were based on expert opinion and observations of UBARM partners, data collected from studies in the Resource Area, and the published literature.

Local Ecology and Life History

Little published information is available regarding the ecology and life history of sage-grouse populations in the Resource Area. Although monitoring (lek counts) has been conducted regularly since the late 1960s (Figure 2), few studies have documented information about aspects of habitat use, survival, sources of mortality, and reproductive success.

In 2002, a research project was initiated by the Ashley National Forest and the UDWR in the Anthro Mountain and Emma/Whitmore Park Areas (Coleman and Christensen 2002, Christensen 2003, Christiansen 2004, McDonald and Christensen 2005).

In 2002, six sage-grouse (three males, three females) were captured and radio-collared. Two of the hens nested and both nests were depredated; ravens were suspected (Coleman and Christensen 2002). The other female and one of the males died during 2002 from predation (predator unknown). Nests were located in mountain big sagebrush dominated communities within two miles of an active lek. All sage-grouse in this study are reported to use sagebrush dominated vegetation near aspen and were often associated with vegetation community edges (Coleman and Christensen 2002). In late fall, sage-grouse were reported to use areas with a greater amount of black sage. Two radio-collared birds moved to Emma Park (~20 miles) for summer range, indicating that the population is somewhat migratory.

In 2003, seven new sage-grouse were captured and fitted with radio-collars and four birds from 2002 remained in the study for a total of eleven radio-collared sage-grouse (eight males, three females) (Christensen 2003). These birds were located periodically throughout the year. Five sage-grouse (one female, four males) died during 2003; predation was suspected but a predator was not identified. One hen produced a successful brood. The brood contained five chicks on August 8, when the hen was found dead. Although specific information on vegetation characteristics of use sites was not reported, Christensen (2003) again reported that broods used areas dominated by mountain big sagebrush near aspen patches that contained plentiful grasses and forbs. In 2003, one male migrated to Emma Park in early October, remained there throughout the winter, and returned to the Alkali lek on Anthro Mountain in the spring of 2004 (B. Christiansen, USFS, personal communication).

In 2004, thirteen males were captured on leks and radio-collared. In addition, two birds were captured in 2003 and affixed with new radio-collars. No females were captured on leks. In the summer, a brood was captured; the hen and four chicks in her brood were fitted with radio transmitters. Christensen (2004) reported that the brood seemed to prefer open areas dominated by grasses, but in close proximity to strips of sagebrush with 25-28% canopy cover. In late summer, the brood frequented an open aspen stand. Although radio-collared sage-grouse were observed to move to Emma Park in 2003, this was not observed in 2004. In 2004, radio-collared sage-grouse were exposed to livestock grazing. Preliminary observations indicate that radio-

Table 3. Conservation Action Planning key ecological attributes (KEAs), associated indicators, and the range of variation for each. Current conditions are in **bold**, desired conditions are in *italics.*

Key Attribute	Indicator	Poor[1]	Fair	Good	Very Good
Population Distribution	Distribution of leks			**Current distribution**	*Current distribution + more leks in the Bookcliffs and on the South Slope of the Uintas.*
Population Size	3-year running average number of males counted on leks	<300	301-625	**626-1,000**	*1,000+*
Population Size	Number of leks	<23	24-35	**36-60**	*60+*
Connectivity of Populations & Sub-populations	Distance to other occupied or potential habitat	Population does not interact with any other population(s).	Next adjacent population 25-35 mi away with few habitat patches in between.	***Next adjacent population 20-35 mi away with large habitat patches connecting the two; a few birds/generation known to move between populations.***	Next adjacent population 15-35 mi away with occasional to regular mixing of individuals through large patches with short separation distances between patches.

[1] **Poor**: Allowing the indicator to remain in this condition for an extended period will make restoration or prevention of extirpation of sage-grouse practically impossible (e.g., it will be too complicated, costly, and/or uncertain to reverse the alteration). **Fair**: The indicator lies outside of its range of acceptable variation and requires human intervention for maintenance. If unchecked, sage-grouse will be vulnerable to serious degradation. **Good**: The indicator is functioning within its range of acceptable variation, although it may require some human intervention for maintenance. **Very Good**: The indicator is functioning within an ecologically desirable status, requiring little human intervention for maintenance within the natural range of variation (i.e., is as close to "natural" as possible and has little chance of being degraded by some random event).

collared birds moved out of the area where livestock were located; however, flocks were reestablished within a few weeks and were found near livestock after the initial introduction (B. Christensen 2004).

In 2005, twenty-eight radio-collared sage-grouse (seven chicks, eight females, thirteen males; eleven of which were radio-collared in 2004) were observed. The 2005 Project Report (McDonald and Christensen 2005) details the objectives, methods, and results of this research investigation for 2005, however we have summarized parts of that report here. The authors found male sage-grouse strutting between April 8 and May 19, 2005 and observed one radio-collared male strutting at more than one lek. Of the eight radio-collared females, five nested and two were successful (>1 chick recruited into fall population). Two of the failed nests were predated (predator unknown) and one was abandoned. Of the seven radio-marked chicks, three are known to have been predated, three lost their transmitters, and one is unknown. Transmitters were found intact, and it is suspected that they may have been attached improperly (B. Christensen, USFS, personal communication). Thirty-three percent of the radio-collared males and females in this study succumbed to predation. Predators, however, were largely unknown although a coyote was once confirmed as the probable predator. As previously mentioned, survival rates for sage-grouse hens reported in the literature range from 35% to 85% (Wallestad 1975, Zablan 1993, Connelly et al. 1994), indicating that predation effects in this part of the Resource Area are not extraordinary.

McDonald and Christensen (2005) used ocular estimation to record species composition, vegetative structure, relative ground cover, and the percent cover of shrubs, grasses, and forbs at each location site; photo points were also taken (B. Christensen, USFS, personal communication). Hens generally nested under sagebrush. The vegetation composition at nest sites included an average of 0.82% trees, 13.7% grasses, 14.6% forbs, and 26.6% shrubs. The authors report that broods and other radio-collared birds were often found in areas dominated by sage-brush, near more open areas dominated by grasses and forbs, or were found near aspen or douglas-fir stands. Birds were frequently associated with vegetation community edges, which had a high variety of grasses and forbs. Sage-grouse were also observed to use ‘islands’ of sagebrush within prescribed burn areas (B. Christensen, USFS, personal communication).

McDonald and Christensen (2005) noted some seasonal movement patterns within Anthro Mountain area. Radio-collared birds seemed to move westward in the late spring and summer to Wire Fence Ridge and then easterly towards Nutters, Alkali, and Chokecherry ridges. The birds appeared to leave the Anthro Mountain area during winter.

Research on radio-collared sage-grouse can provide a wealth of information about many, varied aspects of local sage-grouse ecology, population status, and movements. However, there is a need for greater standardization of methods between agencies and university partners. We recommend that future research projects follow guidelines developed and summarized in Connelly et al. (2003), to the greatest extent practical.

Finally, as this summary indicates, research has focused on birds in the Anthro Mountain area. We recommend that future research strive to address other areas and subunits of the Resource Area for which little information is know while continuing to monitor sage-grouse and their habitats in the Anthro Mountain area.

Local Habitat

The extent of seasonal habitat types in the Resource Area was mapped by the UDWR in 1999. Figure 4 and Figure 5 illustrate where nesting, brood-rearing, and winter habitats are located in the Resource Area.
The UDWR Big Game Range Trend project has been monitoring sites throughout the Resource Area to track changes in vegetation composition, structure, and diversity. Although these sites were placed in areas used by big game, they often overlap sage-grouse seasonal habitat types (Figure 6) and, as such, they can provide information about vegetation and habitat conditions in those areas in a general sense. Data collected at these sites are summarized and available at: http://www.wildlife.utah.gov/range/. The UDWR has also established vegetation monitoring sites in areas where treatments have taken place. These sites are also monitored by the Big Game Range Trend project staff and are evaluated using similar techniques and measures.

Habitat Improvements and Completed Conservation Actions

The UDWR, in conjunction with the Utah Partners for Conservation and Development (UPCD), has implemented several habitat improvement projects in the Resource Area targeted at restoring or enhancing sage-grouse habitat. In 2004, approximately 4,100 acres of habitat in the Resource Area were treated and 7,000 acres were treated in 2005. Treatments were aimed at reducing sagebrush canopy and enhancing native grass/forb cover in the understory. Additional habitat improvement projects are planned for 2006. The UDWR anticipates treating 15,425 acres in the Resource Area in 2006. The location of some habitat improvement projects is given in Figure 7. Table 3 lists the acreage and general location of habitat improvement projects implemented in 2004 and 2005 and proposed for 2006 by the UDWR.

The USFS has also implemented several habitat improvement projects and burn restoration projects on the Uinta Mountains and Tavaputs Plateau. General conclusions (S. Goodrich, USFS, personal communication) from the monitoring of those projects are:

- Big sagebrush is well adapted to drought except on areas bordering or grading into desert shrub communities
- Mountain big sagebrush can return to burned areas with crown cover reaching pre-burn levels in about 15-30 years
- Mountain big sagebrush can return to pretreatment levels following herbicide applications in about the same time as in burned areas
- Limited information indicates Wyoming big sagebrush will take much longer to recover from fire than mountain big sagebrush

In 2006, USU and the Ashley National Forest initiated a study to evaluate the effects of small scale (<100 acres) prescribed burning on use of mountain big sagebrush communities by sage grouse. The selected sites, located on Anthro Mountain, will be burned in the fall of 2007. Two years of pre-treatment and 2 years of post-treatment data will be collected relative to sage-grouse use of the areas and the vegetative response. The information gleaned from this study will enhance UBARM's understanding of fire as a potential threat and potential tool in the Resource Area

Conservation Action Planning: Habitat Quality and Connectivity

Results of UBARMs CAP process related to seasonal habitat quality and connectivity of seasonal habitats are summarized in Table 4. As mentioned before, KEAs, associated indicators, variation, and current and desired conditions were based on expert opinion and observations of UBARM partners, data collected from studies in the Resource Area, and the published literature.

Table 4. Conservation Action Planning key ecological attributes (KEAs), associated indicators, and the range of variation for each. Current conditions are in **bold**, desired conditions are in *italics*.

Key Attribute	Indicator	Poor[1]	Fair	Good	Very Good
Lek habitat quality.	Proximity to sagebrush (or other cover) and openness on lek.	No appropriate cover w/in 400 m of most leks; significant encroachment of tall vegetation on leks.	Dispersed patches of sagebrush cover and little grass w/in 400 m of lek; density of tall vegetation on leks increasing.	**Large patches of sagebrush or other cover w/in 400 m of lek with no encroachment of tall vegetation.**	*Large patches of sagebrush or other cover w/in 400 m of lek with no encroachment of tall vegetation.*
Nesting/early brood-rearing habitat quality.	Sagebrush canopy cover and density; understory composition; proximity to open patches dominated by herbaceous vegetation.	Inadequate sagebrush cover/density; little perennial grasses or forbs in dense sagebrush with no openings.	**Inadequate or high sagebrush cover/density; poor perennial grass/forb cover in sagebrush with limited openings.**	*Adequate sagebrush cover/density; some perennial grasses/forbs in sagebrush with good perennial grass/forb content in openings.*	High stature grasses in shrublands; dense cover in riparian zone; high species richness; a matrix of open patches that includes mesic sites.
Summer/Late Brood-rearing Habitat Quality	Sagebrush canopy cover and density; understory composition; proximity to open patches and mesic sites dominated by herbaceous vegetation.	Little or no shrubland cover/density; little perennial grasses or forbs in dense sagebrush with no open patches or mesic sites.	**Little or high shrubland cover/density; poor perennial grass/forb cover in sagebrush with limited openings and mesic sites or alfalfa fields.**	*Open shrubland (5-10%) with moderate stature grasses; some perennial grasses/forbs in sagebrush with good perennial grass/forb content in openings; some mesic sites.*	High stature grasses in open shrublands (5-10%); dense cover in mesic sites; high species richness; a matrix of open patches and many mesic sites.
Winter Habitat Quality	Sagebrush canopy cover and height.	Majority sparse sagebrush cover or very small patches or majority very dense and tall (i.e. "decadent"); sagebrush frequently covered by snow.	Low stature and/or sparse sagebrush cover on westerly and southerly slopes and drainages or majority very dense and tall (i.e. "decadent"); sagebrush often covered by snow.	***Less than 15% canopy cover of sagebrush on southerly and westerly aspects and few dense patches available; sagebrush rarely covered by snow.***	Widely distributed winter habitat throughout the Resource Area; canopy cover >15% sagebrush on southerly and westerly aspects w/average of 10" above snow depth on >5% slopes; dense sagebrush cover in drainages.
Connectivity of key habitat types	Condition of surrounding natural vegetation	Life history patches are sparse and dispersed creating barriers between low habitat patches.	Habitat patches are isolated and narrowly connected.	***Habitat patches are of generally good quality and close proximity, but with some fragmenting features.***	All habitat patches are within a similar matrix and functionally connected.

[1] **Poor**: Allowing the indicator to remain in this condition for an extended period will make restoration or prevention of extirpation of sage-grouse practically impossible (e.g., it will be too complicated, costly, and/or uncertain to reverse the alteration). **Fair**: The indicator lies outside of its range of acceptable variation and requires human intervention for maintenance. If unchecked, sage-grouse will be vulnerable to serious degradation. **Good**: The indicator is functioning within its range of acceptable variation, although it may require some human intervention for maintenance. **Very Good**: The indicator is functioning within an ecologically desirable status, requiring little human intervention for maintenance within the natural range of variation (i.e., is as close to "natural" as possible and has little chance of being degraded by some random event).

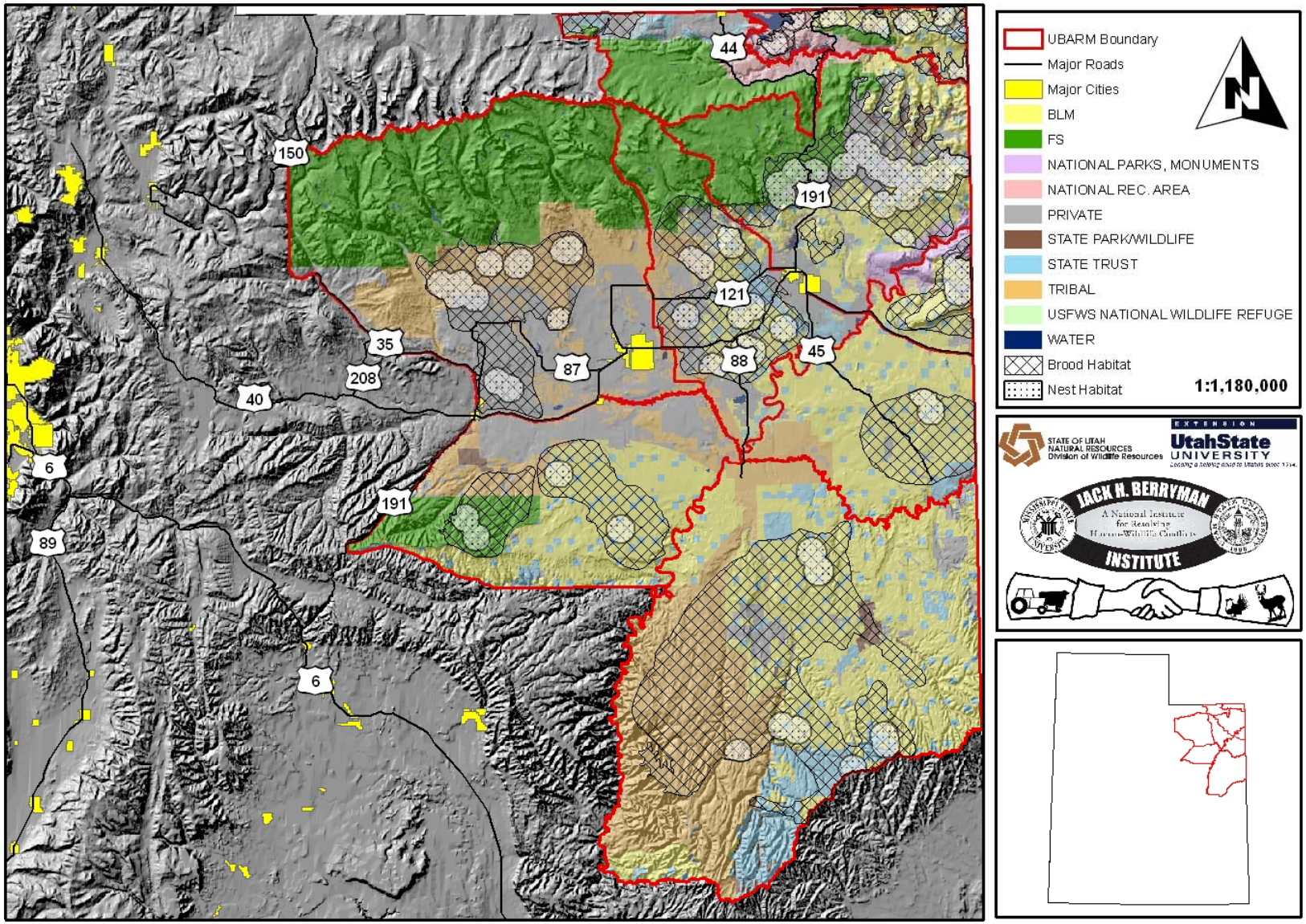

Figure 4. Location of sage-grouse nesting and brood-rearing habitat in the UBARM Resource Area, as identified by the UDWR, 1999.

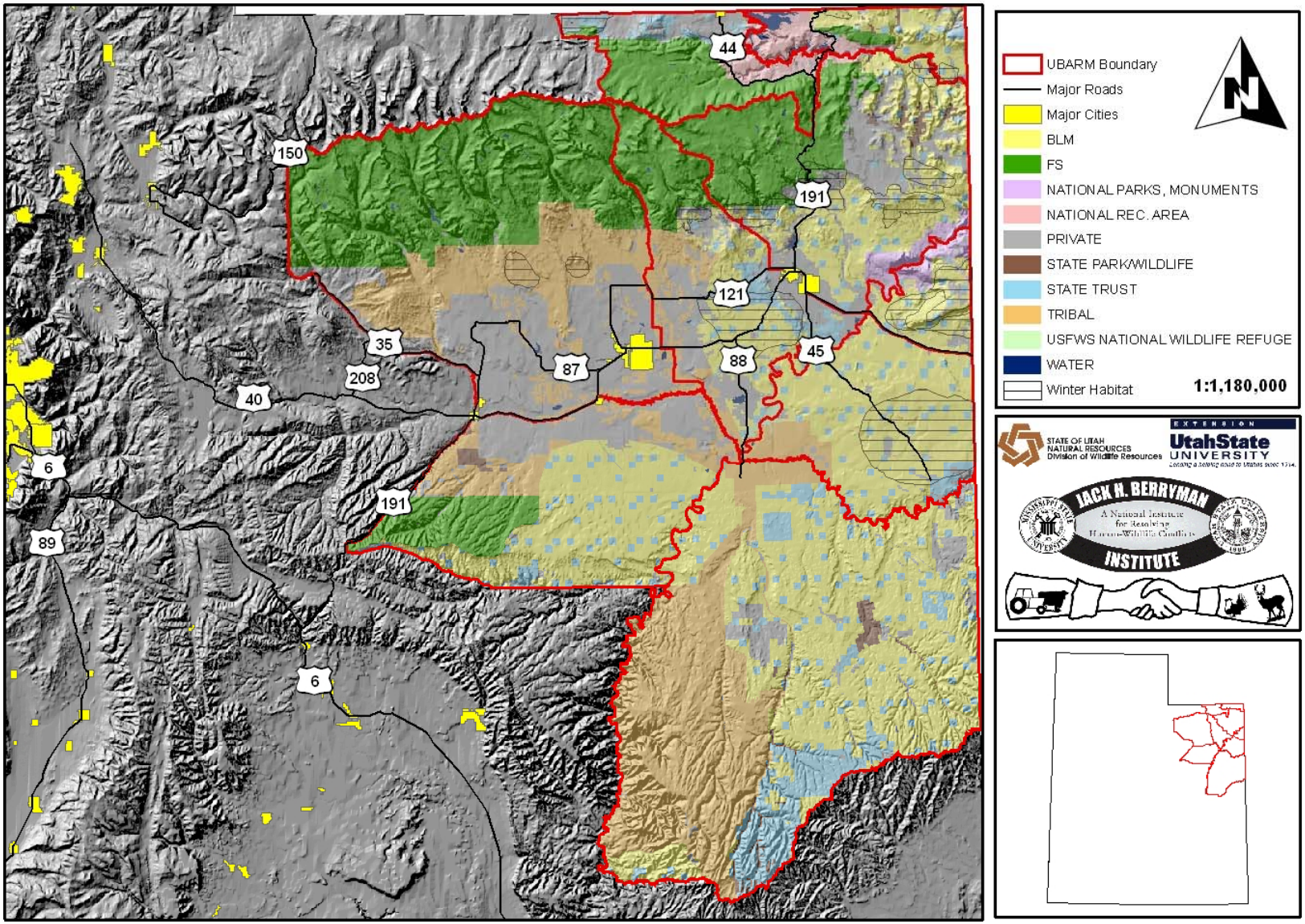

Figure 5. Location of sage-grouse winter habitat in the UBARM Resource Area, as identified by the UDWR, 1999.
UPDATE MAP WITH NEW LOCATIONS

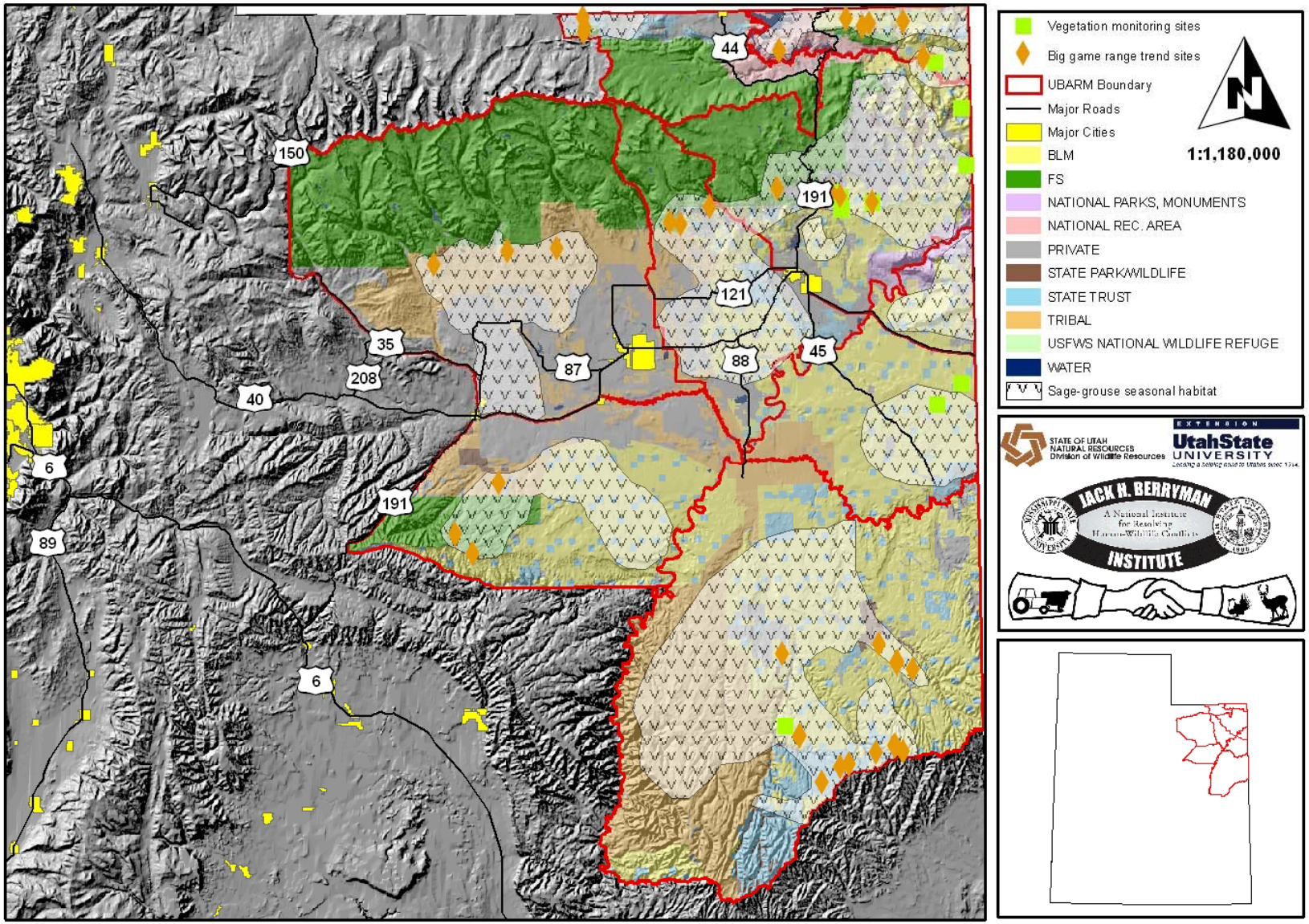

Figure 6. Location of Utah Big Game Range Trend Sites that fall within sage-grouse seasonal habitat types as identified by the UDWR, 1999.

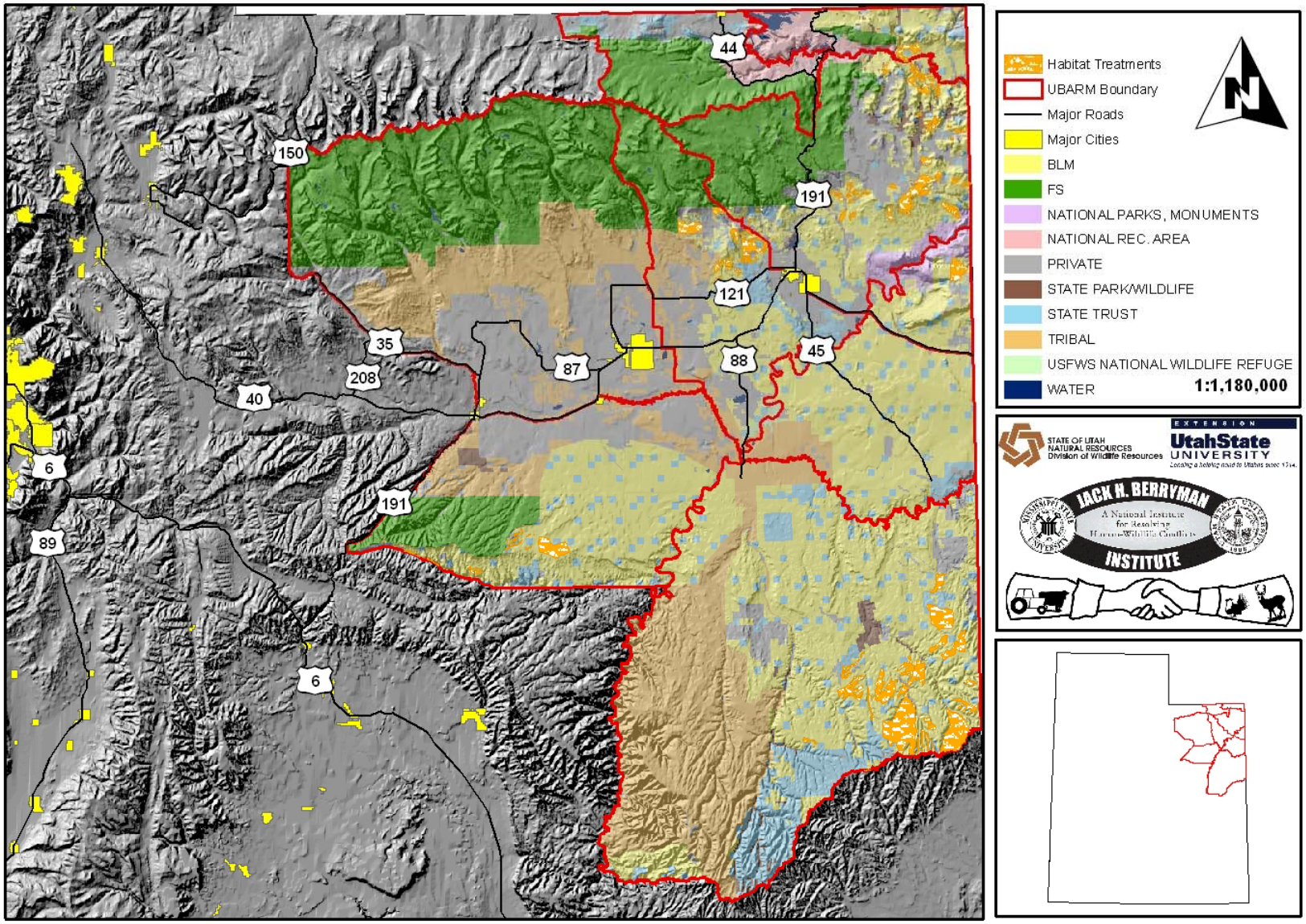

Figure 7. Location of some habitat improvement projects in the UBARM Resource Area.

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

Year	Project Name	Acres
2004	Red Fleet	1,600
	Deadman Bench	500
	Bare Top	1,100
	Horse Point	900
2005	Taylor Flat	1,000
	Red Creek Flat	1,000
	Monument Ridge	1,000
	Wolf Point	1,000
	Ruple Cabin	1,800
	V Canyon Ridges	1,000
	Snake John	200
2006 (proposed)	Blue Knoll	1,000
	Winter Ridge	2,000
	North King's Point	1,000
	King's Point	1,000
	Wolf Point Phase 2	1,350
	Little Asphalt Ridge	1,000
	Goslin Mountain	1,000
	Chew-Blue Mountain	500
	West Stuntz	180
	Brush Creek Bench	300
	Red Creek Flat Phase 2	500
	Clay Basin	1,225
	Anthro Mountain	1,000
	Siddoway	700

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.

A. Development and Human Infrastructure

In this section, we summarize the potential effects of development and human infrastructure including 1) homes and cabins, 2) powerlines, fences, and other tall structures, 3) renewable and non-renewable energy, and 4) roads, on sage-grouse populations in the Resource Area. These impacts were considered together because they are associated with similar stresses (loss of habitat quality and quantity, habitat fragmentation, direct disturbance, increased predator pressure). There is little empirical evidence available regarding the direct or indirect impacts of most of the threats reviewed in this section, especially those that are specific to this Resource Area.

Home and Cabin Development

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

Increases in the human population in the Uinta Basin have led to a corresponding increase in the amount of land being developed. Figure 8 illustrates the trend in the number of residential building permits issued in Uintah County between 1980 and 2003 (Gillam 2006). Housing development reached a peak in the early 1980s and in recent years has stabilized with about 100 new building permits issued each year (Gillam 2006). Most residents live in the Vernal area including the City of Vernal, Naples, and in the unincorporated areas of Maeser and Glines. Most new construction, both residential and non-residential, has also occurred in these areas. In recent years, growth in the unincorporated parts of Uintah County has also been increasing. In 2004, there were 256 permits issued for single-family, residential homes; there were 258 issued in 2005 and 418 issued in 2006. The Uintah County planning department anticipates that approximately 600 new permits will be issued in 2007 (D. Peterson, Uintah County, personal communication). Growth in existing towns and cities is not likely to further directly impact sage-grouse populations, as sage-grouse do not occur in these areas. However, current and future increases in grown in unincorporated parts of Uintah County, including development pressure on Diamond Mountain, Blue Mountain, and other areas where sage-grouse are located, for vacation homes (B. Kitchen, USU Extension, personal communication), potentially will have direct impacts on populations and habitats. Indirectly, growth throughout the area is likely to generate additional impacts from OHV recreation, new roads, new power lines, predation by domestic animals, and other types of infrastructure development and recreation, described elsewhere in this section, the magnitude of which cannot be accurately anticipated.

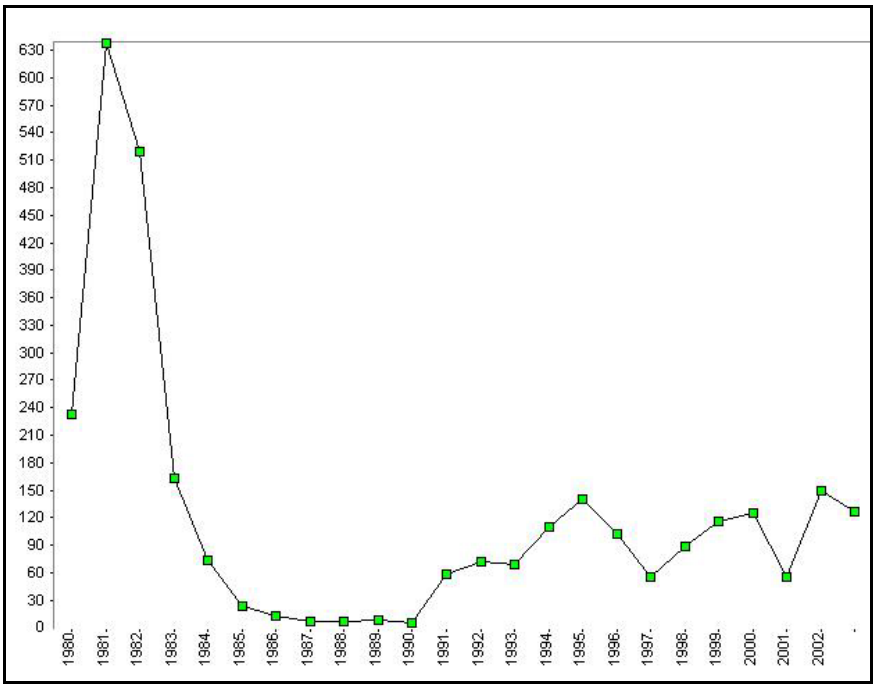

Figure 8. Number of housing permits issued in Uintah County, 1980-2003 (Gillam 2006).

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 with the development of rural properties, and with construction of new county roads. Power lines have also increased in number and length (Figure 9), and transmission and service lines have been constructed to service mines and transfer electric power out of the area.

Renewable & Non-renewable Energy Development

The primary industry in the Resource Area is oil and gas exploration and development. For example, in 1997, there were 462 mining firms in Duchesne County employing 4,671 people (Duchesne County Chamber of Commerce 2006). Although oil and gas wells were established in the Resource Area as early as 1911, construction increased in the 1960s and 1970s and again in the 1980s (Figure 10). In recent years (2000-2004), on average, 348 new wells have been constructed annually (OGM 2006).

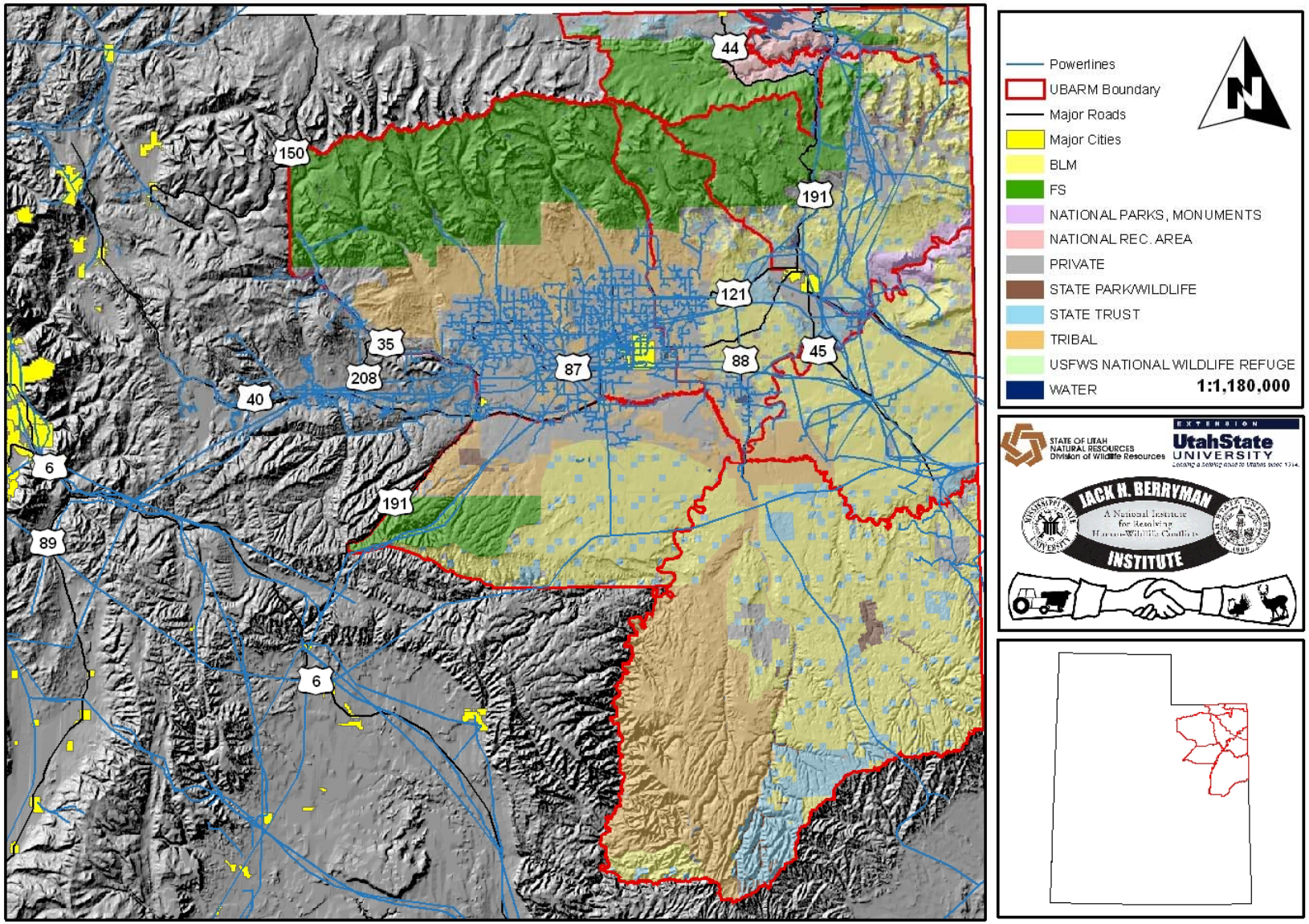

Figure 9. Location of powerlines in the Resource Area. Data from Connelly et al. (2004), obtained from http://sagemap.wr.usgs.gov/index.asp.

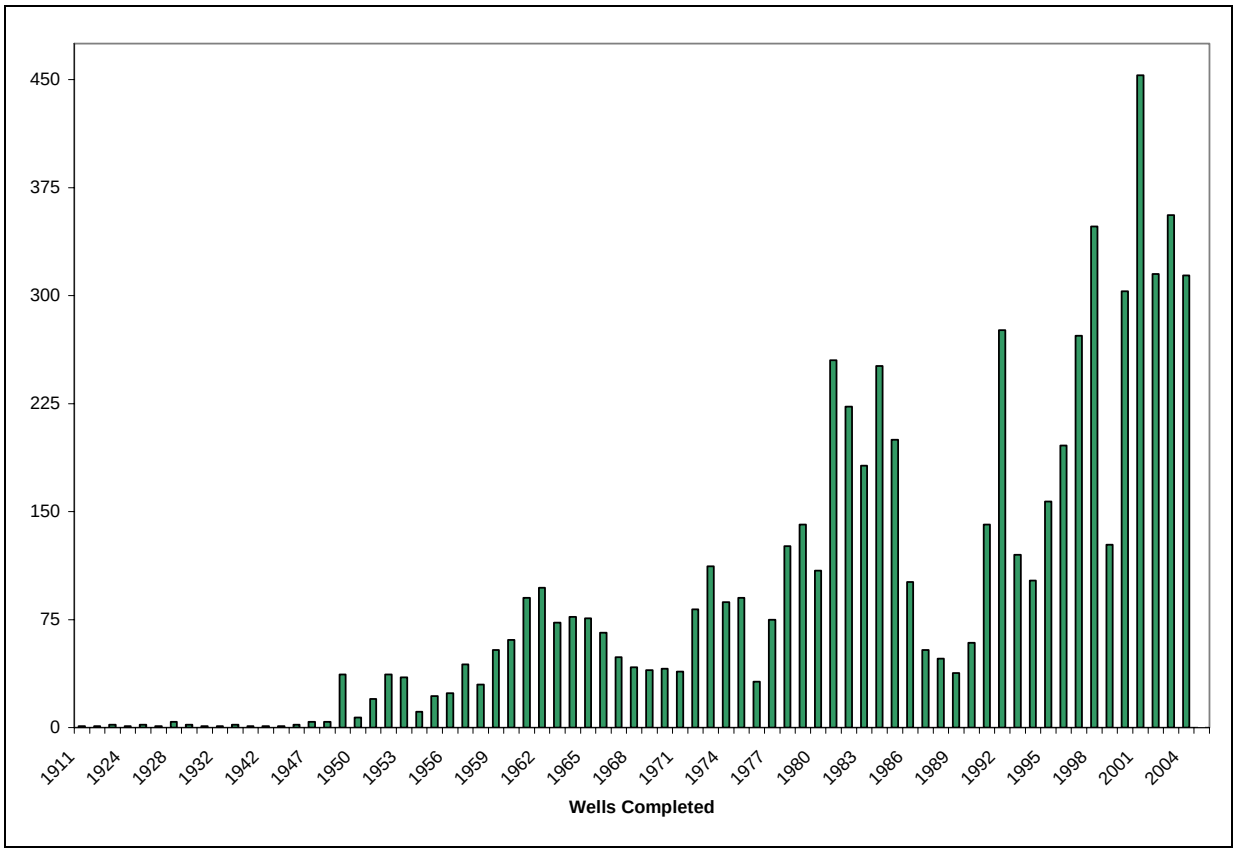

Figure 10. Number of oil and gas wells completed in Uintah County, 1911-2004 (OGM 2006).

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).

The location of drill sites is depicted in Figure 11. Although drill sites only represent places where oil or gas depositions were sought, many sites were fruitful and pads now exist in those areas as well. Figure 11 is provided to illustrate generally where oil and gas impacts are located in the Resource Area.

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

Roads

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.

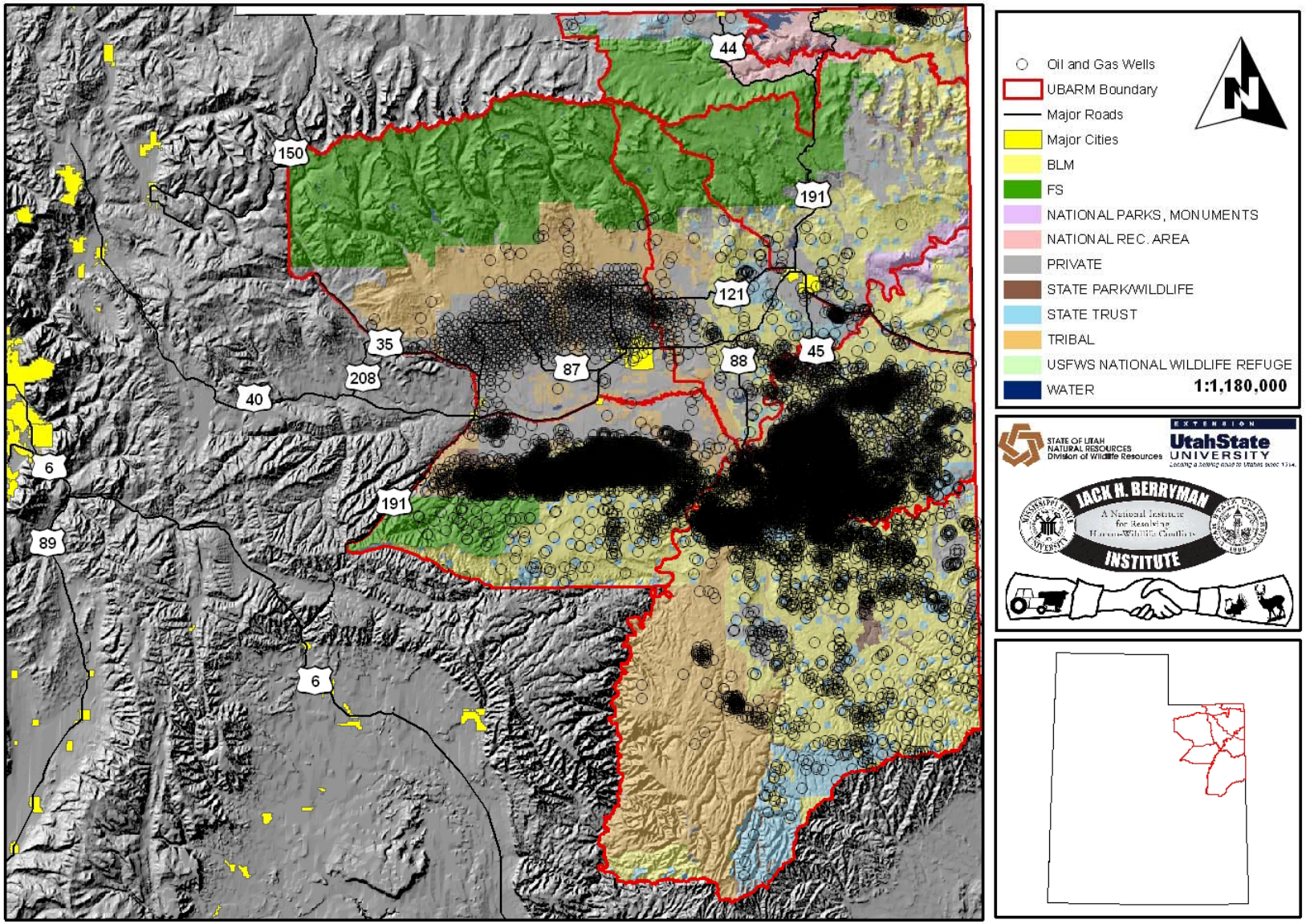

Figure 11. Location of drill sites in the UBARM Resource Area. Data obtained from http://www.ogm.utah.gov/oilgas/MAP_SEARCH/map_search.htm.

B. Drought and Weather

Long periods of below average precipitation, above average summer temperatures, above average snowfall, or below average winter temperatures can have adverse effects on sage-grouse reproductive success and survival. In fact, prolonged drought during the 1930s and in the latter part of the 20th century coincided with 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 1989, 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).

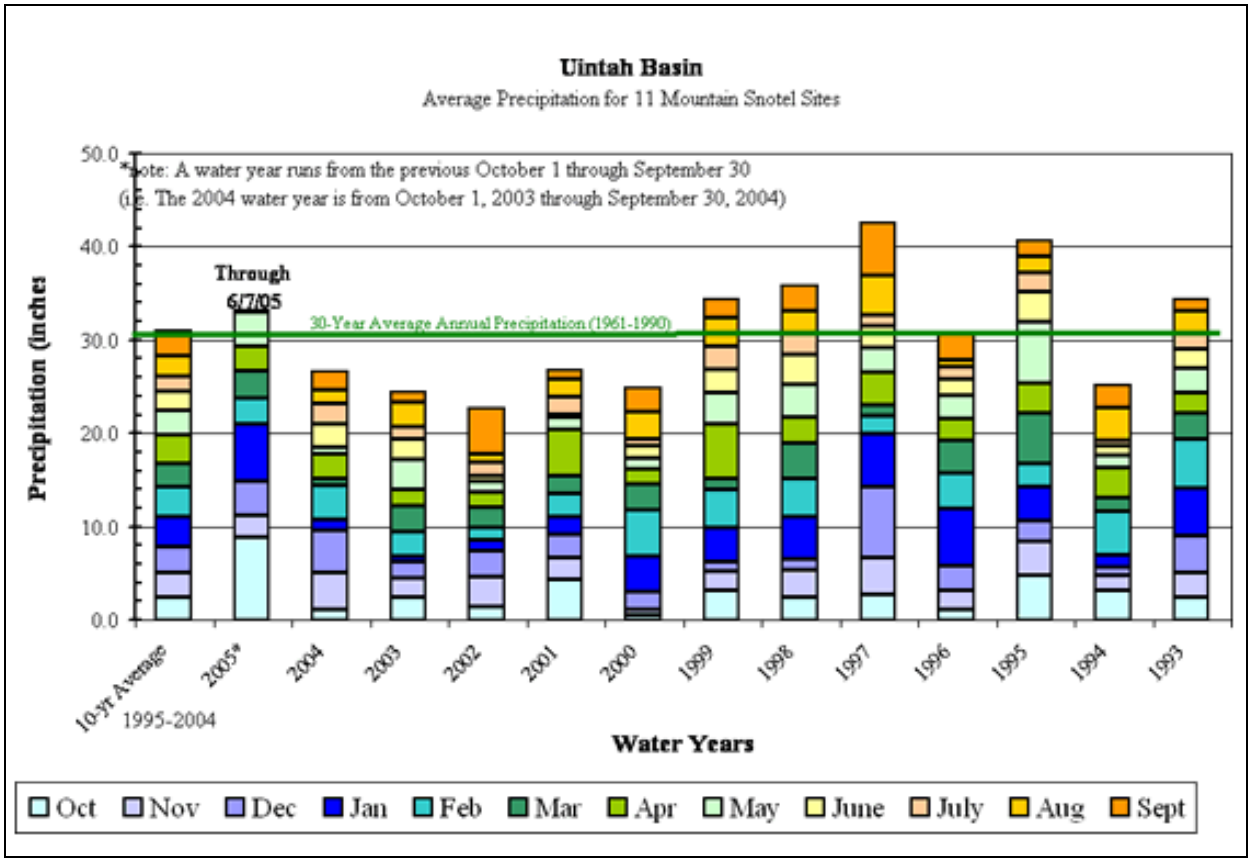

Figure 12. Precipitation in the UBARM Resource Area from 1993-2005. From 2000-2005 precipitation fell below the 30-year average, considered drought conditions (Utah Division of Water Resources 2006).

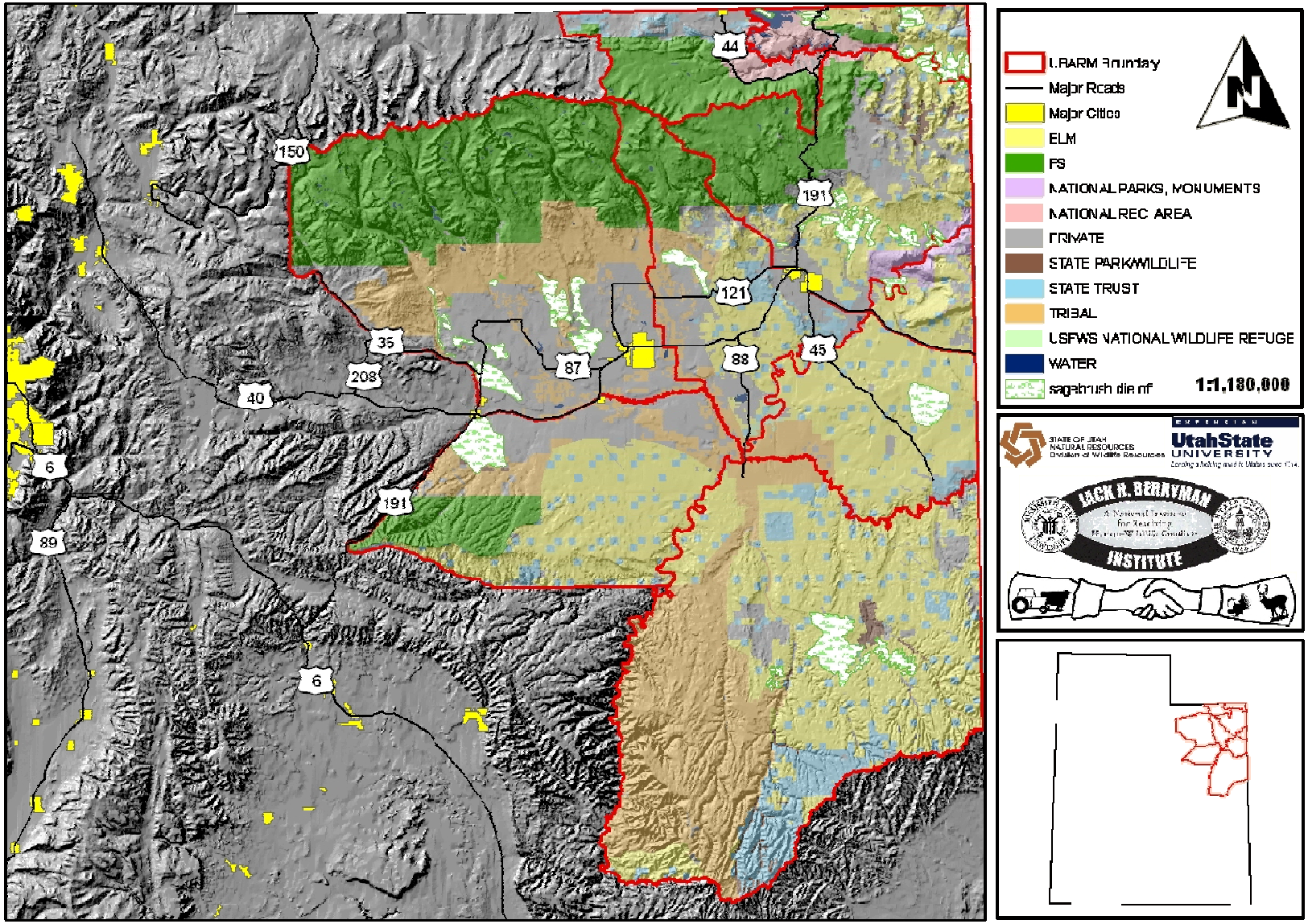

Figure 13. Location of 2002-2004, drought-related sagebrush die-off in UBARM Resource Area.

C. Hunting

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

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 1979 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 per 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 14). 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, the Resource Area has seen a decrease in the number of sage-grouse hunters and an overall decrease in the number of birds harvested (Table 4). In 2005, the size of the area open to hunting in the Resource Area was reduced with removal of the Bookcliffs from the effective area.

Illegal harvest, or poaching, of sage-grouse does occur in the Resource Area. In the spring of 2005, for example, several adult sage-grouse were shot and left on a lek site in the Diamond Mountain subunit (R. Scheetz, UDWR, personal communication). Increased human presence (recreationists, second homes, development, etc) may provide additional opertunities for illegal harvest of sage-grouse. The potential magnitude of these impacts are not known and are difficult to anticipate.

Table 4. Sage-grouse harvest information for the UBARM 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.

Include information on harvest from 2004-2005.

Include information about wing barrels—do we meet guidelines in terms of comparing harvest to fall population size—above or below 10%.

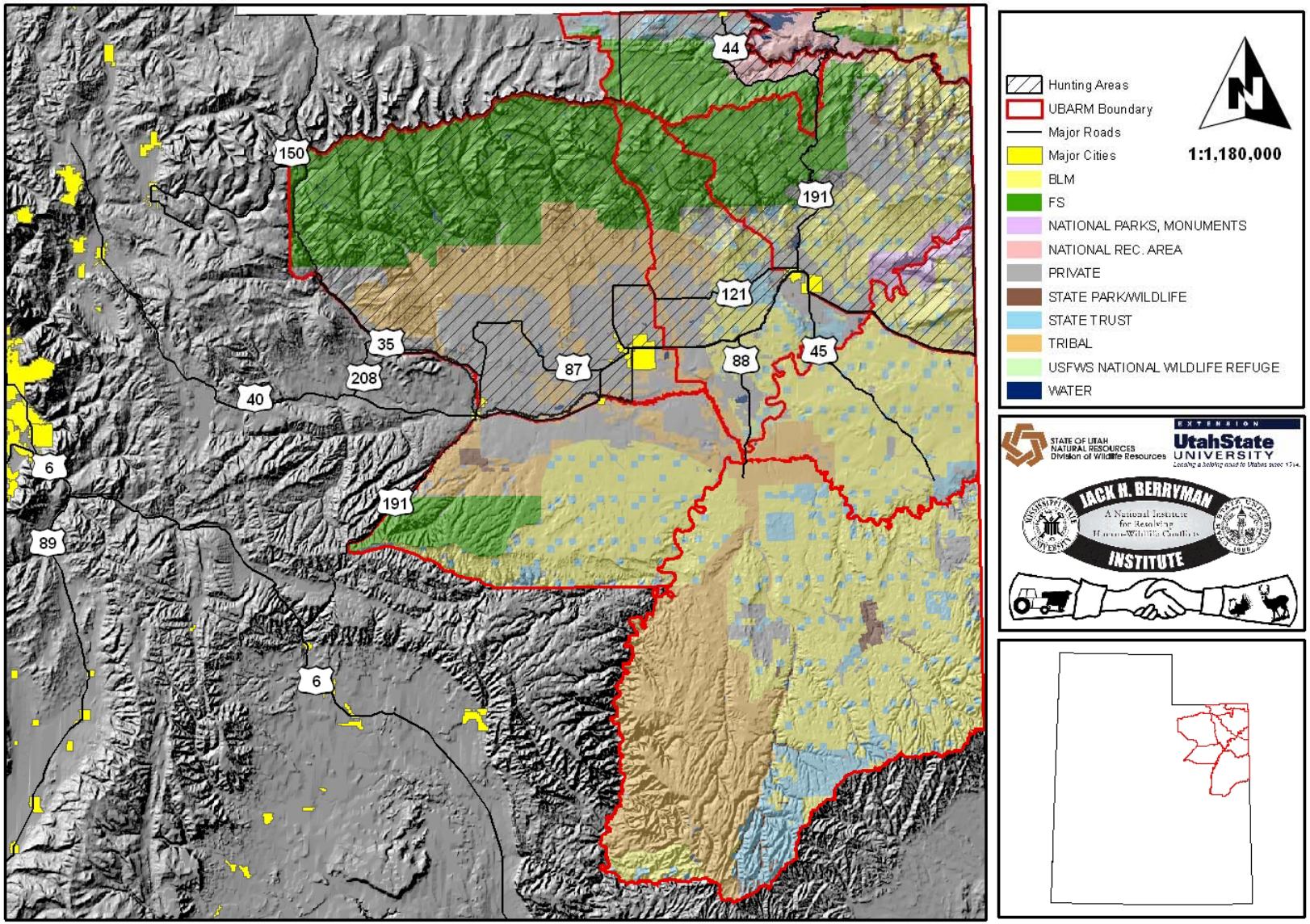

Figure 14. Areas open for sage-grouse hunting in the UBARM Resource Area as of 2000.

D. Fire

Across the Intermountain west, fire suppression is believed to have caused sagebrush stands to increase in canopy cover and density, with a resulting reduction or loss of herbaceous understory species in many areas. Sagebrush stands have become more uniform in age 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 dominate sagebrush species, aridity, soils, topography, and disturbance (Bunting et al. 1987, Miller and Eddleman 2000). In general, sagebrush species are fire adapted and will recolonize an area after a burn. Other threats such as invasive/noxious species (e.g. cheatgrass, *Bromus tectorum*), livestock grazing, and agricultural cultivation, are now present in sagebrush biomes, and influence 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, potentially changing sagebrush-steppe plant communities into grasslands (Miller and Eddleman 2000, Connelly et al. 2000). In the second, the occurrence of fire suppression has prevented the regular setback of succession and promoted the advancement of pinyon-juniper stands (Burkhardt and Tisdale 1969, Young and Evans 1981, Miller and Rose 1995, Miller et al. 2000). In these areas, there is the potential for sagebrush seed sources to be lost, reducing the likelihood that sage brush 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 and USFS, and local governments. The USFS Ashley 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.

Pinyon-juniper encroachment appears to be a potential threat to parts of the Resource Area, primarily on the foothills of Diamond Mtn. and the Bookcliffs. Downy brome invasion is pervasive across the entire Resource Area, especially affecting lower elevation areas considered crucial sage-grouse use areas. 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 accomplished carefully and cautiously in the Resource Area.

E. Incompatible Livestock Grazing

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

Impacts to Sage-grouse Habitat

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

"Beck and Mitchell (2000) summarized potential effects of livestock grazing on sage-grouse habitats, and cited only four references that provide empirical evidence of direct negative effects of livestock grazing on sage-grouse, as follows. Of 161 nests examined in Utah, two were trampled by livestock (one sheep, one cattle) and five were deserted due to disturbance by livestock (Rasmussen and Griner 1938). In Nevada, sage-grouse habitat in wet meadows was degraded through overgrazing by domestic livestock and altered system hydrology (Oakleaf 1971, Klebenow 1985; as reported by Beck and Mitchell 2000). Klebenow (1982) examined sage-grouse habitat use in relation to grazing at the Sheldon NWR in Nevada, where sheep and cattle had grazed for >130 yr. Dominant sagebrush species at the refuge were low sagebrush, mountain big sagebrush, and Wyoming big sagebrush. Grasses included Sandberg and Cusick's bluegrass (*Poa secunda* and *P. cusickii*, respectively) in wet meadows, and Sandberg bluegrass and mat muhly (*Muhlenbergia richardsonis*) in dry meadows. A rest-rotation system was implemented for cattle grazing in 1980 over the majority of the refuge, where season-long grazing had occurred historically; a smaller portion had previously been managed under deferred rotation."

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

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

Strategic supplementation coupled with intensive grazing by livestock at high stock densities for

short periods may be an economical and sustainable way to rejuvenate sagebrush steppe (Provenza et al. 2003). People typically have not viewed sagebrush as valuable forage and thus have not considered using livestock to enhance and maintain diversity in sagebrush steppe. However, recent findings suggest livestock can use sagebrush heavily (Gade and Provenza 1986), and they may be more effective at enhancing plant diversity than fire, chemical, or mechanical means in addition to being less fossil fuel intensive. Sheep and goats supplemented with energy and protein eat twice the sage as unsupplemented animals because they can better cope with sagebrush terpenes that limit its use (Villalba et al. 2002). Fall and winter grazing by livestock rejuvenates sagebrush steppe, and livestock at high stock densities provided appropriate supplement can use sage very effectively (Bork et al. 1998, Dziba et al. 2006).

Impacts on Sage-grouse Behavior and Demographics

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

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

Recommendations

In her extensive literature review, Rowland (2004:11) summarized recommendations found in

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

"Timing of grazing greatly influences the effects of livestock grazing in meadows and riparian areas. These sites are particularly vulnerable in late summer when excessive grazing and browsing may damage riparian shrubs, reduce the yield and availability of succulent herbs (Kovalchik and Elmore 1992), and cause deterioration of riparian function over time (Klebenow 1985). However, moderate utilization by livestock in spring, early summer, or winter is sustainable in non-degraded meadow and riparian areas within sagebrush habitat (Clary et al. 1996, Mosley et al. 1997, Shaw 2004). 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 1992, Mosley et al. 1997). In riparian and meadow habitat degraded by heavy livestock utilization, rest from grazing may be necessary for recovery (Clary and Webster 1989)."

"Manage livestock grazing through stocking rates and season of use on all seasonal ranges of sage-grouse to avoid habitat degradation (Paige and Ritter 1999, Beck and Mitchell 2000, Wisdom et al. 2000), especially on recently disturbed sites, such as those sprayed or burned (Braun et al. 1977). In nesting and brood-rearing habitats, ensure that grazing does not reduce herbaceous understory cover below levels that serve as a deterrent to potential predators of eggs and chicks (Connelly et al. 2000, Hockett 2002). Healthy native understories also support insects and forbs that are important in diets of pre-laying hens and chicks (Johnson and Boyce 1990, Barnett and Crawford 1994, Drut et al. 1994b). Riparian areas and wet meadows used for brood rearing are especially sensitive to grazing by livestock; in these habitats, removal of livestock before the nesting season may be prudent (Beck and Mitchell 2000, Hockett 2002)."

Conclusions

Livestock grazing is an important use of sagebrush rangelands in the Resource Area. Although some incompatible grazing likely occurs within the Resource Area, the majority of livestock operations appear to be coexisting with sage-grouse and sage-grouse populations are stable to increasing. Antidotal evidence exists from Diamond and Blue Mtns. that indicates that sheep grazing can enhance and maintain sagebrush communities that are used by sage-grouse. Livestock grazing may be a useful tool in the Resource Area to manipulate, maintain, or enhance sagebrush habitats. No empirical studies have been conducted in the Resource Area to address the issue of grazing impacts on sage-grouse and this is a topic that may warrant future research.

F. Incompatible OHV Recreation

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

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

OHV recreation is relatively common in the Resource Area; however, specific impacts to sage-grouse populations are unknown and are potentially increasing as people increasingly move into areas where sage-grouse exist. Little information is available on how OHV recreation impacts sage-grouse populations, behavior, and habitat use; this issue may warrant additional research.

G. Downy Brome and Invasive/Noxious Weeds

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

Russian knapweed (*Centaurea repens*), dyers woad (*Isatis tinctoria* L), and several other species of thistle, grasses, and knapweed are listed on the Utah Noxious Weed List (Section 4-17-3, Utah Noxious Weed Act). Although downy brome (i.e. cheatgrass) (*Bromus tectorum*) is not listed there, nor is it included in individual county lists for Uintah, Duchesne, or Daggett Counties, this invasive plant species is known to be established in the Resource Area.

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

Downy brome is an annual grass native to Russia and parts of northern Europe. When it invades sagebrush communities, downy brome is known to increase fire frequency and has the potential to convert sagebrush communities to annual grass rangelands. Downey brome has also been reported to encourage establishment of other invasive species (Grahame and Sisk 2002).

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 on 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 (downy brome is not considered a noxious weed) hay, straw, or mulch. The USFS is also committed to a campaign against the spread of invasive species. Working with agency and local government partners, the USFS aims to create Cooperative Weed Management Area (CWMA) Participative Agreements for all USFS lands.

H. Parasitism and Disease

Several bacterial and parasitic diseases may affect sage-grouse to varying degrees. Sage-grouse have long co-existed with a range of pathogens and many produce no, or few, ill-effects in individuals and populations. Large-scale (i.e. rangewide or statewide) impacts to sage-grouse have not been reported. Below, we discuss a few of the pathogens that appear to be most likely to impact sage-grouse populations (Connelly et al. 2004).

West Nile Virus

West Nile virus (WNV) is an arbovirus, or arthropod-borne virus, of the flavivirus family, which also includes Dengue and Yellow Fever. WNV is one of many mosquito-borne viral infections. Mosquitoes of the Culex family primarily transmit West Nile Virus during normal blood feeding. Some species in this family feed primarily on birds, and birds act as reservoirs or amplifying hosts of the virus. Although many species of birds are known to contract WNV, species in the Corvid family (crows, ravens, and jays) are more susceptible to the disease and are therefore useful geographic detectors of WNV. Mammals, including humans and horses, are considered incidental hosts and are therefore viral 'dead ends'.

In 2003, several cases of WNV were confirmed in sage-grouse in Wyoming (nineteen birds), Montana (3 birds), and Alberta, Canada (5 birds). In that same year, WNV was detected in chickens in Price, Utah and in mosquito pools in the Resource Area. In 2004, sage-grouse in Wyoming, Montana, Colorado, and California tested positive for the virus. In 2005, the virus was confirmed in a dead sage-grouse in the Resource Area, and also in a prairie falcon in Carbon County, south of the Resource Area. Several other bird species were also confirmed to have the virus in Uintah County (B. Maxfield, UDWR, personal communication). Prior to this, sage-grouse had not been exposed to this pathogen. Few sage-grouse appear to be capable of developing immunity to the virus (Cornish, unpublished data) and infection appears to be almost always fatal within 24-48 hours.

Macro-parasites

Coccidiosis—Coccidiosis is an intestinal disease caused by one or more species of the protozoan genus Emieria (Jolley 1982): *E. angusta, E. centrocerci, and E. pattersoni*. Infection results in diarrhea caused by damage to the mucosal lining of the digestive tract. The disease is transmitted through consumption of contaminated feces. Coccidiosis is the most well known of all diseases infecting sage-grouse (Connelly et al. 2004). In Wyoming, Colorado, and Idaho from 1932-1953, this disease resulted in significant loss 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 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 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 Resource Area that was infected with WNV. Parts of Colorado and Wyoming adjacent 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 have not been documented in the Resource Area and, therefore, do not pose as great a potential threat at this time.

I. Predation

Portions of the following section predation were written and compiled with the assistance from representatives from USDA-WS. Wildlife Services has been managing predator populations and collecting data on predator population trends in the state for several decades. They also have an extensive body of personal knowledge about predator population management and the impacts of various management practices.

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, and 3) annual survival of breeding-age birds. Peterson and Silvy (1996) conclude that the relative importance of predation on the viability of sage-grouse populations is relatively unknown and 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) report that nest success rates are generally >40% and suggest that nest predation does not appear to be a problem across the range of sage-grouse. In contrast, Gregg (1991) and Gregg et al. (1994) suggest that nest predation may be limiting grouse numbers in Oregon. Red foxes and common ravens have been implicated in affecting nest success and the annual survival of breeding age birds in the Strawberry valley area of Utah (Bunnell et al. 2000). Researchers suggest that the advancing population of a nonnative predator, the red fox, is responsible for preying upon a large portion of the population in that area (Flinders 1999). In artificial nest studies conducted in Strawberry Valley, ravens depredated 98% of artificial nests within 48 hours of their placement. Remote cameras verified the identity of artificial nest predators (Baxter and Flinders, unpublished).

Trends and Status

Understanding the impact of predation on sage-grouse is difficult, as the primary effects (the number of sage-grouse killed by predators) are 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.

In addition to population survey efforts (Breeding Bird Surveys), we also present records from USDA-WS on numbers of animals taken over the past several decades. In lieu of actual population estimates, these figures provide an indication of population trends. It should be cautioned, however, that trends in animals taken is influenced both by population size and density of the animals themselves and the amount of effort expended in and effectiveness management activities. In addition, it should be noted that several predator species, including red fox, raccoons, and stripped skunks, are relatively new to the sagebrush systems in the Resource Area; sage-grouse lack an evolutionary history of adaptation to these species and, as a result, could be more vulnerable.

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

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

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

Red Fox—While some early records of red foxes exist, red foxes are believed to have been virtually absent on the landscape before the 1970s. Red fox do not exist in government records before 1972, and have increased since then. Red foxes may have been successfully suppressed by rabies or by bait station use, or both. Figure 16 shows red fox take from 1972-2004.

It is interesting to observe that the statewide increase in red fox abundance has occurred during the lowest period of coyote control. Sargeant 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 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 Wisconson, which was displacing the grey fox and Godin (1977) reported *V. fulva* had established itself by 1850 and was displacing the gray fox to some degree along the southeastern seaboard. Godin also speculated that the introduced foxes might have interbred with a scarce population of indigenous red foxes, but historical accounts do not support this. Churcher (1959) concluded from the available evidence that the red fox was native to North America north of 40-45 degree N but was scarce or absent in the hardwood forests where gray foxes were common. Churcher (1973) suggested that the 'original' habitat was the northern mixed hardwood and softwood forest zones. He also observed that the red fox might have been found in the hardwoods to the south and the tundra to the north. Gilmore (1946) believed that red foxes were absent from Pennsylvania during aboriginal times, and concluded that they did not range into the mid eastern United States. Rhoads (1903 cited in Churcher 1959) stated that, "in earlier colonial times the red fox was unknown in the austral zone [southern states]".

Archaeological evidence from Ontario, Canada (Peterson et al. 1953) has shown that the red fox was present in the Midland area prior to introductions during the decade 1639-49, and that it was present earlier in the Oxford and Middlesex counties of southern Ontario, Canada. Sites farther south did not have red foxes (Gilmore 1946).

Once the red fox began to spread south and west from northeastern U.S. after its introduction from Europe, it expanded its range to include the prairies of the mid west and continued to expand west to Colorado and Utah. It has currently 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 17 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.

Raccoon—Although no USDA-WS data were available regarding raccoon take in the Resource Area or the state of Utah, UBARM members noted the appearance and increase of this species in the Resource Area in the last 5-10 years.

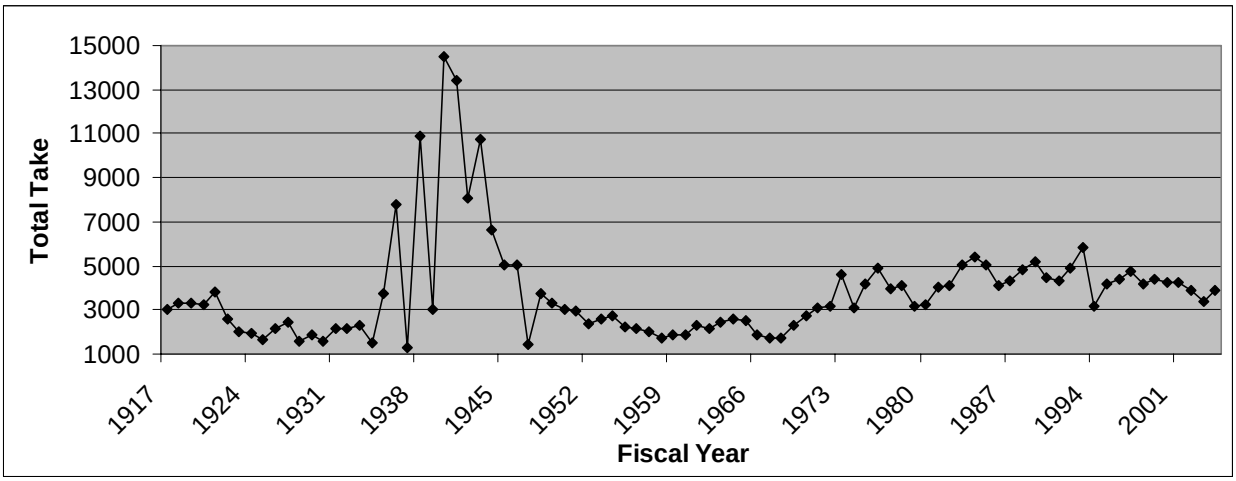

Figure 15. USDA-WS reported coyote take in Utah, 1917-2004.

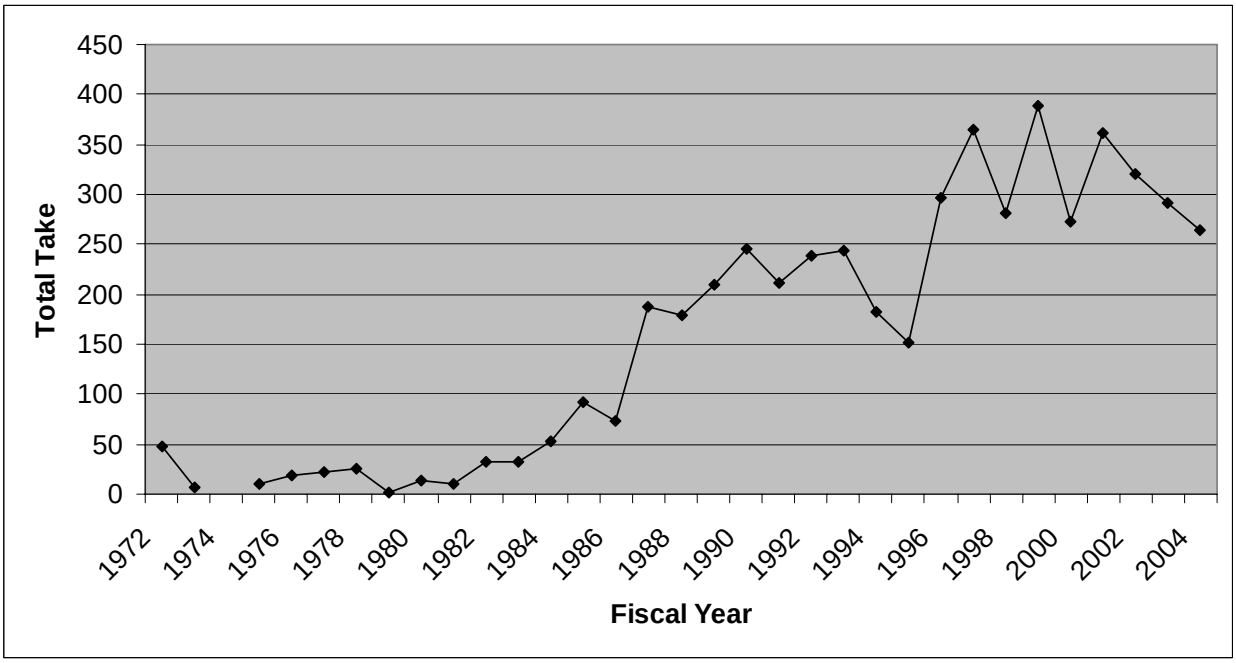

Figure 16. USDA-WS reported fox take in Utah, 1972-2004.

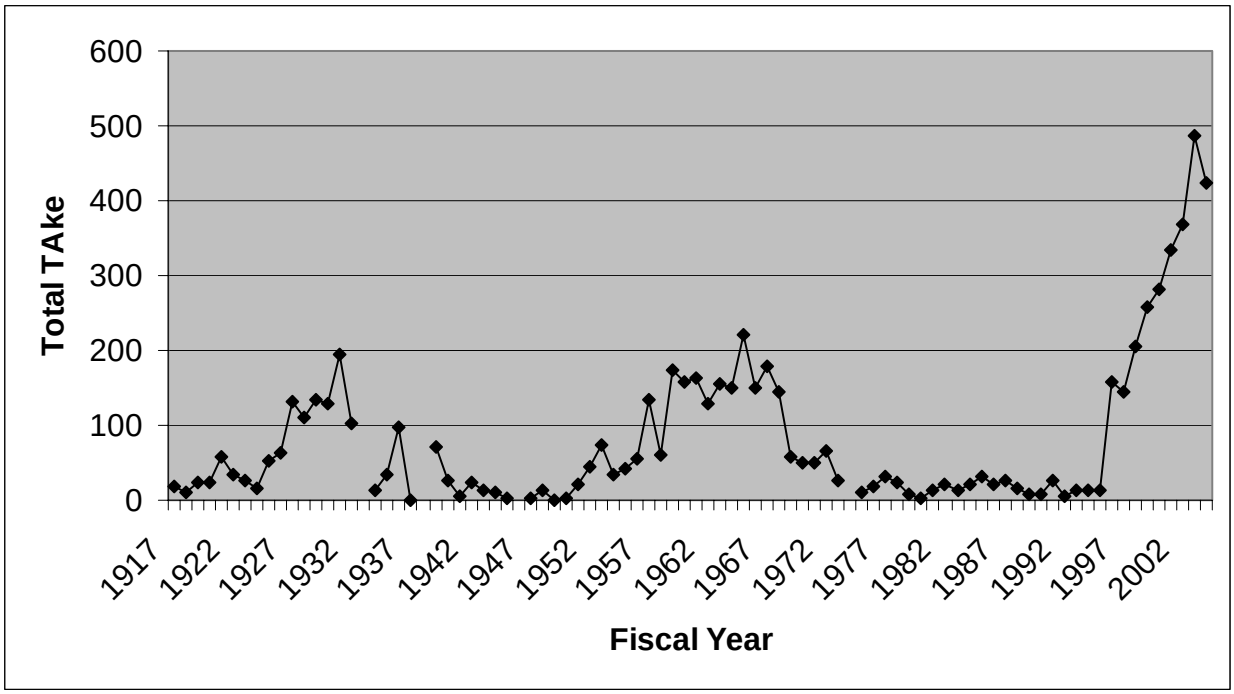

Figure 17. USDA-WS reported skunk take in Utah, 1917-2004, data reported by USDA-WS.

Trends in Predator Management

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

Correlations exist between livestock inventories and the intensity of predator management efforts. Domestic sheep numbers are 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 from year to year in some cases and from decade to decade since the early 1900s. Toxics were used extensively in the early years when sheep numbers were high. Additionally, predator management during that time, involved many trappers, setting and tending steel traps statewide. As many as 132 men were hired (1936) to set traps and apply baits. Figure 15 shows the recorded take of coyotes from the predator control program between 1917 and 2004. These data do not include poisoned coyotes, which were not found (but estimated as 7-10 coyotes for each one found).

Strychnine and thallium treated single-lethal-dose (SLD) baits were the main toxicants used between 1920 and 1950. Compound 1080 was developed around 1945, first as a rodenticide and

later as a predicide in large bait stations. USDA-WS records indicate that 1443 bait stations were applied in 1969, covering 54% of the townships in the State. Bait placement from 1950 to 1972 were large-bait stations, while SLD baits were used prior to that. From about 1950 to 1972, Compound 1080 became the main force in controlling coyotes in all districts of Utah by the government and by private individuals. The low take of coyotes by the government 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 station' to target birds. Records also note that UDWR personnel targeted areas for bird suppression, which were not treated by the federal program.

Impacts of Predation on Sage-grouse

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

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

Autenrieth (1981) suggested that nest predation was likely the most important population constraint on sage-grouse in his study area. Predation on adult birds does occur and may be significant in some cases. Presnall and Wood (1953) reported tracking a coyote approximately five miles to its den in northern Colorado, and finding evidence along the way that the coyote had killed three adult sage-grouse and destroyed a sage-grouse nest. Examination of the stomach contents from an adult female coyote removed the next day, showed parts of an adult sage-grouse, plus six newly-hatched sage-grouse chicks. The area around the den site was littered with sage-grouse bones and feathers. No other prey animal remains were found around the den, and it appeared that the pups were 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 (BYU) confirmed predation, primarily by red fox and coyote, as the cause of death for 13 of 21 radio-instrumented sage-grouse in the first year in their study area (Bunnell and Flinders 1999). Two additional instrumented birds could not be found but were suspected to have been killed by predators, suggesting a 71% predation loss of instrumented birds. Additionally, eleven other sage-grouse were found dead in their study area, and all but one of these birds 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 sage-grouse populations, or if these predators have negative population-level effects on sage-grouse. However, the above studies indicate there may be some benefit to the removal of these predators in some situations,

especially in conjunction with appropriate monitoring and research.

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

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 sage-grouse have been documented defending their nests from ground squirrels (Schroeder 1997). Girard (1937) observed females attacking predators in defense of their brood. In an attempt to lead potential predators away from nests and/or young chicks, females have been documented performing distraction displays. The distraction display includes dragging wings on the ground while moving erratically (Petersen 1980). In addition, a female will occasionally re-nest if predators destroy her first nest early in the incubation period (Patterson 1952, Eng 1963, Connelly et al. 1993, Schroeder 1997), 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 a 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 graze in Utah. Although sheep numbers are down, today more cattle ranching operations exist in the state as 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 early years when sheep numbers were high. Congress passed the Animal Damage Control Act of March 2, 1931. Records show hiring 1936 up to 132 men for predator control in Utah. Poison baits placed by men in the various field districts, were more effective at controlling predator populations over a larger area than today. In 1939, government trappers reported taking 16,719 predators, which does not reflect all of those poisoned. This amount was a record catch for any one fiscal year and shows more predators were taken in early years than records of today. The number of predators taken during this era not only exceeds the modern ‘take’ but also likely represents a larger percentage of the population of the day. Modern records (since 1972) show that on

average, USDA-WS in Utah takes about 5,000 coyotes per year using 25 field men and several fixed-wing aircraft along with contracted helicopter work. Private hunters and trappers annually in Utah take another 5,000 coyotes on average.

Today, the coyote population in Utah is near 100,000 based on studies by USDA-WS research personnel (Connolly, USDA-WS, unpublished data, 1996). Predator damage management focuses on individuals causing damage as opposed to population reduction (or eradication in the case of the wolf) as in the past. Currently, control is practiced on less of the land mass, with more restrictions, and for the protection of fewer livestock than at any time in Utah history. Correspondingly, there are probably more coyotes alive today than at any time in Utah history.

Strychnine and thallium were the main poisons used in the early 1900s until the advent of compound 1080 in about 1945. Compound 1080 was first effectively used on rodents and later on predators. From about 1950 to 1972, 1080 became the main method in controlling coyotes in all districts of Utah by the government and by private individuals. It is impossible to know precisely the effect it has 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 was largely overused, because there were no dosage restrictions or regulations in place during that time.

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 from the public to control them.

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

Incidentally, sage-grouse could have benefited from the high numbers of sheep concentrated in winter areas. Proper sheep grazing in the winter has the effect of rejuvenating sagebrush. As sheep numbers declined, sagebrush became decadent to some degree. Although natural cycles may have once occurred in sage-grouse populations, 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. Many of the sage-grouse predators discussed above are known to occur in the Resource Area and USDA-WS does conduct predator control in the area related to livestock operations which is likely to influence predator-prey dynamics involving sage-grouse. Under these management conditions, sage-grouse numbers in the Resource Area are increasing or stable and, given current circumstances and management actions, predation by native predators, excluding ravens in some instances, is considered a moderate threat to sage-grouse populations in the area. Predation by nonnative predators, including domestic animals, red foxes, and raccoons, and native (but anthropomorphically inflated) raven populations, is an issue of greater concern, especially when the cumulative effects of increased nonnative predator populations, habitat fragmentation, reduced habitat quality (because of invasive species, etc) are considered. Nonnative 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 and raccoons in the Resource Area could 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, as well as the mandates and policies of the federal government at the time when vegetation management was accomplished on federal land. Because much of the land in the Resource Area is under federal management, this is an important consideration when evaluating past and current conditions. In the past, many vegetation treatments were conducted to increase forage for livestock.

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

Several treatment types manipulate sagebrush communities. Connelly et al. (2004:7-46 to 7-50) describes the mechanical, chemical, and biological techniques available and discusses their successes and challenges.

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

Little empirical data exists regarding how sage-grouse have responded to vegetation treatments in the Resource Area. Several thousand acres have been treated in the Resource Area with the intent of improving sage-grouse habitat (Table 3). For monitoring that we are aware of, post-treatment data was reported earlier in the Plan. Reported post-treatment conditions and conclusions preferred by sage-grouse, however, that does not infer that those conditions do not exist or that the treatments were unsuccessful. Overall, we feel there is an imperative to better monitor vegetation treatments in the Resource Area to expand our understanding of the effects of vegetation management on sage-grouse populations and habitats in the Resource Area.

III. Conservation Strategy

One of the main purposes of this Plan is to provide a framework of strategies and associated actions that can be implemented to abate threats, address information gaps, and guide monitoring efforts. Strategies and actions listed below (the order is irrelevant) were developed by UBARM 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 UBARM 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 UBARM partners. However, 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. It does, however, provide a framework of resources and expertise.

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

A. Priority Evaluation

In order to help prioritize strategies, actions, and most effectively allocate resources, we have assigned a rank of ‘low’, ‘medium, ‘high’, or ‘very high’ to each threat with regards to its contribution to reduction in population health or habitat condition (Table 5). Again, given the stipulations regarding a lack of empirical, locally-based information in many cases, these rankings are based on the best information available to us, and our implicit, experiential knowledge of the Resource Area. Ranking definitions are based on The Nature Conservancy’s Conservation Action Planning process (TNC 2005). Rankings are provided to help highlight potential priorities for subsequent strategies and actions.

UBARM partners and others can use the rankings in Table 5, combined with the strategies and actions listed below, 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 (given current and foreseeable scenarios) to reducing or degrading aspects of sage-grouse populations in the UBARM 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 UBARM Resource Area							
Threat	Reduced Population Size	Population Distribution	Reduced Lek Habitat Quality	Reduced Nesting/Early Brood-rearing Habitat Quality	Reduced Summer/Late Brood-rearing Habitat Quality	Reduced Winter Habitat Quality	Reduced Connectivity of Seasonal Habitat Types	Reduced Connectivity of Populations & Sub-populations
Home and Cabin Development	L	M	L	L	L	L	L	L
Power lines, Fences, & Other Tall Structures	-	M	H	M	M	M	M	M
Oil and Gas Development	M	M	M	M	M	M	M	M
Roads	L	M	M	M	L	M	H	H
Drought and Weather	L	-	L	H	H	H	-	-
Hunting Pressure	L	L	-	-	-	-	-	-
Incompatible Fire Management Practices	-	H	H	H	H	H	H	M
Incompatible Livestock Grazing	-	L	L	H	H	L	-	-
OHV Recreation	-	M	H	M	M	L	L	L
Invasive/Noxious Weeds	-	M	M	VH	VH	H	M	L
Parasites and Disease	H	H	-	-	-	-	-	-
Predation	VH	H	-	-	-	-	-	-
Vegetation Management	-	-	H	H	H	H	H	M
Pinyon-Juniper Encroachment	-	M	H	M	M	H	H	H

B. Strategies and Actions

1. **Strategy**: Increase cooperation and coordination between UBARM and public and private partners.
   - **1.1. Action**: By 2007, meet with the Ute Tribe Fish and Game Department to update them on UBARM activities and encourage participation
   - **1.2. Action**: In 2007, UDWR biologists will coordinate with Ute Tribe biologists to identify sage-grouse lek sites and count birds on Tribal lands
   - **1.3. Action**: Work with the NRCS to review and potentially endorse NRCS WHIP and EQIP projects that would benefit sage-grouse in the Resource Area

   Partners: USU Extension, Ute Tribe, UDWR, NRCS
   Threats addressed: Vegetation management
   Aspects of Sage-grouse ecology addressed: population size, population distribution, seasonal habitat quality

2. **Strategy**: Increase information/education opportunities with local community and UBARM partners
   - **2.1. Action**: By 2008, develop informational handouts about sage-grouse ecology and UBARM activities
   - **2.2. Action**: Through 2016, include information about UBARM activities in County Extension newsletter
   - **2.3. Action**: Schedule spring field tour of habitat management projects
   - **2.4. Action**: Coordinate workshops for private partners to share information about habitat enhancement, funding opportunities, and other relevant topics to be identified as needed
   - **2.5. Partners**: USU Extension, UDWR, USFS, BLM, SITLA, NRCS, Utah Farm Bureau Federation (UFBF), private partners
   - **2.6. Threats Addressed**: Vegetation management, fire management, pinyon-juniper encroachment, livestock grazing
   - **2.7. Aspects of Sage-grouse Ecology Addressed**: Seasonal habitat quality

3. **Strategy**: By 2016, increase brood-rearing habitat quality in the Resource Area
   - **3.1. Action**: Work with the NRCS and private partners to develop NRCS, WHIP, and EQIP projects that would increase brood-rearing habitat quality in the Resource Area
   - **3.2. Action**: Work with agency partners to develop projects that would increase brood-rearing habitat quality in the Resource Area
   - **3.3. Action**: Work with private and public partners to monitor effects of habitat improvement projects on vegetation and sage-grouse habitat use

   Partners: NRCS, UDWR, USFS, BLM, Ute Tribe, 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

4. **Strategy:** Increase the amount of mesic sites available to sage-grouse during the late summer and early fall
   - **4.1. Action:** Work with public and private partners to maintain or create mesic sites in areas used by sage-grouse during late summer and fall

4.2. Action: During times of drought, coordinate with public and private partners to maintain water available for sage-grouse during late summer and early fall in areas used during this time

Partners: NRCS, UDWR, USFS, BLM, Ute Tribe, SITLA, USU Extension, private partners
Threats Addressed: Drought and weather, livestock grazing, vegetation management
Aspects of Sage-Grouse Ecology Addressed: Summer/late brood-rearing habitat quality

5. **Strategy**: By 2016, increase population and habitat monitoring efforts in the Resource Area
   - **5.1. Action**: Encourage public and private partners to use techniques from Connelly et al. (2003a) "Monitoring of Greater Sage-grouse Habitats and Populations"
   - **5.2. Action**: In 2007, UDWR biologists will coordinate with Ute Tribe biologists to identify sage-grouse lek sites and count birds on Tribal lands
   - **5.3. Action**: UDWR to enlist and coordinate private volunteers and/or other agency biologists to search for new leks and conduct lek counts on active leks
   - **5.4. Action**: Through 2016, test dead sage-grouse for West Nile Virus and any other parasites/pathogens of importance

   Partners: NRCS, UDWR, USFS, BLM, Ute Tribe, SITLA, USU Extension, private partners
   Threats Addressed: Parasites/disease
   Aspects of Sage-Grouse Ecology Addressed: Population size, population distribution, connectivity of populations and subpopulations

6. **Strategy**: By 2016, work with public and private partners to reduce invasive/noxious plant species, especially in areas used for nesting and brood-rearing
   - **6.1. Action**: Coordinate with county weed control department to control invasive/noxious weeds in areas used by sage-grouse
   - **6.2. Action**: Avoid controlled burns and fight wildfires in areas dominated by downy brome
   - **6.3. Action**: Encourage and support use of chemical and mechanical treatments to control downy brome and invasive/noxious weeds

   Partners: NRCS, UDWR, USFS, BLM, Ute Tribe, SITLA, USU Extension, County Weed Boards & departments, private partners
   Threats Addressed: Invasive/noxious weeds, vegetation management, fire
   Aspects of Sage-grouse Ecology Addressed: Lek habitat quality, nesting/early brood-rearing habitat quality, summer/late brood-rearing habitat quality, connectivity of seasonal habitat types

7. **Strategy**: By 2016, minimize effects of roads and utilities in areas used by sage-grouse
   - **7.1. Action**: Re-vegetate utility corridors with sage-grouse seed mixes
   - **7.2. Action**: Avoid placement of new roads and utilities near lek sites (specific distances should be site specific)
   - **7.3. Action**: Where possible, install perch deterrents on tall structures located in areas used by sage-grouse
   - **7.4. Action**: Where practical, install low-profile tanks in areas used by sage-grouse

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

8. **Strategy:** Through 2016, avoid locating homes/cabins within important sage-grouse use areas, while ensuring private property rights. If development does occur, the work will minimize impacts to biodiversity
   - **8.1. Action:** Participate in county planning efforts for home/cabin development to ensure that biodiversity impacts are minimized
   - **8.2. Action:** Educate County planning departments about where important sage-grouse use areas are located
   - **8.3. Action**: Establish easements or other land protection in crucial habitat
   - **8.4. Action**: Work with county planners and county council to establish zoning ordinances for crucial habitat that protect those areas from inappropriate development

   Partners: NRCS, UDWR, USFS, BLM, Ute Tribe, SITLA, USU Extension, County Planning departments, private partners

   Threats Addressed: Home and cabin development, roads, power lines, fences, and other tall structures

   Aspects of Sage-Grouse Ecology Addressed: Seasonal habitat quality, connectivity of seasonal habitats, connectivity of populations and subpopulations

9. **Strategy:** Through 2016, avoid locating oil and gas roads or pads near lek sites. Where impacts do occur, implement interim reclamation to well site(s) as soon as practical
   - **9.1. Action:** Participate in county planning efforts for oil and gas exploration and development to ensure that sage-grouse impacts are minimized
   - **9.2. Action:** Influence BLM/USFS/SITLA/private enterprise planning efforts to minimize impacts to sage-grouse

   Partners: NRCS, UDWR, USFS, BLM, Ute Tribe, SITLA, USU Extension, private partners
   Threats Addressed: Renewable and non-renewable energy development, roads, power lines, fences, and other tall structures
   Aspects of Sage-grouse Ecology Addressed: Seasonal habitat quality, connectivity of seasonal habitat types, connectivity of populations and subpopulations

10. **Strategy:** Through 2016, prevent reestablishment of pinyon/juniper through annual monitoring and maintenance level control efforts
    - **10.1. Action:** Revisit and retreat as needed pinyon/juniper removal site

    Partners: NRCS, UDWR, USFS, BLM, Ute Tribe, SITLA, USU Extension, private partners
    Threats Addressed: Pinyon-juniper encroachment, vegetation management
    Aspects of Sage-grouse Ecology Addressed: Seasonal habitat quality, connectivity of seasonal habitat types

11. **11. Strategy**: Monitor impacts of hunting on sage-grouse population in Resource Area
    - **11.1. Action**: Review and advise UDWR on sage-grouse harvest plans

    Partners: UDWR, UBARM
    Threats Addressed: Hunting
    Aspects of Sage-grouse Ecology Addressed: Population size

12. **Strategy:** By 2016, key public and private lands in the UBARM Resource Area (specific locations to be selected) are protected and/or managed to conserve/improve sage-grouse nesting and breeding habitat
    - **12.1. Action:** Encourage use of UBARM defined desired conditions for state and federal lands and influence management actions in order to move toward those conditions
    - **12.2. Action:** Support partner efforts that protect sage-grouse and sage-grouse habitat on public lands
    - **12.3. Action:** Pursue private land protection on a few key parcels (TBD)
    - **12.4. Action**: Pursue habitat improvement projects or land management strategies on private lands in areas used by sage-grouse for nesting and brood-rearing

    Partners: NRCS, UDWR, USFS, BLM, Ute Tribe, SITLA, USU Extension, private partners, The Nature Conservancy
    Threats Addressed: Home and cabin development, power lines, fences, and other tall structures, renewable and non-renewable energy development, roads, livestock grazing, recreation, vegetation management
    Aspects of Sage-grouse Ecology Addressed: Seasonal habitat quality, connectivity of seasonal habitat types, connectivity of populations and subpopulations

13. Strategy: Provide for a level and system of 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

13.4. Action: Manage livestock to enhance riparian conditions

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

Threats Addressed: Livestock grazing

Aspects of Sage-grouse Ecology Addressed: Seasonal habitat quality

14. Strategy: Maintain and, where possible, improve forb component in the understory

14.1. Action: Reclaim and/or reseed areas disturbed by treatments when necessary, using seed mixtures high in native bunch grasses and desirable forbs

14.2. Action: Restore understory vegetation in areas lacking desirable quality and quantity of herbaceous vegetation where economically feasible

14.3. Action: Conduct vegetation treatments to improve forb diversity, (e.g., harrowing, aerating, chaining) and reclaim or reseed disturbed area, if needed

14.4. 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, Ute Tribe, SITLA, USU Extension, private partners

Threats Addressed: Vegetation management, fire, renewable and non-renewable energy development, roads, pinyon-juniper encroachment, invasive/noxious weeds

Aspects of Sage-grouse Ecology Addressed: Seasonal habitat quality

15. Strategy: Manage pinyon/juniper stands to reduce encroachment into sagebrush/grass communities

15.1. Action: Remove encroaching trees and tall shrubs mechanically (chainsaws, chaining, etc) or by other methods, where needed to maintain visibility at lek sites and security from predation in other seasonal habitats

15.2. Action: Brush-cut or treat with other mechanical methods on specified areas and re-claim or re-seed as necessary

15.3. Action: Identify areas where pinyon or juniper trees are encroaching on good quality sagebrush habitat and treat as needed

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

Threats Addressed: Pinyon-juniper encroachment, vegetation management, predation, fire

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

16. Strategy: Enhance existing riparian areas or create small wet areas to improve nesting and brood-rearing habitat

16.1. Action: Identify opportunities or needs to create small wet areas, implement such projects where economically feasible

16.2. Action: Design and implement livestock grazing management practices to benefit riparian areas

16.3. Action: Modify or adapt pipelines or developed springs to create small wet areas

16.4. Action: Locate projects to minimize potential loss of water table associated with wet meadows

16.5. Action: Protect existing wet meadows and riparian areas where necessary

16.6. Action: Manage vegetation and artificial structures to increase water-holding capability of areas

16.7. Action: Install catchments to slow run-off, hold water, and eventually raise water tables

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

Threats Addressed: Drought and weather, vegetation management

Aspects of Sage-grouse Ecology Addressed: Nesting/Early brood-rearing habitat quality, summer/late brood-rearing habitat quality, connectivity of seasonal habitats

17. Strategy: Improve lek vegetation conditions to allow for predator recognition and visibility

17.1. Action: Open lek areas that have been invaded by sagebrush and other shrubs

17.2. Action: Map and inventory leks with potential for restoration

17.3. Action: Maintain and enhance desired conditions for leks

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

Threats Addressed: Predation, invasive/noxious weeds, pinyon-juniper encroachment, power lines, fences, and other tall structures

Aspects of Sage-grouse Ecology Addressed: Population size, lek habitat quality, population distribution

18. Strategy: Minimize impacts of exotic and invasive/noxious plant species

18.1. Action: Identify areas where undesirable vegetation is encroaching on sage-grouse habitat.

18.2. Action: Treat areas where undesirable vegetation has become or is at risk of becoming a factor in sage-grouse habitat loss or fragmentation

18.3. Action: Work with existing weed management programs to incorporate sage-grouse habitat needs

18.4. Action: Identify large areas of introduced plant species that are not meeting sage-grouse habitat needs and reseed with native species where appropriate

18.5. Action: Manage fire, transportation and vegetation treatments to minimize undesirable vegetation where possible

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

Threats Addressed: Invasive/noxious species, vegetation management, fire, roads

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

19. Strategy: Minimize impacts of agricultural conversion on sage-grouse

19.1. Action: Maintain the CRP program and improve its benefit to wildlife by altering seed mixes
19.2. Action: Expand Grassland Reserve Program (GRP) opportunities in sage-grouse habitats
19.3. Action: Maintain or reestablish sagebrush patches of sufficient size and appropriate shape to support sage-grouse between agricultural fields
19.4. Action: Work with NRCS and others to maintain the CRP program and enroll important sage-grouse habitats currently in grain production
19.5. Action: Encourage use of sage-grouse friendly seed mixes, including bunchgrasses, forbs and big sagebrush, in CRP and other grassland plantings
19.6. Action: Rehabilitate old, low diversity, sod bound CRP fields with sage-grouse friendly seed mixes including bunchgrasses, forbs, and big sagebrush
19.7. Action: Encourage interest and enrollment of key sage-grouse habitats in relevant Farm Bill programs
Partners: NRCS, UDWR, USFS, BLM, SITLA, USU Extension, private partners
Threats Addressed: Vegetation management
Aspects of Sage-grouse Ecology Addressed: Lek habitat quality, nesting/early brood-rearing habitat quality, summer/late brood-rearing habitat quality, connectivity of seasonal habitat types

20. Strategy: Minimize the amount of quality sage-grouse habitat eliminated by residential and commercial land development consistent with private property rights
20.1. Action: Participate with County land use decision makers in identifying key sage-grouse habitats
20.2. Action: Maintain sagebrush environments of sufficient size and shape around developments in sage grouse habitat
20.3. Action: Encourage the voluntary use of conservation easements and other land protection vehicles with willing sellers in sage grouse habitats
20.4. Action: Educate rural residents about the importance of good grazing management in keeping small tracts weed free and capable of providing wildlife habitat
Partners: NRCS, UDWR, USFS, BLM, Ute Tribe, SITLA, USU Extension, County Planning departments, private partners
Threats Addressed: Home/cabin development, roads, invasive/noxious weeds, livestock grazing, power lines, fences and other tall structures.
Aspects of Sage-grouse Ecology Addressed: Seasonal habitat quality, connectivity of seasonal habitat types.

21. Strategy: Minimize sage-grouse habitat loss to oil and gas activities while ensuring continued development
21.1. Action: Reduce fragmentation of sage-grouse habitat by oil and gas development activities
21.2. Action: Minimize disturbance to sage-grouse associated with oil and gas development
21.3. Action: Reduce cumulative impacts of oil and gas development
21.4. Action: Use directional drilling where feasible to minimize surface disturbance, particularly where well density exceeds 1:160 acres
21.5. Action: Minimize pad size and other facilities to the extent possible, consistent with safety

21.6. Action: Plan and construct roads to minimize duplication
21.7. Action: Cluster development of roads, pipelines, electric lines and other facilities
21.8. Action: Use existing, combined corridors where possible
21.9. Action: Use early and effective reclamation techniques, including interim reclamation, to speed return of disturbed areas to use by sage-grouse
21.10. Action: Reduce long-term footprint of facilities to the smallest possible
21.11. Action: Avoid aggressive, non-native grasses (e.g. intermediate wheatgrass, pubescent wheatgrass, crested wheatgrass, smooth brome, etc) in reclamation seed mixes
21.12. Action: Eliminate noxious weed infestations associated with oil and gas development disturbances
21.13. Action: Minimize width of field surface roads
21.14. Action: Avoid ridge top placement of pads and other facilities
21.15. Action: Use low profile above ground equipment, especially where well density exceeds 1:160 acres
21.16. Action: Avoid breeding/nesting season (March 1 – June 30) construction and drilling when possible in sage-grouse habitat
21.17. Action: Limit breeding season (March 1 – May 1) activities near sage-grouse leks to portions of the day after 9:00 am and before 4:00 pm
21.18. Action: Reduce daily visits to well pads and road travel to the extent possible in sage-grouse habitat
21.19. Action: Utilize well telemetry to reduce daily visits to wells, particularly where well density exceeds 1:160 acres
21.20. Action: Locate compressor stations off ridge tops and at least 2,500 feet from active sage-grouse leks, unless topography allows for closer placement
21.21. Action: Avoid locating facilities within ¼ mile of active sage-grouse leks, unless topography allows for closer placement
21.22. Action: Plan for and evaluate impacts to sage-grouse of entire field development rather than individual wells
21.23. Action: Study, and attempt to quantify, impacts to sage-grouse from oil and gas development
21.24. Action: Evaluate need for near-site and/or off-site mitigation to maintain sage grouse populations during oil and gas development and production, especially where well density exceeds 1:160 acres
21.25. Action: Implement near-site and/or off-site mitigation as necessary to maintain sage-grouse populations
21.26. Action: Share sage-grouse data with industry to allow planning to reduce impacts
Partners: UDWR, USFS, BLM, SITLA, County Planning departments, private partners
Threats Addressed: Renewable and non-renewable energy development, roads, power lines, fences, and other tall structures, invasive/noxious weeds, vegetation management
Aspects of Sage-grouse Ecology Addressed: Seasonal habitat quality, connectivity of seasonal habitat types, connectivity of populations and subpopulations, population distribution

22. Strategy: Minimize impacts of utility lines in sage-grouse habitat
22.1. Action: Avoid new construction during important periods and re-route lines where technically and economically feasible to avoid impacts

22.2. Action: Schedule maintenance to minimize important periods, however, maintenance in emergency situations will be unrestricted
22.3. Action: Install raptor deterrents when applicable
Partners: UDWR, USFS, BLM, SITLA, private partners
Threats Addressed: Power lines, fences, and other tall structures
Aspects of Sage-grouse Ecology Addressed: Seasonal habitat quality, connectivity of seasonal habitat types

23. Strategy: Minimize the impact of excessive predation
23.1. Action: Plan and conduct research to determine the population-level effects of predation on sage-grouse
23.2. Action: Where sage-grouse population-level effects of predation are clearly identified, plan and implement site-specific predation management as necessary. Incorporate a monitoring plan to determine success
23.3. Action: Plan and conduct research to determine if man-made raptor perches increase predator effectiveness in sage-grouse use areas
23.4. 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
23.5. Action: Remove trees, remove/modify raptor perches, and maintain quality sagebrush habitat, where predation concerns on sage-grouse have been identified
23.6. Action: Begin site-specific predation management considering all predator species (especially common ravens and red fox) where necessary and appropriate
Partners: UDWR, USFS, BLM, SITLA, USDA-WS, private partners
Threats Addressed: Predation, pinyon-juniper encroachment, power lines, fences and other tall structures
Aspects of Sage-grouse Ecology Addressed: Population size, seasonal habitat quality

24. Strategy: Improve knowledge of disease in sage-grouse populations
24.1. Action: Collect grouse parasite and disease organism samples while handling birds for other research
24.2. Action: Monitor radio-collared and other grouse for West Nile Virus and other disease outbreaks
Partners: UDWR, USFS, BLM, private partners
Threats Addressed: Parasites and disease
Aspects of Sage-grouse Ecology Addressed: Population size, population distribution, connectivity of populations and subpopulations

25. Strategy: Increase subpopulation numbers and genetic distribution in Resource Area subunits (TBD)
25.1. Action: Use translocation from within the Resource Area to supplement subpopulations
25.2. Action: Use translocation from areas outside the Resource Area to supplement subpopulations
25.3. Action: Use translocation techniques developed by Baxter et al. in Strawberry Valley
Partners: UDWR, USFS, University partners, private partners
Threats Addressed: None
Aspects of Sage-grouse Ecology Addressed: Population size, population distribution,

connectivity of populations and subpopulations

26. Strategy: Increase knowledge base regarding the positive and negative effects of sagebrush habitat improvement projects on other shrubsteppe species

26.1. Action: Identify and/or develop research and monitoring protocol to address impacts to other shrubsteppe species of management practices targeted at improving or enhancing sage-grouse populations and/or habitats

Partners: USFS, BLM, USU Extension, UDWR, University partners

Threats Addressed: Vegetation Management

Aspects of Sage-grouse Ecology Addressed: None

27. Strategy: Fill gaps in knowledge and gather additional information on sage-grouse populations, sage-grouse ecology, and response of sage-grouse to management activities.

27.1. Action: Annually search for new seasonal use areas using radio-collared sage-grouse or other types of presence/absence or abundance surveys.

27.2. Action: Collect data on habitats used by sage-grouse following protocol and guidelines recommended in Connelly et al. (2003).

27.3. Action: Evaluate the effects of development of human infrastructure (specific types as listed in the Plan or as appropriate) on sage-grouse populations, habitat use, and movement patterns.

27.4. Action: Evaluate the effects of management actions (predator management, habitat restoration or enhancements, etc) on sage-grouse habitat use, movement patterns, and, if possible, population trends.

27.5. Action: Starting in 2009, develop monitoring plans for individual projects (implemented by any and all partners) to evaluate their effects on sagebrush habitats and sage-grouse use, movement patterns, distribution, and/or population trends.

27.6. Action: Research alternative methods for management of noxious and invasive plant species.

Partners: UDWR, USFS, BLM, SITLA, USDA-WS, private partners

Threats Addressed: Predation, pinyon-juniper encroachment, power lines, fences and other tall structures

Aspects of Sage-grouse Ecology Addressed: Population size, seasonal habitat quality

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Appendix A

Uinta Basin Adaptive Resource Management Local Working Group
Standard Operating Procedures

Appendix B

Uinta Basin Adaptive Resource Management Local Working Group
Memorandum of Understanding