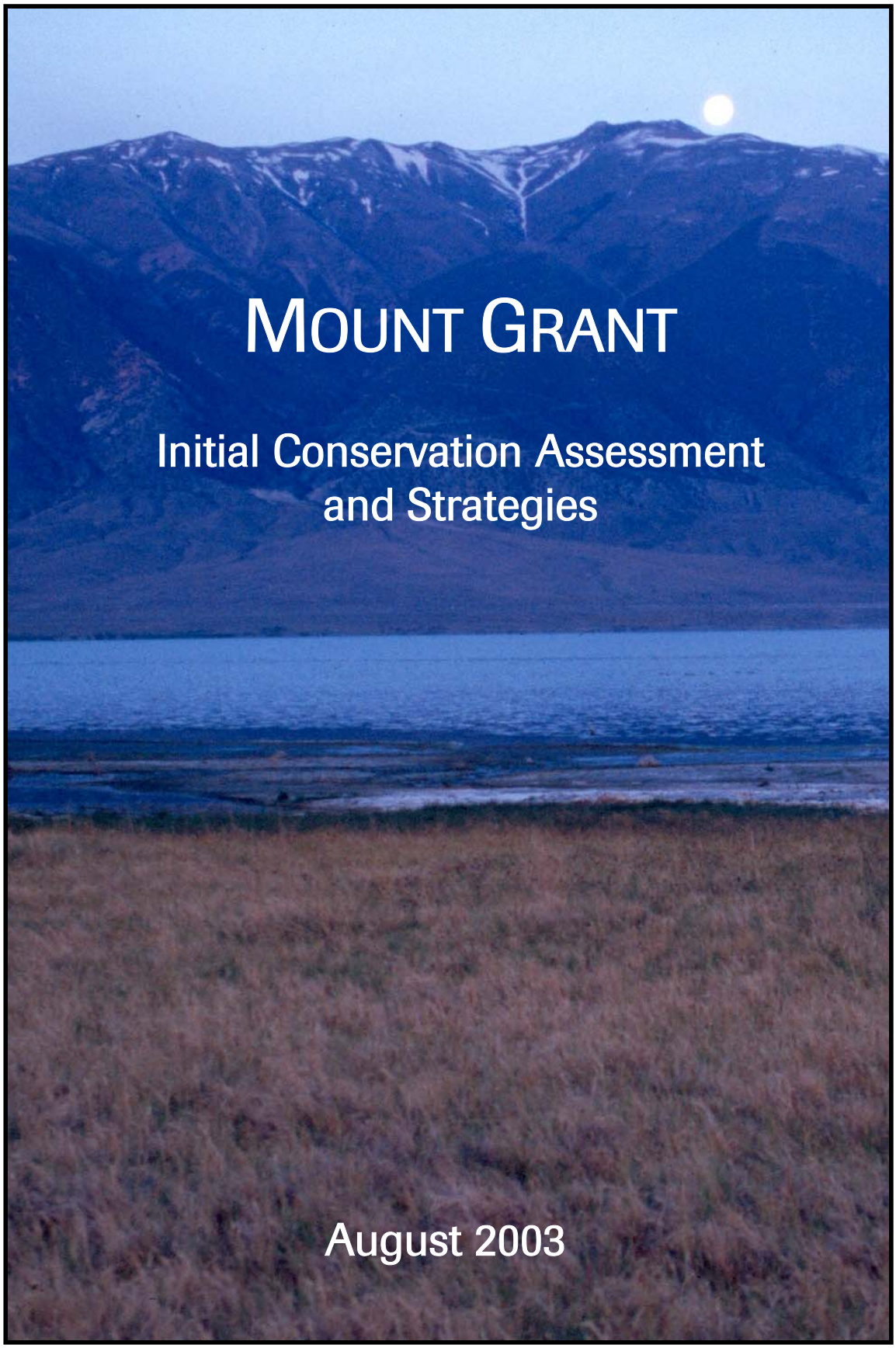

MOUNT GRANT

Initial Conservation Assessment and Strategies

August 2003

The Nature Conservancy

SAVING THE LAST GREAT PLACES ON EARTH

MOUNT GRANT

Initial Conservation Assessment and Strategies

August 2003

by

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The Nature Conservancy of Nevada

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EXECUTIVE SUMMARY

The Great Basin Conservation Initiative is a collaborative effort by The Nature Conservancy and Department of Defense to address conservation planning, strategy development, and implementation on priority areas within the 72 million acre Great Basin ecoregion. Hawthorne Army Depot, a 147,236 acre military installation located in the western Great Basin, was selected to develop conservation strategies for an identified conservation area in the southern Wassuk Range. An assessment team comprised of representatives from Hawthorne Army Depot, Day Zimmermann Hawthorne Corporation (the base operating contractor), U.S. Fish & Wildlife Service, Nevada Division of Wildlife, University of Nevada Reno, Flying M Ranch (BLM public lands permittee holder), Walker River Paiute Tribe, and The Nature Conservancy worked together on this initial conservation assessment of Mount Grant.

Mount Grant encompasses representative higher elevation terrestrial systems that are part of the landscape-scale South Wassuk Range area identified for its conservation value. The area is comprised of a mosaic of sagebrush shrublands and pinyon-juniper woodlands interspersed with riparian habitats, springs and seeps, montane meadows, wetlands, subalpine woodlands, and alpine habitats. Several rare or declining species of concern occur here including plants, Greater Sage Grouse, bats, butterflies, and desert bighorn sheep. It has not been grazed by livestock since the 1930s because the military manages the watershed as its surface water supply for base operations. In addition, public access is restricted. As a consequence, the Mount Grant area is in much better condition than much of the rest of the Great Basin.

The assessment team used The Nature Conservancy's 5-S framework for conservation area planning to develop conservation strategies directed at reducing critical threats to selected focal ecological systems and species. The 5-S framework includes steps to make initial assessments of current viability of selected representative ecological systems and species (focal conservation targets), identifies stresses and sources of stresses (threats) to the conservation targets, develops specific strategies to abate critical threats, and assesses measures of success. It provides for categorical rankings of threats and priorities according to prescribed category definitions. The methodology was applied to Mount Grant in a series of facilitated workshops and meetings co-sponsored by BLM's Carson City Field Office and TNC's Efroymson Fellowship Program with four other conservation area teams. The workshops allowed land management agencies and tribal governments to work with biological experts and receive peer-reviewed feedback on each assessment area.

Eight focal conservation targets were chosen for the Mount Grant conservation assessment area to represent all geographic scales of biodiversity present. They are listed in the following table from largest to smallest geographic scale along with their nested conservation targets. Nested conservation targets are species and plant communities that rely on the focal conservation targets for their habitat. It is assumed that conservation actions directed at focal conservation targets will benefit nested targets as well.

Focal Conservation Target	Description	Nested Conservation Targets
Sagebrush/ Pinyon Woodlands	A dynamic mosaic of matrix-forming shrublands and woodlands dominating the middle elevations on Mount Grant. These areas function as watershed recharge for surface and ground water resources.	Sagebrush and Pinyon Plant Communities; Bodie Hills Rockcress; Beatley Buckwheat; Wassuk Beardtongue; Pinyon Jay; Juniper Titmouse; Sagebrush Vole; White-tailed Jackrabbit; Desert Bighorn Sheep; White Mountains Cloudy Wing
Surface Water	Technically, a natural resources target rather than a strict conservation target. This includes several perennial and associated ephemeral stream drainages in the Mount Grant watershed.	Aquatic Macroinvertebrate Assemblage; Lahontan Cutthroat Trout (potentially)
Greater Sage Grouse	A landscape-scale upland bird dependent on a variety of sagebrush and meadow habitats throughout its life cycle.	
Subalpine and Alpine Systems	Large and small patch open woodlands, shrublands, and barren slopes at the highest elevations on Mount Grant. These areas also function as watershed recharge for surface and ground water resources.	High Elevation Plant Communities; Gray Wavewing; Mono Ragwort; Sagebrush Vole; Pika; Desert Bighorn Sheep; High Elevation Bumble Bee Assemblage
Riparian Forests and Shrublands	Streamside vegetation found along perennial drainages dominated by forests and tall shrublands of cottonwood, willows, and aspen. One of the most important habitats for a variety of birds, butterflies, and small mammals.	Riparian Plant Communities; Riparian Resident and Migratory Bird Assemblages; Cooper's Hawk; Lewis's Woodpecker; Riparian Small Mammal Assemblage; Desert Bighorn Sheep; Riparian Butterfly Assemblage; Apache Silverspot
Montane Meadows	Small patch herbaceous communities associated with high water tables at drainage headwaters and along lower gradient stream sections.	Meadow Plant Communities; White-tailed Jackrabbit; Small Mammal Assemblage
Springs and Seeps	Small, isloated perennial and ephemeral groundwater discharge sites scattered throughout the area.	Desert Bighorn Sheep; Aquatic Macroinvertebrate Assemblage
Lakeshore Wetlands	Small patch herbaceous wetlands adjacent to Walker Lake fed by high water tables and isolated springs. An important habitat for amphibians, birds, butterflies, and small mammals.	Wetland Plant Communities; Water Bird Assemblage; Western Snowy Plover; Amphibian Assemblage

The initial viability assessment for the eight selected focal conservation targets considered the best available information on size, condition, and landscape context criteria for each. The overall initial viability score for the Mount Grant area was good, while viability ranks for individual conservation targets are provided in the following table. Sagebrush/ pinyon woodlands and Greater Sage Grouse had lowest overall viability estimates at fair, subalpine and alpine systems had greatest overall viability estimates at very good, while the five other focal conservation targets had good initial viability estimates.

Conservation Target Viability	Size	Condition	Landscape Context	Overall Viability Rank
Sagebrush/Pinyon Woodlands	Good	Fair	Fair	Fair
Surface Water	Good	Good	Fair	Good
Greater Sage Grouse	Fair	Fair	Fair	Fair
Subalpine and Alpine Systems	Very Good	Very Good	Good	Very Good
Riparian Forests and Shrublands	Very Good	Good	Good	Good
Montane Meadows	Good	Good	Good	Good
Springs and Seeps	Very Good	Good	Good	Good
Lakeshore Wetlands	Good	Fair	Good	Good
Mount Grant Biodiversity Health Rank				**Good**

Threats are combinations of stresses and sources of stresses that decrease viability of focal conservation targets within the next ten years—a useful timeframe for planning. The team evaluated known threats data and made an initial assessment of the severity of damage and scope for each stress, then determined sources for each stress and analyzed their relative contribution and irreversibility. This systematic analysis reveals the most critical threats that require action to improve viability of conservation targets. The following table is a summary of highest ranked threats across the eight focal conservation targets.

Active Threats Across Systems	Surface Water	Riparian Forests and Shrublands	Montane Meadows	Springs and Seeps	Sagebrush/ Pinyon Woodlands	Greater Sage Grouse	Subalpine and Alpine	Lakeshore Wetlands	Overall Threat Rank
Fire suppression/ Risk of catastrophic fire	High	-	Low	-	High	High	-	-	High
Invasive/noxious species	-	Low	-	-	High	Medium	-	High	High
Climate change	-	-	-	-	-	-	High	-	Medium
Grazing practices	-	-	Low	Low	-	Medium	-	-	Low
Historic Threats Across Systems									
Grazing practices	-	-	-	-	Medium	Medium	-	-	Medium
Construction of ditches, dikes, or diversions	-	Medium	Medium	High	-	-	-	-	Medium
Threat Status for Targets and Site	Medium	Low	Low	Medium	High	Medium	Medium	Medium	High

The threats assessment revealed that the overall threat status for Mount Grant is high and is driven primarily by two high ranking active threats: fire suppression/risk of catastrophic crown fire and invasive/noxious species. These threats primarily impact matrix sagebrush/pinyon woodlands, but also impact surface water, Greater Sage Grouse, and lakeshore wetlands conservation targets.

Strategies to address these critical threats at Mount Grant were brainstormed by the team and critiqued by other workshop participants. They were further refined through interviews with experienced land managers, academics, and independent consultants. Strategies developed from this assessment are recommended for consideration by the responsible land managing agencies and entities, and they are not intended to be directives. Action steps for each strategy were scored for direct benefit to all conservation targets and then ranked through an analysis of feasibility, relative cost, and leverage value. Leverage was defined as the degree to which a particular action facilitates successful implementation of another strategy. Broad strategies and their overall benefit are summarized in the following table, while more specific action steps are documented in the full report.

Recommended Management Strategies for Mount Grant	Focal Conservation Targets Benefited	Priority Rank
Use fuels reduction methods and allow prescribed natural fire to create thinned areas within the continuous woody matrix.	Sagebrush/Pinyon Woodlands Surface Water Greater Sage Grouse	High
Develop and implement a weed plan to eliminate or manage invasive species.	Sagebrush/Pinyon Woodlands Lakeshore Wetlands	High
Continue implementing and monitoring the updated grazing plan for the Lucky Boy BLM Allotment.	Sagebrush/Pinyon Woodlands Surface Water Montane Meadows Springs and Seeps Riparian Forests and Woodlands	Medium

The fuels reduction and prescribed natural fire strategy to reduce the risk of catastrophic fire was downgraded from very high to high priority rank because action steps are untested at the necessary landscape-scale and are relatively costly. However, direct benefits, ease of implementation, capacity (leader/institution), and leverage ranked high to make it a high overall priority.

Regardless of priority ranks for management strategies, taking action for next steps is dependent on securing sufficient funding and coordination for implementation. Nothing in this assessment is intended to obligate any parties or land managers to take action without adequate resources. An analysis of capacity factors indicated that expanding the multidisciplinary team and securing adequate funding to implement strategies are important next steps.

Measures of success were not directly addressed among team participants in the workshops because of time constraints. An adaptive management program is recommended to provide needed feedback on effectiveness and applicability of management strategies in reducing threats and improving conservation target viability. TNC is interested in working with Hawthorne Army Depot to develop adaptive management and monitoring at Mount Grant. Workbook documentation accompanying this report is designed to assist with monitoring and is expected to be updated periodically.

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ACKNOWLEDGEMENTS

First and foremost, acknowledgement is given to the Mount Grant conservation assessment team for their hard work, time, and interest in working together to develop conservation strategies for this area in the western Great Basin. I thank John Boone, MaryJo Elpers, Tom Fitzgerald, Brian McMenamy, Craig Mortimore, Tina Nappe, Ernie Paine, Jim Purrell, and Chad Williams for participating on the team. We are indebted to members of the four other conservation assessment teams who participated in the Efroymson workshops for their comments, critiques, and suggestions, for improving the Mount Grant assessment.

Several individuals assisted with providing information and discussion of issues that were incorporated into this report. Thanks go to Dr. Robin Tausch, Dr. Louis Provencher, George Gruell, Walt Mandeville, Dr. Rich Rust, Dan Jacquet, Ame Hellman, and Kei Sochi. I also thank Greg Low with The Nature Conservancy, not only for his superb facilitation of the workshop sessions, but for his knowledge and experience in thinking strategically about the things that matter most. Special thanks to Brian McMenamy for the accompanying maps and data management assistance.

The final version of the assessment was improved with comments and clarifying discussions held at the Army Depot in August 2003. Comments were provided by Lieutenant Colonel David Dornblaser (Commanding Officer) and Jim Purrell from HWAD, Tom Fitzgerald, John Peterson, Kelly King, and Larry Marshall from Day Zimmermann Hawthorne Corporation, and Ernie Paine, from Flying M Ranch. Dr. John Boone, UNR team member, and colleagues Louis Provencher and Sue Wainscott of The Nature Conservancy, also provided separate helpful review comments.

Financial support was provided by the Department of Defense Legacy Resource Management Program for the Great Basin Conservation Initiative. I express appreciation to military and civilian staff who supported this work in various ways, especially Dr. J. Douglas Ripley and Dr. Thomas Lillie. The conservation workshop forum was supported with financial assistance from Carson City Field Office BLM and from TNC's Efroymson Fellowship Program—we greatly appreciate that assistance.

BACKGROUND

GREAT BASIN CONSERVATION INITIATIVE

The Legacy Resource Management Program of the Department of Defense (DoD) has supported a number of conservation initiatives led by The Nature Conservancy (TNC) in the U.S. where large military installations occur. Among the various southwestern efforts is the Great Basin Conservation Initiative, which began in December 1999, and supports TNC of Nevada's effort to implement a focused organization-wide conservation approach called *Conservation by Design* (TNC 2000a).

TNC's *Conservation by Design* approach includes four fundamental components that are illustrated in figure 1.

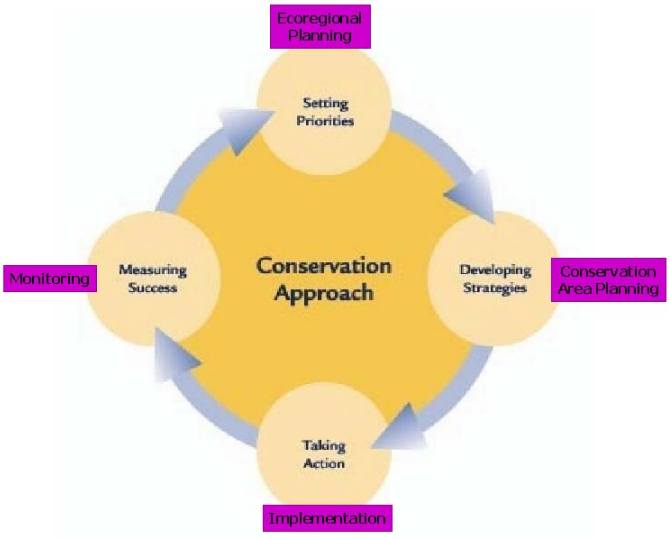


Figure 1. TNC's Conservation by Design approach.

The four components of *Conservation by Design* include setting **priorities** through the ecoregional planning process; developing **strategies** to conserve both single and multiple areas via conservation area planning; taking direct conservation **action**; and **measuring** conservation success through monitoring and other means. The latter component of measuring success provides the adaptive feedback loops for setting new conservation priorities and developing additional strategies as situations change over time.

With funding support from the Legacy Program, TNC of Nevada completed a first iteration of the conservation blueprint for the Great Basin ecoregion in May 2001, thus helping TNC set conservation priorities in the Great Basin (Nachlinger *et al.* 2001). The Great Basin Ecoregional Blueprint identifies a network of 358 conservation areas that collectively represent the ecological systems, natural communities, and species characteristic of the 72 million acre desert ecoregion. The 358 conservation areas were selected to complement one

another by including different assemblages of conservation targets—rare species, plant communities, and ecological systems either unique to or representative of the Great Basin. Simultaneously, they were selected to provide maximum acreage efficiency by building from already protected core areas and incorporating the least area possible. The 358 areas encompass about 28.5 million acres of land and water, which is just under 40% of the Great Basin ecoregion. Approximately five percent of the acreage identified for conservation is land managed by DoD. In addition, associated military air space is substantially larger than the DoD land footprint and accounts for another ten percent of the conservation area acreage. Management of land in the shadow of military air space is administered jointly by DoD and various governmental agencies, primarily the Bureau of Land Management (BLM).

The Legacy Resource Management Program continues to support *Conservation by Design* in the current phase of the Great Basin Conservation Initiative which involves developing conservation strategies at priority sites to guide implementation. The Hawthorne Army Depot (HWAD) is one of several DoD installations in the Great Basin where we currently are developing conservation strategies with multiple partners. This report outlines an initial assessment and conservation strategies for an important conservation area identified at HWAD in the Great Basin Ecoregional Blueprint.

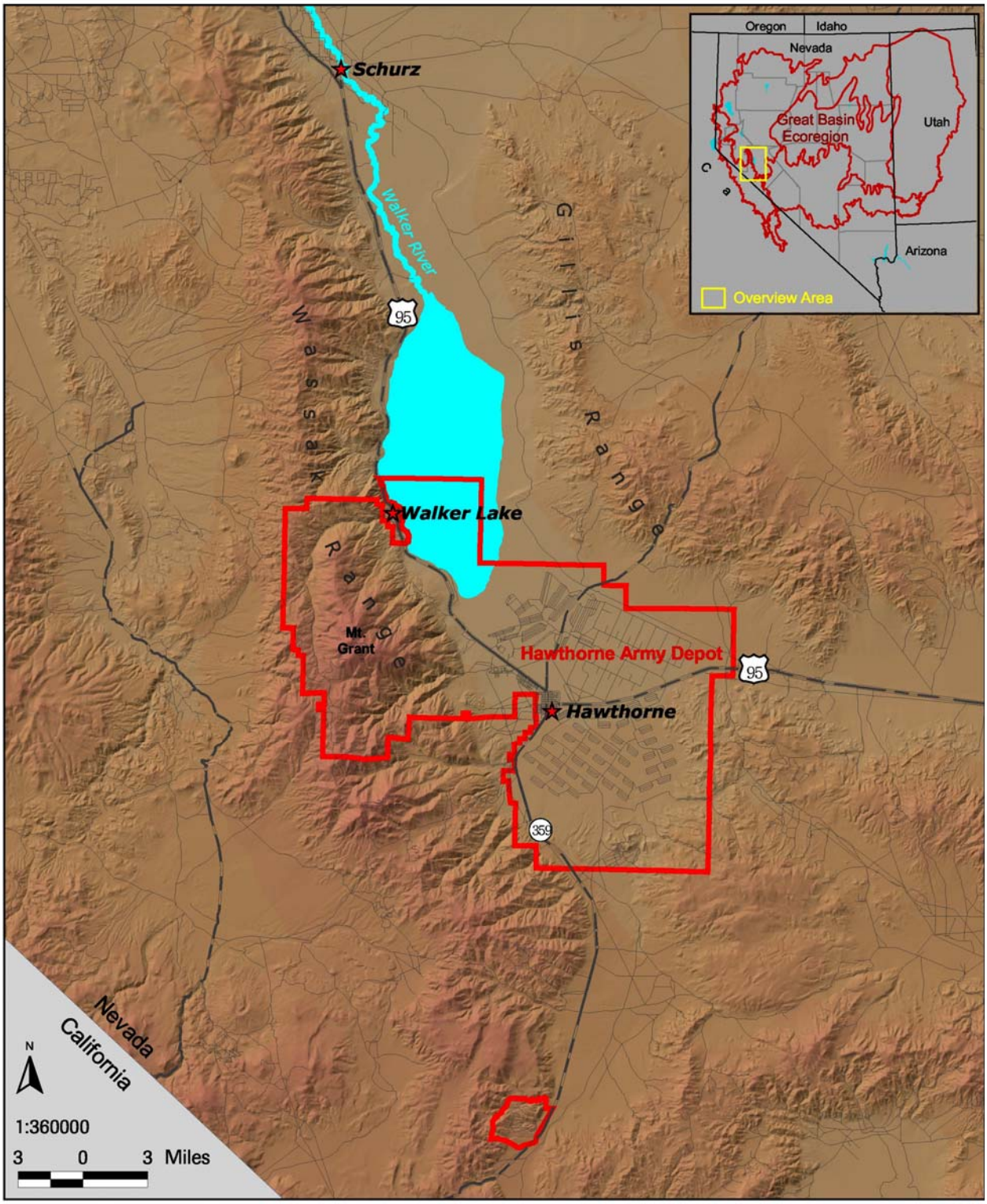
Hawthorne Army Depot Conservation Areas

Hawthorne Army Depot is a 147,236 acre military installation located in the western-most section of the Great Basin ecoregion (figure 2). The depot stores, renovates, and detonates conventional weapons and is described as the largest of its kind in the world. The boundaries of HWAD overlap with four conservation areas that were identified within the Lahontan Basin and California sections of the Great Basin ecoregion. Two sites, South Wassuk Range and Walker Lake-Walker River, are larger landscape-scale sites, while the other two, Thorne Dune and Anchorite Hills, are smaller functional sites (Poiani and Richter 2000). Table 1 summarizes known conservation values (at the ecoregional scale) for the four identified areas at HWAD.

Table 1. Great Basin ecoregion conservation areas at Hawthorne Army Depot.

Conservation Area Name	Acres	Conservation Area Type	Number of Conservation Targets	Number of Great Basin Endemics
Anchorite Hills	33,815	Functional	8	0
South Wassuk Range	121,547	Landscape-scale	31	4
Thorne Dune	24,858	Functional	15	0
Walker Lake-Walker River	233,410	Landscape-scale	22	1

Figure 2. Hawthorne Army Depot and Mount Grant (Wassuk Range) regional overview.



The Anchorite Hills conservation area was selected to capture montane ecological systems in good condition and habitat for a rare butterfly, although it includes the New Bomb satellite area with little conservation value. South Wassuk Range conservation area encompasses all of the Mount Grant watershed lands administered by HWAD and areas beyond. It was selected for numerous montane ecological systems in excellent condition and for several specific montane species targets. Thorne Dune was selected primarily to capture the suite of unique sand dune-obligate invertebrates and the sand dune ecological system, which is centered on BLM administered lands to the northeast of HWAD. However, its boundary includes the lower bajada slopes of the Gillis Range in the vicinity of Thorne, to capture habitat for a rare plant, and this area includes the northeast corner of HWAD. Walker Lake-Walker River area encompasses all of the portions of Walker Lake and its immediate shoreline that is administered by HWAD and a great deal beyond the depot. It is one of the few fish-inhabited terminal lakes in the Great Basin, and was selected primarily for aquatic and riparian targets and for its concentration of migratory water birds.

The South Wassuk Range conservation area, which includes the Mount Grant watershed, is the most important conservation area on HWAD because of its landscape-scale size and overall ecologically intact condition. Of the four areas identified at HWAD it has the greatest number of conservation targets overall, as well as having the greatest number of conservation species endemic to the Great Basin ecoregion. Conservation value of the South Wassuk Range for representative higher elevation ecological systems in excellent condition has been previously documented (Tetra Tech 1998; Nachlinger 1990). This conservation value is further highlighted because of the lack of livestock grazing since the 1930s and its use by the Natural Resources Conservation Service for baseline vegetation management information. Mount Grant is one of the rare examples of representative Great Basin upland ecosystems that is in good condition and mostly ecologically intact because of favorable historical natural resources management by the military. Current management of the Mount Grant watershed includes controlled public access, restricted vehicle use, military training restrictions, prohibited livestock grazing, and research opportunities. These activities and restrictions contribute to biodiversity protection in the Wassuk Range and to an increased understanding of both patterns and processes in Great Basin montane ecological systems.

INTRODUCTION

LONG-TERM VISION

The long-term vision for the Mount Grant area is to protect a functional Great Basin landscape of nearly 65,000 acres, encompassing a rich spectrum of representative native upland and riparian habitats and their associated rare species. Under current Army management focused on protection of the surface water resource, this vision is likely within reach with relatively minor changes. However, the Department of Defense may deem it necessary in the future to adjust management in a direction away from protective actions

and more toward military mission activities that possibly could impact functioning of ecological systems.

A functioning landscape at Mount Grant would include:

- Viable and sustainable populations of both common and rare native plants and animals maintained in natural settings;
- Key habitat corridors between critical mating, nesting, feeding and other upland habitats in the area functioning and restored for sagebrush obligate birds and other native animals;
- Effective ecological linkages along the Wassuk Range crest to the north and south, and up and down its elevational gradients, for protection of wide-ranging species that have home ranges beyond the immediate area;
- A natural fire regime, operating within a range of pre-settlement natural variation, restored and maintained throughout the Mount Grant landscape to sustain key matrix ecological systems and native fire-dependent species;
- Invasive and noxious plant (and animal) species populations managed, controlled, or eliminated where feasible;
- Very minor, temporary, and biologically non-significant military activities; and,
- Coordinated, ecologically compatible, adaptive management by DoD/HWAD along with neighboring public land management agencies, and implemented with additional partner organizations and entities.

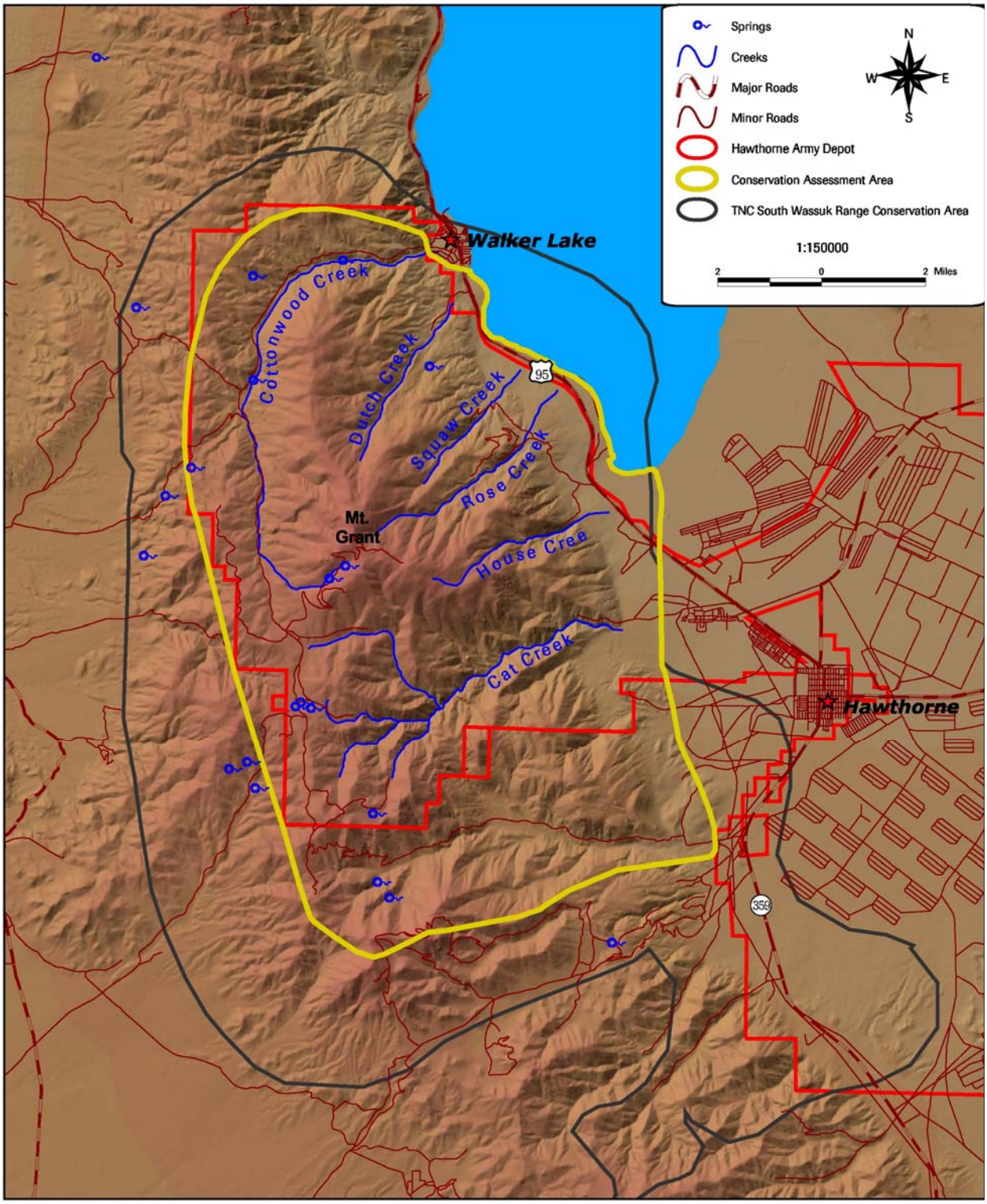
DESCRIPTION OF ASSESSMENT AREA

Location

The Mount Grant conservation assessment area (hereafter **Mount Grant**) is centered around Mount Grant located in the core area of the Wassuk Range, Mineral County, NV (figure 3). As defined for this effort, it is 64,796 acres in extent, which primarily includes east flowing drainages of the Walker Lake watershed unit. It is bounded on the north by the north slopes of Cottonwood Creek and on the south by the south slopes of Corey Creek. It is bounded on the west near the watershed divide of Cottonwood Creek and on the east by Walker Valley and Walker Lake. It encompasses a part of the South Wassuk Range landscape-scale conservation area in the western Great Basin identified in ecoregional planning. **Mount Grant** is centered on HWAD lands.

Mount Grant is topographically diverse, rising from the desert shores of Walker Lake at 3,945 feet in elevation to the alpine summit of Mount Grant itself at 11,239 feet in elevation. This is a dramatic 7,300 foot elevation change in about four miles, which defines sharp and rugged mountain terrain. Steep canyons and streams that convey high quality surface water dissect mountain slopes on the range's east side. The area is geologically diverse. Briefly, it is composed of pre-Tertiary and Cretaceous intrusive rocks made up of diorite, quartz monzonite, and granodiorite, interspersed by older volcanic and sedimentary roof pendants, and younger volcanic rocks that are mainly tuffs and basalts (Ross 1961).

Figure 3. Mount Grant conservation assessment area.



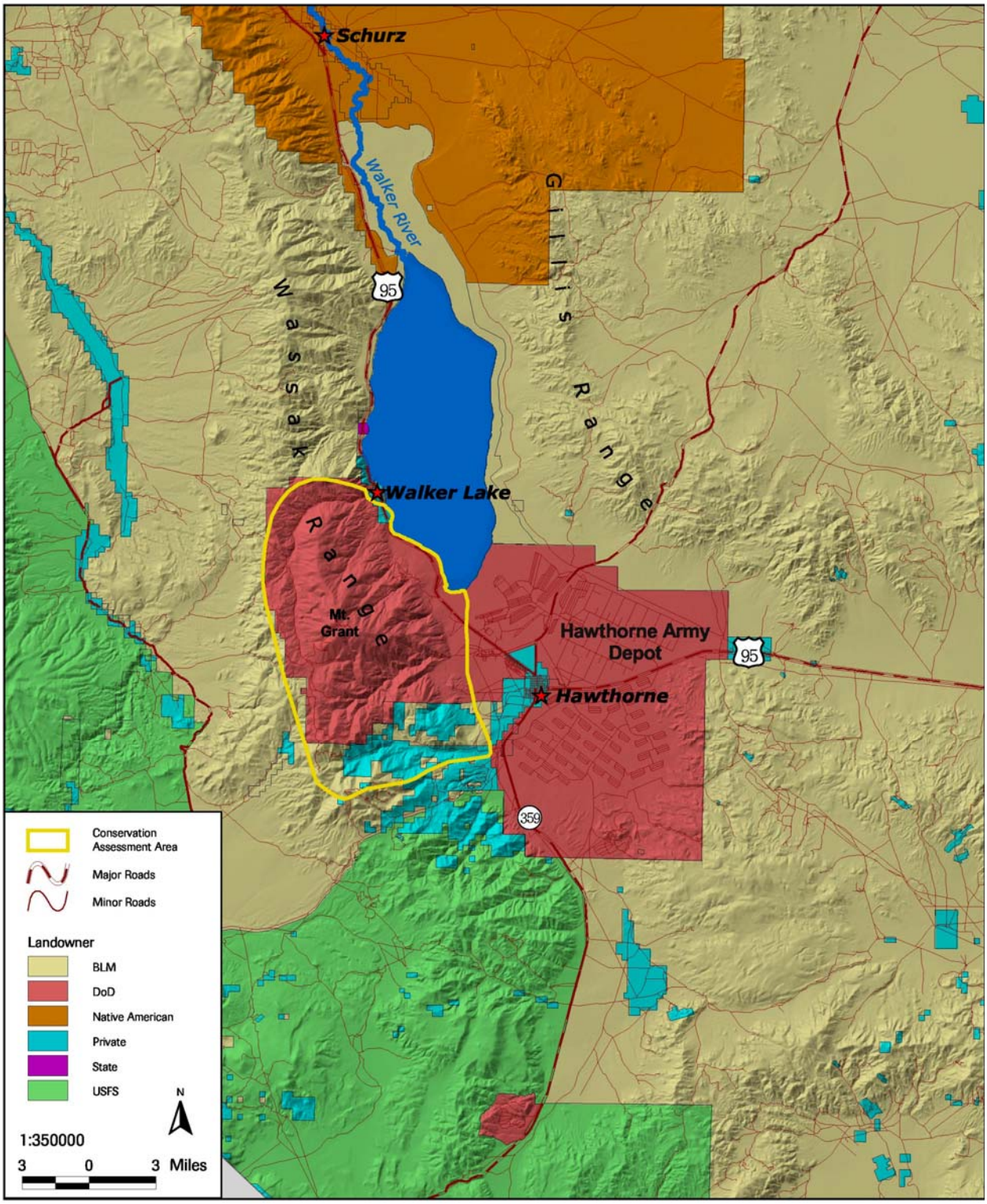
Management and Land Uses

Land ownership and management in the Mount Grant area are mapped on figure 4. The majority of the area is managed and partially owned by HWAD. Beyond the depot boundaries, Carson City BLM manages adjacent lands to the north, west, and south, while the USFS Humboldt-Toiyabe National Forest manages land farther to the south in the southernmost Wassuk Range. The Walker River Paiute Tribe (WRPT) owns land about six miles north of HWAD, and although their reservation does not adjoin **Mount Grant**, the tribe considers it a sacred mountain and continues to use it today. Several parcels of private land are adjacent to HWAD boundaries, for example, at the mouth of Dutch Creek and in the Lucky Boy Pass area. Within the **Mount Grant** area, HWAD manages 75% as withdrawn lands (and owns 1%), BLM manages 13%, and a number of private entities own 12% in total.

An Integrated Natural Resources Management Plan (INRMP) guides management at HWAD within the context of the Army's primary mission activities of weapons storage and disposal (Tetra Tech 1998). In addition to supporting the military mission at HWAD, the management plan guides maintenance of the Mount Grant watershed in an ecologically sound condition; buffering wildlife areas on Mount Grant and at Walker Lake, as well as administrative areas, from military impacts; and, monitoring natural resource conditions. HWAD allows public visitation on Mount Grant for day use, hunting, and unobtrusive recreation (e.g. birding, photography).

A 2001 Consolidated Resource Management Plan (CRMP) guides management for the BLM Carson City Field Office. The CRMP updates and incorporates decisions from eight major field office planning documents and five amendments to these plans. Areas under BLM management in the **Mount Grant** area are in multiple use. They include three grazing allotments (Butler Mountain, East Walker, and Lucky Boy adjoin HWAD lands from north to south) and one herd management area (Wassuk HMA). The landscape is dominated by a mosaic of the sagebrush shrublands and pinyon-juniper woodlands with functional connections across management boundaries. There is an increasing need for coordinated management across jurisdictional boundaries because of increasing scale, magnitude, and complexity of conservation issues. These issues are discussed in later sections on viability and threats.

Figure 4. Land ownership and management of the Mount Grant conservation assessment area.



Ecological Overview

Mount Grant contains a major watershed and supports a wide variety of representative Great Basin habitats and rare species. The area is comprised of matrix sagebrush shrublands and pinyon-juniper woodlands interspersed with riparian habitats, springs and seeps, montane meadows, wetlands, subalpine woodlands, and alpine habitats. The ecological condition and significance of the montane uplands on Mount Grant has been recognized by biologists and natural resource agencies for decades. The Natural Resources Conservation Service (NRCS) has identified it for baseline comparisons with similar areas subject to different grazing management. Since the early 1990s, TNC of Nevada has been involved in scientific inventorying—primarily for rare plants and plant communities—and providing conservation management recommendations to HWAD for the Mount Grant area (Nachlinger 1990; Nachlinger 2001). Ecological systems mentioned below in this brief overview are described in greater detail in the section on conservation targets.

Matrix vegetation at **Mount Grant** is comprised primarily of mosaics of sagebrush shrublands and pinyon woodlands. A number of sagebrush communities are found throughout the area depending on elevation, soil types, and soil depths. They may be dominated by several different species of sagebrush and with bunchgrasses in the understory. The woodlands may be dominated by conifers or hardwood trees and typically have sagebrush species and bunchgrasses in the understory. The sagebrush shrublands and pinyon woodlands provide habitat for several rare plants and animals with distributions restricted to the Great Basin.

At elevations above sagebrush and pinyon plant communities, scattered subalpine woodlands are interspersed with highest elevation alpine communities. Subalpine woodlands on **Mount Grant** are dominated by pines. Alpine herbaceous communities, shrublands, and barren talus slopes define sparsely vegetated areas above tree limit. A few rare plant and animal species occur in the subalpine and alpine ecological systems on Mount Grant.

Riparian and aquatic systems are well represented at **Mount Grant**. Riparian areas are prevalent along the numerous montane drainages. A number of distinct plant communities define the green, broad-leaved riparian systems that boldly contrast with the grayish, small-leaf shrubs of the surrounding matrix communities. Riparian areas are very important habitats for a number of animals and animal assemblages.

Drainage flats and areas where the water table is near the surface provide settings for montane meadows. These systems are small patch size communities dominated by sedges and grasses and associated with broad-leaved plants. Montane meadows, along with the sagebrush shrublands, are very important habitats for Greater Sage Grouse and a number of other animals. Isolated spring systems are additional small patch communities with high biological value scattered on **Mount Grant**. These aquatic systems are integral to hydrologic processes in the area and function as important habitat for a number of animals.

METHODS

TNC's 5-S Framework for Conservation Area Planning

TNC has developed a 5-S framework for conservation area planning (Low 2001, TNC 2000b). The 5-S approach first involves an assessment of a conservation area's focal conservation target **systems**—defined as the highest priority ecosystems, natural communities, or species, **stresses** to those systems, and **sources** of those stresses. Stresses and their sources of stress define the critical threats to focal conservation targets. When analyzed within the context of the current situation—for example, past and current land use, ownership patterns, partnering opportunities for taking management action, and stakeholder concerns—critical threats form the basis for identifying specific and measurable **strategies** for conservation. Conservation strategies that address both threat abatement (ongoing activities) and the ecological health of the conservation targets (restoration) might be identified, if appropriate. Then, key measures of **success** are identified and monitored in an adaptive management manner to determine the effectiveness and accuracy of the identified conservation strategies. Thus, the approach provides a baseline—the initial assessment—and it spawns two specific products—conservation strategies and measures of conservation success. The five components (5-S) of TNC's conservation area planning are illustrated in figure 5 and discussed in greater detail in specific sections of the assessment that follow.

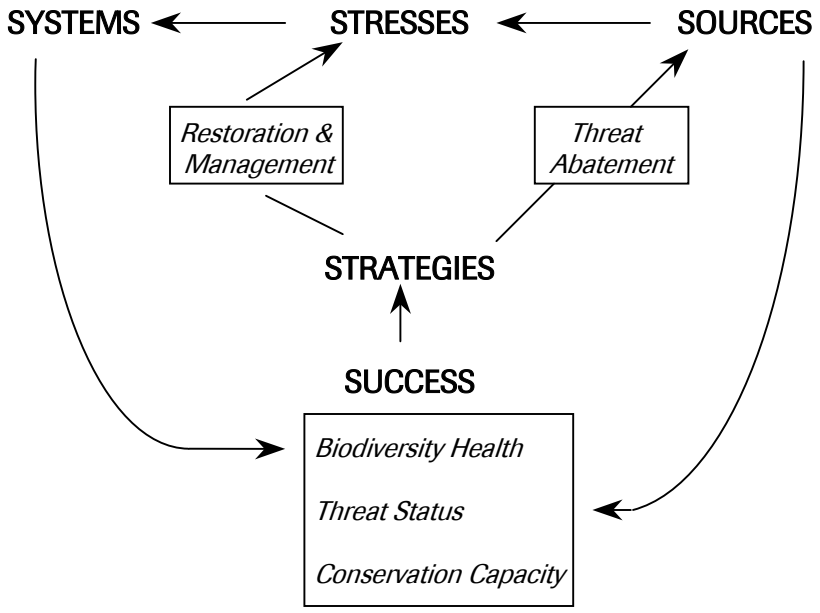


Figure 5. Diagram of TNC's five components (5-S) of conservation area planning.

EFROYMSON WORKSHOP FACILITATION

The Mount Grant conservation area assessment was formally conducted within TNC's Efroymson Fellowship Program. This program is designed to involve conservation partners in TNC's initial site assessments by providing funding and facilitation for a series of intensive workshops that focus on the 5-S approach to conservation assessment. It involved participation by agency, academic, and independent partners in two separate 3-day intensive workshops that focused, in this case, on assessments for five separate conservation areas. Invited participants brought a breadth and depth of knowledge about conservation issues and opportunities at the five individual areas. Each area team accomplished work independently and had that work peer reviewed by the other teams at various steps during the workshops, which provided feedback and strengthened outcomes for all five areas. Documentation of team work was captured in an automated, color-coded Excel workbook created by TNC as a planning tool. Many of the tables in this document were imported from the **Mount Grant** workbook produced at the workshops. An Excel© file of the entire Mount Grant workbook accompanies this document.

Figure 6. Efroymson workshop participants on Mount Grant team (back table), Reno, NV.
Photo: Greg Low, The Nature Conservancy, 2001

The BLM Carson City Field Office co-sponsored this series of workshops because four of the five conservation areas fall within its jurisdictional boundaries and the agency is supportive of collaborative, multi-scale approaches to land management. The four conservation areas in addition to **Mount Grant**, which were selected for their similar conservation targets or issues, included Blowing Sand Mountains (another DoD area team), Jumbo Grade (in the Virginia Mountains), Pine Nut Mountains, and Amargosa River.

In addition, less formal concurrent and subsequent team meetings and field trips contributed to development of the conservation assessments. For the Mount Grant area, the team or partial team met three additional times and also attended briefing meetings with the

Commanding Officer at HWAD twice to receive feedback on the assessment process and products.

Figure 7. Efroymson workshop participants discussing conservation issues at Geiger Grade, Virginia Range.
Photo: Greg Low, The Nature Conservancy, 2001

The **Mount Grant** conservation team was comprised of ten members. Table 2 lists their names, affiliations, and areas of expertise. Because the U.S. Fish & Wildlife Service and Nevada Division of Wildlife are signatory partners to HWAD's INRMP, their participation on the team was specifically requested by DoD.

Table 2. Members of the Mount Grant conservation area assessment team.

Name	Affiliation	Expertise
John Boone	University of Nevada, Reno	Rodents & Small Mammals
MaryJo Elpers	U.S. Fish & Wildlife Service	Ecological Systems
Tom Fitzgerald	Day Zimmermann Hawthorne Corporation	HWAD Engineering Division, Water & Greater Sage Grouse
Brian McMenamy	The Nature Conservancy	Data Management and Geographic Information Systems
Craig Mortimore	Nevada Division of Wildlife	Wildlife & Greater Sage Grouse
Jan Nachlinger	The Nature Conservancy	Ecological Systems & Rare Plants
Tina Nappe	The Nature Conservancy Board	Wildlife
Ernie Paine	Flying M Ranch	Ranching, BLM Allotments, & Greater Sage Grouse
Jim Purrell	Hawthorne Army Depot	HWAD Facilities Management
Chad Williams	Walker River Paiute Tribe	Fisheries and Natural Resources

Two Efroymson workshops were facilitated by TNC's Greg Low and were held in Reno February 19-21, and in Amargosa Valley May 14-16, 2002. Several additional experts provided input to this plan via the workshop review process. Many individuals interviewed are knowledgeable about Greater Sage Grouse biology and other sagebrush obligate birds, the role of fire in sagebrush/pinyon matrix vegetation, riparian function, and hydrologic processes. Data also were gathered and synthesized from NatureServe Explorer (2002), Nevada Division of Wildlife (1961-2001), Nevada Natural Heritage Program (2002), and Nevada Partners-in-Flight Bird Conservation Plan (Neel 1999).

CONSERVATION TARGETS: NATURAL SYSTEMS, SPECIES, AND VIABILITY

Conservation assessments begin with an understanding of focal conservation targets—including natural processes that maintain them—as they are the focus for conservation area planning and measuring conservation success. The objective of the conservation target selection step was to capture **Mount Grant's** significant biodiversity at the appropriate spatial scales to guide the area's conservation assessment and strategy development. By selecting a set of conservation targets that function at multiple scales within **Mount Grant**, management actions can be directed at the appropriate scale and be more efficient (Poiani *et al.* 2000). The geographic scale of conservation targets vary from regional to local scales (figure 8).

The **Mount Grant** team identified seven priority natural systems and one species for the focus of this conservation assessment. All eight selected focal conservation targets are listed and briefly described in table 3 with expanded descriptions of each in following sections. Appendix 1 provides a complete list of associated plants, plant communities, animals, and animal assemblages that are nested conservation targets within the seven focal conservation target systems (one focal conservation target is a species). Nested conservation targets are species and plant communities with conservation management requirements assumed to be addressed adequately within the focal ecological system conservation target. Focal species conservation targets represent a fine-filter approach to conservation, whereas focal ecological system-level conservation targets with their suite of nested conservation targets represent a coarse-filter approach. Although there are several other ways to approach conservation management, TNC favors using a combination of the fine-filter and coarse-filter approaches because experience with it in many landscapes and situations indicates that it is an effective and comprehensive approach (Poiani *et al.* 2000).

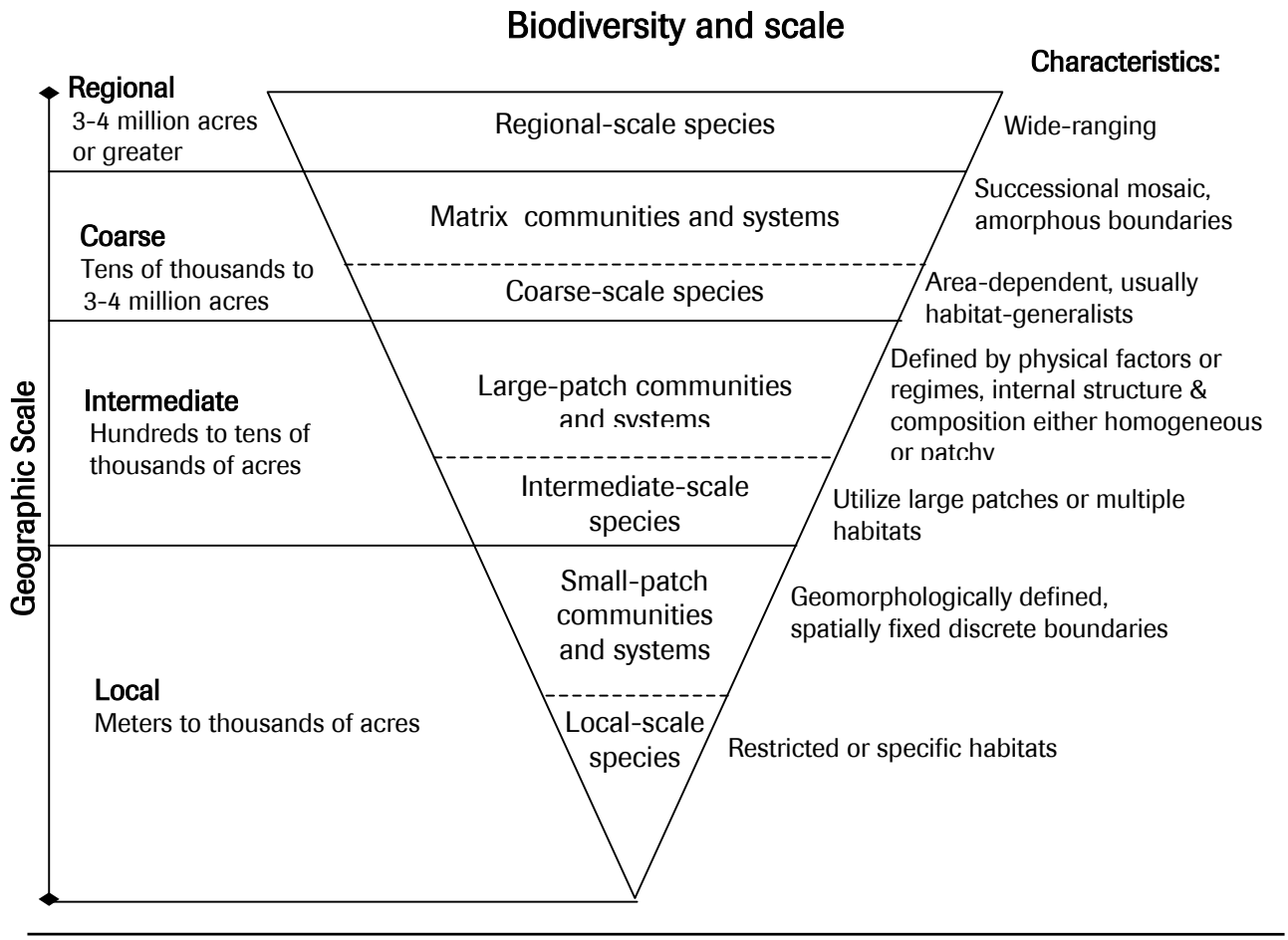


Figure 8. Geographic scales of conservation targets (after Poiani *et al.* 2000).

Table 3. Eight focal conservation targets in the Mount Grant conservation assessment area.

Conservation Target	General Description
Sagebrush/ Pinyon Woodlands	A dynamic mosaic of matrix-forming shrublands and woodlands dominating the middle elevations on Mount Grant. These areas function as watershed recharge for surface and ground water resources.
Surface Water	Technically, a natural resources target rather than a strict conservation target. This includes several perennial and associated ephemeral stream drainages in the Mount Grant watershed.
Greater Sage Grouse	A landscape-scale upland bird dependent on a variety of sagebrush and meadow habitats throughout its life cycle.
Subalpine and Alpine Systems	Large and small patch open woodlands, shrublands, and barren slopes at the highest elevations on Mount Grant. These areas also function as watershed recharge for surface and ground water resources.

Riparian Forests and Shrublands	Streamside vegetation found along perennial drainages dominated by forests and tall shrublands of cottonwood, willows, and aspen. One of the most important habitats for a variety of birds, butterflies, and small mammals.
Montane Meadows	Small patch herbaceous communities associated with high water tables at drainage headwaters and along lower gradient stream sections.
Springs and Seeps	Small, isloated perennial and ephemeral groundwater discharge sites scattered throughout the area.
Lakeshore Wetlands	Small patch herbaceous wetlands adjacent to Walker Lake fed by high water tables and isolated springs. An important habitat for amphibians, birds, butterflies, and small mammals.

To illustrate the coarse-filter and fine-filter approach at **Mount Grant**, the interrelated mosaic of sagebrush/pinyon woodlands was selected as a focal conservation target because: 1) this matrix-forming ecological system is widespread; 2) it includes predominant sagebrush shrublands and pinyon and juniper woodlands that are important habitat for numerous animals and plants; and 3) natural processes maintaining the system are critical for maintenance and long-term sustainability of rare and representative species. If the ecological condition and functions of the sagebrush/pinyon woodlands is very good (or improved to very good), it is assumed that the species and plant communities dependent on the ecological system also would be in very good condition and have very good landscape context (connectivity and functioning ecological processes). Similarly, montane meadows were selected as a focal conservation target because this ecological system is important habitat for numerous animals and plants, and natural processes maintaining the system are critical for maintenance and long-term sustainability of rare and representative species. Nevertheless, Greater Sage Grouse has specific conservation issues, and although sagebrush/pinyon woodlands and montane meadows systems are very important habitats for it, the bird was identified as an independent focal conservation target. The team felt that viability and threats to Greater Sage Grouse were specific to the species and possibly different enough from viability and threats to the sagebrush/pinyon woodlands system that the Greater Sage Grouse could not be assessed sufficiently at the scale of an ecological system conservation target. Similarly, the team thought that conservation strategies for Greater Sage Grouse might be different than for the sagebrush/pinyon woodlands system.

Geographic scales of the eight conservation targets identified at **Mount Grant** are diagrammed in figure 9. Descriptions of the selected focal conservation targets follow in order of their decreasing geographic scale. Figure 10 is a general distribution map of focal and nested conservation targets depicted as Gap Analysis Project (GAP) vegetation types and occurrences of rare species (Utah Cooperative Fish and Wildlife Research Unit 1996; Nevada Division of Wildlife 1961-2001; Nevada Natural Heritage Program 2002).

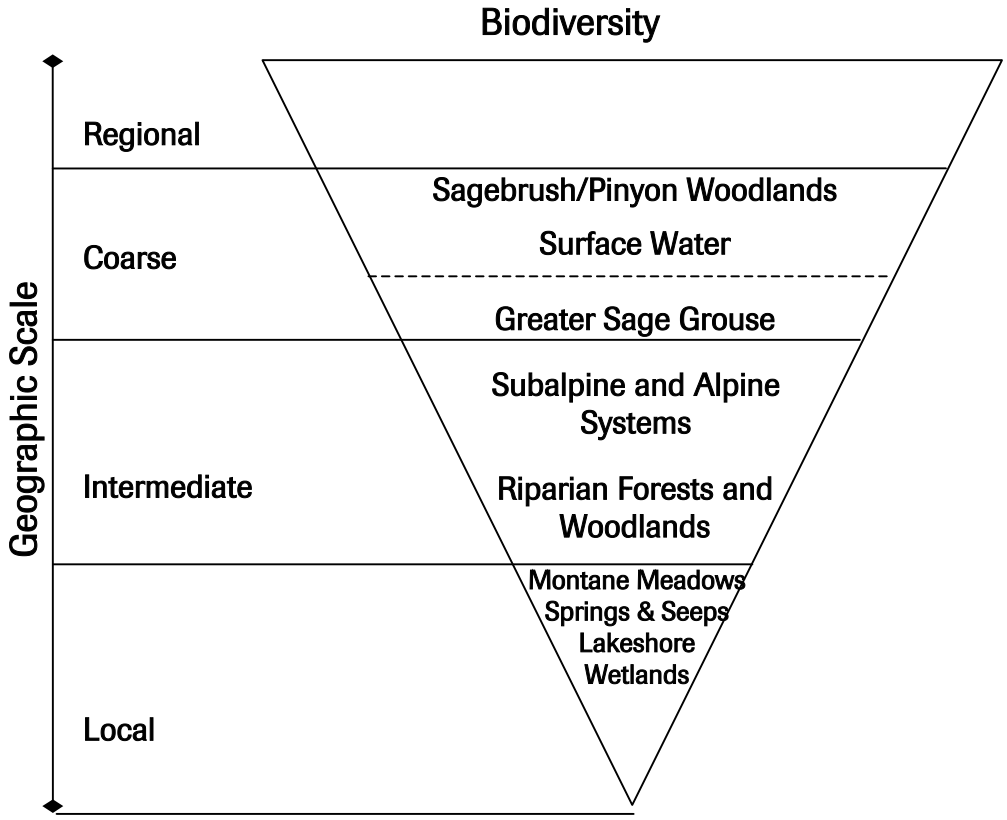


Figure 9. Geographic scales of selected focal conservation targets at Mount Grant.

Sagebrush/Pinyon Woodlands

Sagebrush/Pinyon Woodlands comprise key matrix plant communities at middle and higher elevations. The sagebrush shrublands are characterized by basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), Wyoming sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), mountain sagebrush (*Artemisia tridentata* ssp. *vaseyana*), or low sagebrush (*Artemisia arbuscula*). In areas with deeper soils, herbaceous cover of bunchgrasses and herbs increase in importance and define sagebrush steppe communities. These shrublands provide habitat for a number of sagebrush obligate species of concern as a result of documented declines in the **Mount Grant** area as well as throughout the Great Basin. Woodlands are dominated by singleleaf pinyon pine (*Pinus monophylla*), sometimes with Utah juniper (*Juniperus osteosperma*), or mountain mahogany (*Cercocarpus ledifolius* var. *intermontanus*). Typically, sagebrush and perennial grass species comprise the understory of the woodlands where an understory is present. In addition, smaller areas with black sagebrush (*Artemisia nova*) and western juniper (*Juniperus occidentalis*) define additional upland communities. The sagebrush/pinyon woodlands function in watershed recharge for surface and ground water resources for this landscape. In figure 10, distribution of the sagebrush/pinyon woodlands is depicted by five GAP vegetation types: sagebrush, sagebrush and grassland, mountain sagebrush, mountain mahogany, and pinyon-juniper.

Figure 10. Focal and nested conservation targets depicted by vegetation and known rare species occurrences in the Mount Grant conservation assessment area.

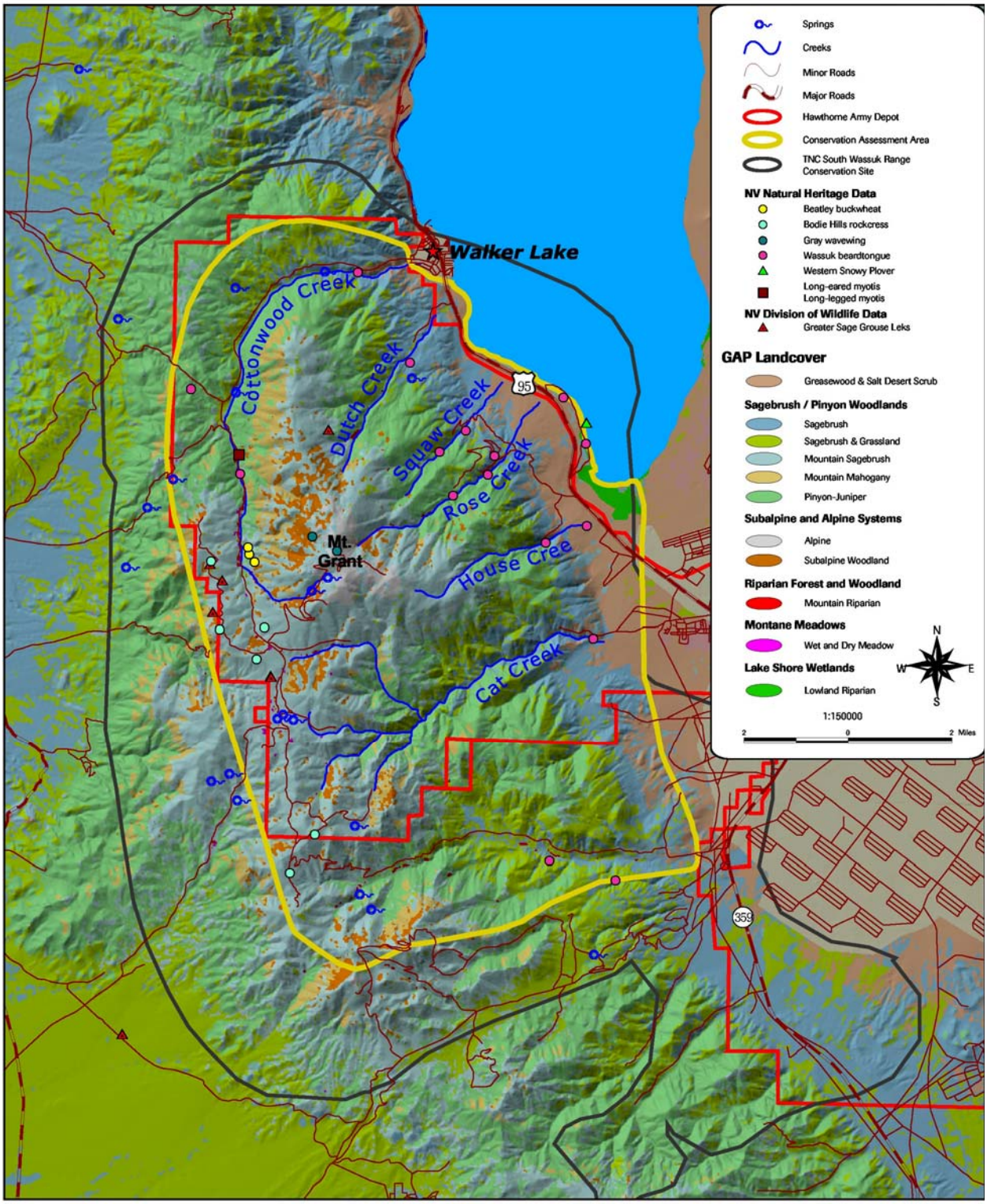


Figure 11. The sagebrush/pinyon woodland system at lower elevations on Mount Grant is illustrated by this mosaic of sagebrush shrublands and pinyon woodlands showing an older fire scar in Dutch Creek drainage.
Photo: Jan Nachlinger

Figure 12. Mountain sagebrush communities at higher elevations on Mount Grant also represent the sagebrush/pinyon woodland system.
Photo: Jan Nachlinger

Mosaics of sagebrush/pinyon woodlands provide important habitats for a diversity of large and small mammals, birds, and plants so a number of nested conservation targets occur in the matrix shrubland and woodland systems. Three rare plants known to occur in these systems are Bodie Hills rockcress (*Arabis bodiensis*), Beatley buckwheat (*Eriogonum*

beatleyae), and Wassuk beardtongue (*Penstemon rubicundus*). Bodie Hills rockcress is ranked G2, Beatley buckwheat is ranked G2Q, and Wassuk beardtongue is ranked G2G3. Global rank definitions are provided at the end of Appendix 1, p. 64. A rare butterfly, the White Mountains cloudy wing (*Thorybes mexicana blanca*), ranked T2G5, is found in these montane systems.

Figure 13. The sagebrush/pinyon woodland system provides habitat for three rare plants—Bodie Hills rockcress, Beatley buckwheat, and Wassuk beardtongue, respectively.
Photos: Jan Nachlinger

Two small mammals are nested conservation targets in matrix shrubland and woodland systems: sagebrush vole (*Lemmiscus curtatus*), and white-tailed jackrabbit (*Lepus townsendii*). Both mammals are ranked G5, but with declining trend because of habitat disturbance or loss (NatureServe 2002). Desert bighorn sheep (*Ovis canadensis nelsoni*), ranked T4G4, is a wide-ranging conservation target nested in these matrix systems. Three birds use the sagebrush/pinyon woodlands system for habitat and are nested conservation targets: Pinyon Jay, Juniper Titmouse, and Mountain Quail (Neel 1999). The Greater Sage Grouse, with a G4 rank, primarily uses sagebrush shrublands for habitat, but its viability and complex conservation issues influenced the team's decision to not nest it within this ecological system conservation target.

Surface Water

Surface Water in the Mount Grant watershed is a key natural resource for HWAD because it is the main water supply for military operations and readiness. A high surface water quality is required to keep treatment and cost to a minimum. Other than minor chlorinating, the surface water supply currently receives no additional treatment before being used by the base. To maintain this high surface water quality standard, the military has restricted grazing and public access to the watershed since the late 1920s. Consequently, a large landscape on Mount Grant has been viewed as a baseline area for comparison with similar terrestrial ecological systems subject to grazing management elsewhere.

Figure 14. Cat Creek Reservoir is part of the surface water natural resource target at Mount Grant.
Photo: Tom Fitzgerald, Day Zimmermann Hawthorne Corporation

Surface waters from Cottonwood Creek, Squaw Creek, Rose Creek, House Creek, and Cat Creek are collected in a chain of open catch basins, weirs, and diversions and conveyed by pipe to four storage reservoirs (creeks are shown on figure 10, although the entire surface water system is not depicted on the map). Surface water is dependent on annual recharge of the mountain aquifer, which occurs mainly from precipitation during winter months. Only Cottonwood Creek maintains enough discharge to reach Walker Lake once in a while.

Nested within this target is a suite of aquatic macroinvertebrates that live in the creeks. An Army study identified 82 aquatic macroinvertebrates with mayflies (Order Ephemeroptera) and caddisflies (Order Trichoptera) listed as the most abundant (USAEHA 1979). Aquatic macroinvertebrates are important indicators of the health of aquatic systems, and their specific identifications are used to evaluate water quality (Batzer *et al.* 1999).

In this assessment, surface water is not a classic conservation target; rather, it is assessed as a natural resource target that currently is critical for military mission success at HWAD. Surface water, in addition to providing a resource for military operations, is important for maintaining natural aquatic and riparian systems and species that depend on those systems. Above the points of diversion on the main five creeks, aquatic and riparian systems have benefited from historic and current military management to maintain high water quality. Some aquatic habitats have been enhanced immediately above catch basins. However, below points of diversion where water is piped, the viability of these systems has been compromised as a result of decreased flows. For example, Cottonwood Creek currently does not provide a migration route for fish between the lake and stream as a result of diversion and low natural runoff (Tetra Tech 1998). If other water sources become available and management changes in the future, there may be an opportunity for re-establishment of

naturally flowing streams along portions of creeks below the present points of diversion, and increased stream discharge might allow for restoration of historical riparian corridors along several creeks and renewed connectivity for Lahontan cutthroat trout migration along Cottonwood Creek. Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*), is ranked T3G4 and is a federally threatened species listed under the Endangered Species Act of 1973 as amended.

Greater Sage Grouse

Greater Sage Grouse is the only species-level focal conservation target selected for this assessment (figure 15). It was highlighted as a separate conservation target and was not nested within the sagebrush/pinyon woodlands ecological system because of special conservation issues for the species that the team felt would not be adequately addressed within the context of the matrix ecological system. Greater Sage Grouse is considered a landscape species at the coarse scale because its movements often cover large distances across varying landscape as seasons progress. A diverse landscape with high quality and quantity of sagebrush types, open areas for strutting, and meadows and riparian stringers for brood rearing, are all important for Greater Sage Grouse—they add up to a desired landscape composition (Neel 2001). These habitat combinations are present at **Mount Grant**.

Figure 15. Greater Sage Grouse habitat in low and mountain sagebrush communities along the west boundary at Mount Grant.

Photo: Jan Nachlinger **Greater Sage Grouse (inset)** *Photo: Don Baccus ©1996, Calif. Dept. of Fish and Game*

The Greater Sage Grouse population at **Mount Grant** is thought to be part of a genetically distinct western population found in Douglas, Lyon, and Mineral counties, NV, and in adjoining Mono and Inyo counties, CA. It is referred to as the Mount Grant population management unit (PMU) within the bi-state planning area of Governor's State Sage Grouse Conservation Plan (Neel 2001). The Greater Sage Grouse is a species of

concern in the Great Basin—at present it is not listed nor is it a candidate for listing by the U.S. Fish and Wildlife Service under the Endangered Species Act (U.S. Fish and Wildlife Service 2002). However, improving its status, trend, and habitats are goals of many federal and state agencies and other entities in an effort to prevent its listing.

There are six documented leks on Mount Grant in high quality mountain sagebrush and low sagebrush habitat (Nevada Division of Wildlife 1961-2001). Two leks occur on a knoll north of Lapon Meadows, three leks occur along a ridge adjacent to HWAD's west perimeter road north of Lapon Canyon, and one lek occurs on high slopes above Dutch Creek about two miles north of Mount Grant. These leks are depicted on figure 10 and represent point occurrences among vast Greater Sage Grouse habitat at Mount Grant.

Montane meadows are very important for Greater Sage Grouse. Chicks are highly dependent on forbs and insects, and meadows offer them in greater abundance unless very favorable conditions occur in sagebrush shrublands. Both Lapon Meadows and the headwater meadow on the North Fork Cat Creek are used by Greater Sage Grouse for brood rearing. In summer, Greater Sage Grouse juveniles and adults are often observed along the low sagebrush ridge adjacent to HWAD's west perimeter road.

Subalpine and Alpine Systems

Subalpine and Alpine Systems are small and large patch shrublands, woodlands, herblands, or talus slopes at the highest elevations (figure 16). Subalpine woodlands are open stands dominated by either limber pine (*Pinus flexilis*) or whitebark pine (*Pinus albicaulis*). They typically have mountain or low sagebrush understories, but at higher elevations the shrub understory is replaced by more open cover of perennial bunchgrasses and cespitose plants. With increasing elevation and more extreme growing conditions, trees eventually give way to sparser alpine communities. A predominant shrubland near the end of the road on Mount Grant is dominated by prickly phlox (*Leptodactylon pungens* var. *hallii*). A mosaic of alpine herbaceous communities comprised of grasses and cespitose plants and barren talus slopes define the sparsely vegetated areas above tree limit centered on Mount Grant (Bell and Johnson 1980). The subalpine and alpine systems conservation target is depicted in figure 10 by two GAP vegetation types: alpine and subalpine woodland (whitebark pine).

A number of species and one animal assemblage are nested in this conservation target. One nested rare plant occurs in alpine settings, gray wavewing (*Cymopterus cinerius*), ranked G2G3. The desert bighorn sheep and sagebrush vole are nested again within the subalpine and alpine systems, along with pika (*Ochotona princeps*). Although the pika is ranked G5, it is possibly genetically distinct from Sierra Nevada and Rocky Mountain populations as a result of isolation in the Wassuk Range (Hafner and Sullivan 1995). An assemblage of high elevation bees were identified as nested targets for the subalpine and alpine ecological systems. This diverse assemblage of pollen-collecting hymenoptera are important alpine pollinators (Dr. Rich Rust, UNR, personal communication).

Figure 16. Whitebark pine and limber pine at higher elevations on Mount Grant represent alpine and subalpine systems.
Photo: Jan Nachlinger

Riparian Forests and Shrublands

Riparian Forests and Shrublands occur streamside in both major and minor drainages. Spatially, they typically are small (linear) patch systems, but where drainages widen on Mount Grant as they do along upper Cottonwood Creek, they can form broad communities. They are very important for ecosystem function services including erosion control, bank stabilization, water temperature control, sediment filtration, floodplain formation, energy dissipation, floodwater delay, and groundwater recharge (Gregory *et al.* 1991). Also, they are critical for many riparian-dependent and facultative species (Naiman *et al.* 1993).

Riparian forests and tall shrublands at **Mount Grant** are structurally complex with usually dense overstory, mid-level, and understory layers of vegetation. A variety of plant communities are present and those forming forests are dominated by Frémont cottonwood (*Populus fremontii*) at lower elevations and aspen (*Populus tremuloides*) at middle and higher elevations (figure 17). Shrublands are dominated by arroyo willow (*Salix lasiolepis*), which occurs at lower and middle elevations, or are mixed willow shrublands, co-dominated by Geyer willow (*Salix geyeriana*) and Lemmon willow (*S. lemmonii*) at middle and higher elevations (figure 18).

Aspen sometimes forms discrete stands somewhat removed from riparian drainages in places were topography and moisture favor growth. Understory plants are comprised of grasses, grass-like plants, and broad-leaved herbs, which may have high to low ground cover depending on light and moisture conditions. Ecotones with adjacent upland vegetation are quite abrupt on Mount Grant where soil water availability drastically declines and soil temperature increases from drainage to upland slopes. Distribution of the riparian

forests and woodlands are under-represented by the GAP vegetation in figure 10 where they are depicted by the one montane riparian type. (Riparian vegetation in the Wassuk Range tends to occur in smaller patches than the size of GAP's minimum mapping unit).

Figure 17. Lower elevations of Cottonwood Creek are dominated by Frémont cottonwood.
Photo: Jan Nachlinger

Figure 18. Upper elevations of Cottonwood Creek are dominated by willows, and along with cottonwoods and aspen, they represent riparian forests and shrublands system at Mount Grant.
Photo: Jan Nachlinger

Because riparian corridors provide food (abundant insects), water, and cover, they are key habitats for a diversity of large and small mammals, butterflies, and birds. Several rare and sensitive animal species and animal assemblages are nested within this system conservation target. They include: riparian small mammal assemblage, Cooper's Hawk, Lewis's Woodpecker, riparian resident bird assemblage, riparian migratory bird assemblage, and riparian butterfly assemblage, including the rare Apache silverspot (*Speyeria nokomis apacheana*), ranked T3G4. The desert bighorn sheep also is included because of its dependence on riparian systems for water.

Animal assemblages are surrogates for suites of related species with little known specific information other than that they are harbored within a given system, For example, the riparian small mammal assemblage includes four species of cricetid mice [white-footed mice (*Peromyscus* spp.), western harvest mouse (*Reithrodontomys megalotis*), montane vole (*Microtus montanus*), desert woodrat (*Neotoma lepida*)], five species of heteromyid mice [pocket mice (*Chaetodipus formosus*; two *Perognathus* spp.) and kangaroo rats (two *Dipodomys* spp.)], and several species of spermophiles [ground squirrels (*Spermophilus* spp.) and chipmunks (*Tamias* spp.)]. High elevations at **Mount Grant** have unusually dense populations of sagebrush vole, and could potentially provide habitat for heather vole (*Phenacomys intermedius*; Boone *et al*. 1998). Small mammals provide a variety of ecosystem functions, such as influencing plant composition and structure (from feeding, caching, and digging behavior), changing soil structure and chemistry (burrowing), and contributing to energy cycles (preying on smaller animals and providing a prey base for others).

The portions of riparian systems located below points of diversions for the surface water system are not included in this assessment because of contrasting riparian viability and stresses to the riparian system. If the critical role of surface water to the military mission changes in the future, the entire riparian system may be able to be evaluated for conservation management and restoration.

Montane Meadows

Montane Meadows occur at headwater areas of the major drainages and as stringer meadows along flatter sections of the streams where soils are saturated or nearly saturated (figure 19). Soil moisture, texture, periodic fire, and herbivory may play a role in their maintenance. These are small patch systems, but like riparian areas, they too are key habitats for a diversity of plants and animals because of the cover, food, and water that they provide.

Montane meadows on **Mount Grant** typically are moist meadows dominated by grasses and sedges, such as wire grass (*Juncus balticus*), slenderbeak sedge (*Carex athrostachya*), wooly sedge (*Carex lanuginosa*), small-wing sedge (*Carex microptera*), and bluegrasses (*Poa* spp.). A number of broad-leaved herbaceous plants used by Greater Sage Grouse are present, including: mountain dandelion (*Agoseris glauca*), pussytoes (*Antennaria rosea*), hawksbeard (*Crepis acuminata*), and clovers (*Trifolium wormskjoldii* and others)

(Nachlinger 1990). In figure 10, montane meadows are under-represented and depicted by one GAP vegetation type: wet and dry meadows.

Figure 19. Montane meadow along upper Cottonwood Creek—dominated by grasses in association with many herbs.
Photo: Jan Nachlinger

Nested conservation targets in montane meadows include the white-tailed jackrabbit and a small mammal assemblage.

Springs and Seeps

Springs and Seeps were selected as a separate conservation target because of their unique hydrologic and biological values. They are small patch ecological systems dependent on ground water, and are present at various elevations throughout the area (figure 20). The most notable springs at **Mount Grant** are Sorhouet Spring along Cottonwood Creek, Wild Horse Spring at 6,800 feet elevation in the pinyon trees, the headwater springs of Lapon Meadows, and the unnamed spring at 10,300 feet elevation along the road on the south slopes of Mount Grant. Distribution of this focal conservation target is depicted on figure 10 as point locations for springs.

These aquatic systems were not nested within the Surface Water natural resource target because of their special conservation issues and because they are not managed in the same fashion. The springs and seeps are perennial or ephemeral sources of water to the watershed, and they are important habitat for aquatic species or used by terrestrial animals. Aquatic macroinvertebrates are a nested aquatic species assemblage, while desert bighorn sheep is a nested terrestrial animal because of its dependence on these small systems for water.

Figure 20. Springs and seeps at Mount Grant are small, isolated systems among matrix plant communities.
Photo: Jan Nachlinger

Lakeshore Wetlands

Lakeshore Wetlands are small patch herbaceous systems with direct connections to water sources (figures 21 and 22). There are several plant communities that make up emergent freshwater marsh wetland and grassland habitats. Areas may be dominated by cattail (*Typha domingensis*), bulrushes (*Scirpus nevadensis* and *S. pungens*), saltgrass (*Distichlis spicata* var. *stricta*), or alkali muhly (*Muhlenbergia asperifolia*). Distribution of lakeshore wetlands are depicted on figure 10 as the lowland riparian type.

Figure 21. Lakeshore wetlands at Mount Grant occur adjacent to Walker Lake.
Photo: Jan Nachlinger

Figure 22. Emergent marshes are a component of lakeshore wetlands.
Photo: Jan Nachlinger

Two nested species assemblages include a water bird assemblage and amphibian assemblage. Amphibians include the western toad (*Bufo boreas*) and Great Basin spadefoot (*Spea intermontana*), which were surveyed by Espinoza and Tracy (1999).

Lakeshore wetlands, along with the lowest reaches of riparian drainages are functionally tied to Walker Lake surface water levels. Conservation management of Walker Lake and Walker River involve greater issues at a larger geographic scope than this team attempted to address here. The lake, river, and closely associated ecological systems, likely will be targeted to address regional water issues in the near future as a result of passage of the 2002 Farm Security and Rural Investment Act (specifically, the desert terminal lakes section).

VIABILITY

The current viability, or ecological integrity, of each conservation target was ranked by the team based on the best available information for this assessment. We considered three important factors—size, condition, and landscape context—when characterizing viability of the conservation targets (TNC 2000b). Definitions for each factor follows.

Size is a measure of the area or abundance of the conservation target's occurrence. For ecological systems and communities, size is simply a measure of the occurrence's patch size or geographic coverage. For animal and plant species, size takes into account the area of occupancy and number of individuals. Another aspect of size is minimum dynamic area, or the area needed to ensure survival or re-establishment of a target after natural disturbance.

Condition is an integrated measure of the composition, structure, and biotic interactions that characterize the occurrence. This includes factors such as reproduction, age structure, biological composition (presence of native versus exotic species; presence of characteristic patch types for ecological systems), structure (canopy, understory, and groundcover in a forested community; spatial distribution and juxtaposition of patch types or seral stages in an ecological system), and biotic interactions (levels of competition, predation, and disease).

Landscape context is an integrated measure of two factors: the dominant environmental regimes and processes that establish and maintain the target occurrence, and connectivity. Dominant environmental regimes and processes include herbivory, hydrologic and water chemistry regimes (surface and groundwater), geomorphic processes, climatic regimes (temperature and precipitation), fire regimes, and many kinds of natural disturbance. Connectivity includes such factors as species targets having access to habitats and resources needed for life cycle completion, fragmentation of ecological communities and systems, and the ability of any target to respond to environmental change through dispersal, migration, or recolonization.

Four values ranging from very good to poor were used to rank the current size, condition, and landscape context of the conservation targets. The team explicitly defined rankings for the mosaic of sagebrush/pinyon woodlands (table 4). However, for the other conservation targets the rankings were more intuitively assigned after evaluating information and discussing known threats because of workshop time constraints.

Initial assessments of viability rankings for the eight conservation targets are given in table 5. The overall viability rank across all focal conservation targets at **Mount Grant** is currently considered good (table 5, lower right). This rank was calculated from numerical non-linear scores for individual rankings of size, condition and landscape context across all conservation targets. Overall viability—site biodiversity health rank—seemed intuitively right to the team because **Mount Grant** has been restricted from public access since the 1930s and has been managed for a high quality surface watershed. Discussion of initial viability assessments for each focal conservation target follows in order of decreasing geographic scale of the conservation targets.

Table 4. Definitions of viability ranks for sagebrush/pinyon woodlands ecological system focal conservation target, with current ranks highlighted in color.

Rank	Size (minimum dynamic area)	Condition (characteristic native vegetation)	Landscape Context (fire regime)
Very Good	All patches of pinyon woodlands and sagebrush shrublands occupy appropriate ecological sites defined by combinations of elevation, soil types, aspect, slope angle, and topography.	1) Woodland mosaic of open (<10% canopy cover), sparse (11-20% canopy cover), medium (21-35% canopy cover), and dense (>35% canopy cover) woodland patches in roughly equal amounts. 2) Multiple age classes. Clumped regeneration of trees. More than 15% cover of mature potential trees (>150 yrs old). 3) Shrubland mosaic of sagebrush-grass represents all successional phases in appropriate proportion. 4) Understory biomass (perennial grass, forbs, shrubs, and tree saplings & seedlings) near potential for normal year given soil type and canopy cover. 5) Microphytic crust intact between shrubs.	Pinyon woodland patches with fire return intervals spanning ~75-300 yrs, surrounded by sagebrush shrubland-grassland mosaics with a few dispersed trees and fire return intervals spanning ~25-75 yrs. Intact landscapes on all sides with no cheatgrass present.
Good	**Too much tree-dominated vegetation**: Sparse canopy cover on most sagebrush sites.	1) Woodland mosaic with >40% of patches in either open or dense canopy cover. 2) Multiple age classes. Clumped regeneration of trees. 3) Shrubland mosaic with greater proportion of mature stages present. 4) Understory biomass near but < potential for a normal year; less diverse. 5) Microphytic crusts present.	Woodlands surrounded by shrublands with mostly young trees (<2 m in height). Reduced herbaceous understory, but present. Cheatgrass abundance minimal on most sites. Fire return intervals longer on ~25% of sites.
Fair	**Either too much tree-dominated vegetation**: Medium canopy cover occupying ~50% of shrubland sites, or dense canopy cover occupying ~25% of shrubland sites. **Or too few trees/ shrubs**: Patches of type conversion to annual grasses.	1) Mosaic of woodland on woodland soils with >55% of patches in either open or dense canopy cover 2) Multiple age classes but smaller trees increasing in abundance. More uniform distribution of trees.. 3) Shrubland mosaic with few early stages present 4) Cover of native perennial grasses, forbs, and shrubs in trace amounts. 5) Microphytic crust is a minimal component.	Woodlands surrounded by moderate PJ expansion onto shrubland sites (young trees 50-75%). Cheatgrass present on most sites. Fire return intervals longer on ~50% of sites or too frequent on <25% of sites.
Poor	**Either too much tree-dominated vegetation**: Dense canopy cover occupying most shrubland sites. **Or too few trees/ shrubs**: Widespread type conversion to annual grasses.	1) Woodland mosaic on woodland soils with >70% of patches in either open or dense canopy cover or with <10% in either sparse or medium canopy cover. 2) Midstory filled with small trees. 3) Shrubland mosaic lacking early stages. 4) Complete loss of understory or understory of weedy annuals or perennials. 5) Microphytic crusts absent.	Woodlands completely surrounded by heavy PJ expansion (multiple age classes) onto sagebrush ecological sites. Cheatgrass significant in most understories. Fire return intervals too long on most sites or too frequent on >75% of sites.

Table 5. Viability rankings of focal conservation targets at Mount Grant.

Systems (Conservation Target) Viability	Size	Condition	Landscape Context	Overall Viability Rank
Sagebrush/Pinyon Woodlands	Good	Fair	Fair	Fair
Surface Water	Good	Good	Fair	Good
Greater Sage Grouse	Fair	Fair	Fair	Fair
Subalpine and Alpine Systems	Very Good	Very Good	Good	Very Good
Riparian Forests and Shrublands	Very Good	Good	Good	Good
Montane Meadows	Good	Good	Good	Good
Springs and Seeps	Very Good	Good	Good	Good
Lakeshore Wetlands	Good	Fair	Good	Good
Site Biodiversity Health Rank				**Good**

Sagebrush/Pinyon Woodlands

Sagebrush shrublands and pinyon-juniper woodlands currently occupy the full areal extent of potential habitat for this conservation target in the **Mount Grant** area. A very minor amount has been converted to other cover types for infrastructure (roads, Rose Creek Reservoir, and Camp Dixie). In theory, the size is very good because soils that support the system have not been appreciably modified or destroyed. In practice, size rank was downgraded to good primarily because the mix of shrublands and woodland types is less than ideal with too much tree-dominated vegetation present at the expense of sagebrush and associated perennial bunchgrasses. On steeper eastside slopes, pinyon woodlands have increased their areal extent by expanding into the shrubland component of landscape mosaic. Some sagebrush dominated areas in Cottonwood Canyon have large amounts of mature and over-mature sagebrush and no younger, vigorously growing sagebrush. The team actually may have been too conservative with this rating since the extent of woody coverage is a condition criterion, but was confused for size.

A grade of fair was estimated for condition of the shrubland/woodland mosaic because many areas have greater cover by woody species (both sagebrush and pinyon) and less cover by herbaceous bunchgrasses than expected for healthy condition communities. Greater woody cover changes both the composition and structure of the communities. Pinyon cover by mature trees is greater both on patches of woodland soils and in ecological sites that would normally support sagebrush dominated communities with a low cover of associated young pinyon. Some areas (middle Cottonwood Canyon, upper Rose Creek) have a closed pinyon canopy where understory plants have diminished cover because of competition with trees. Changes to matrix community composition and structure were corroborated by an independent site visit in June 2002 by two wildland fire ecologists, George Gruell and Jim Brown (Brown and Gruell 2002). Pinyon does not appear to be expanding into higher elevation mountain sagebrush sites, however. Tree encroachment–

the process in which a native species increases to dominate vegetation beyond the unproductive soils where they were historically found, is extensive in the Great Basin (Blackburn and Tueller 1970, Tausch and Nowak 1999, Miller and Tausch 2001). It more recently has been identified as a concern at **Mount Grant**.

In addition, lower elevation big sagebrush shrublands have been invaded by cheatgrass where past disturbance occurred, for example, in areas close to roads and where historic grazing concentrated. One area at about 5,800 feet elevation in Cottonwood Canyon has high (~60 %) cheatgrass cover where an historic goat herd was based and a burn occurred in the late 1980s. Once introduced, cheatgrass competes with native bunchgrasses and other herbaceous plants effectively reducing vigor of the native understory component of the communities (Melgoza *et al.* 1990). When cheatgrass is present in sagebrush shrublands, it readily increases in abundance with any disturbance.

A fair rank was given for landscape context of these matrix ecological systems because the natural fire regime within sagebrush/pinyon woodlands has been altered by historic fire suppression. As a result, infrequent, low intensity fires no longer occur under current HWAD fire suppression management (Tetra Tech 1998). For example, a recent burn (caused by military training) in low sagebrush on upper slopes at about 9,200 feet elevation was suppressed even though it likely would have burned with fairly normal low intensity and spread in a lobe-like pattern.

Ecological sites that support pinyon woodlands have low productivity soils with fairly low cover of grasses. They do not have sufficient cover of fine fuels (grasses) to carry fire, so fires in surrounding sagebrush communities generally would self-extinguish when they reached "historic" pinyon woodland patches. Crown fires were unlikely because woodlands were open typically with less than 30% canopy cover. Accordingly, pinyon (and juniper) could grow old (120-600 years) unless struck by lightning (West *et al.* 1998, Miller *et al.* 1999, Tausch 1999a). On a recent field visit, Gruell and Brown (2002) noted considerable mortality of pinyon pine apparently from drought and bark beetle infestation. These create highly flammable fuel conditions, and when exacerbated by dense crowns in close contact with accumulated litter on the ground in surrounding tree-encroached shrubland ecological sites, they would support high intensity stand replacement fire (Brown and Gruell 2002).

Surface Water

The size of the surface water system is currently considered good by the team. It includes five creek drainages (Cottonwood, Squaw, Rose, House, and Cat creeks) which flow to the east side. According to HWAD's INRMP, the watershed generates about 14,700 acre-feet of surface water annually (Tetra Tech 1998). Since 1994, when surface flows exceed water storage capacity in any given year, HWAD discharges to Walker Lake (up to about 3 acre-feet per day) to mitigate the loss of surface runoff to the lake. Two creeks in the watershed are not part of the surface water system—Lapon Creek, which flows west away from HWAD property, and east flowing Dutch Creek with privately owned water rights. The size rank was slightly downgraded because of the potential to add water from unused creeks should the situation change.

Quality of the surface water at **Mount Grant** typically is excellent. It is the only known surface water source in the region that is not contaminated by *Giardia lamblia* and it generally has acceptable total dissolved solids for potable water. Chlorinating is the only treatment given before the water is distributed for consumption. However, for the last several years, spring coliform counts have been higher than acceptable for potable water. It is unclear whether this indicates a trend in poorer quality water as a result of recent increases in human or animal use or simply anomalies attributable to early season runoff periods or decadal climate patterns. The team ranked condition as good. The Army's contractor, DZHC, monitors water quality and suggested that condition might need to be downgraded to fair if coliform levels continue to be high in the months ahead.

Landscape context of the surface water resource was ranked fair. The condition and ecological processes of the major upland terrestrial systems (sagebrush shrublands and pinyon woodland communities) that contribute to proper functioning of the watershed, including recharge, are compromised by an altered fire regime that may be outside the historic and natural range of variability. Canopy densities are high and woody materials have accumulated creating a more continuous fuel within the montane zone. The increased tree cover transpires more water than shrubland systems and likely impacts watershed recharge (Miller and Wigand 1994). Additionally, watershed quality is at risk because of a greater likelihood of a catastrophic crown fire occurring in uplands. It is unknown whether the denser canopy is because normal fire frequencies have reduced significantly from fire suppression or if the area is just naturally at a more extreme point within the vegetation-fire spectrum. However, the current situation could lead to a very intense and extensive fire causing slope instability and soil erosion that would negatively impact water quality of the surface water resource. This risk would be greatest if large catastrophic fire and flooding events occurred across multiple drainages. Because viability is assessed for long term (about 100 years) duration, risk of catastrophic crown fire during that period decreases the landscape context rank.

Greater Sage Grouse

Greater Sage Grouse, the only species-level focal conservation target, received fair viability rankings across each of the three factors summing to an overall initial fair viability assessment. Size was conservatively assessed as fair because there is some uncertainty in observational data. Over the region, declines in sage grouse population since the 1950s have been recorded (Neel 2001). The birds are not that commonly seen by frequent observers at **Mount Grant** and their numbers appear to be declining compared to historic observations (HWAD and DZHC personnel). NDOW has lek and brood count data, but it is spatially and temporally spotty (NDOW 1961-2001). They also have observations from 1993 and 2001 aerial surveys. One of the data sources that NDOW uses for population estimates is hunter's wing counts, but hunts have been limited here and have not occurred for the last three years because of concern for grouse numbers, which means that culled data are not current. Nevertheless, NDOW estimates that bird numbers are stable at **Mount Grant**. Separate observations by Great Basin Bird Observatory and Nevada breeding bird surveys suggested a population size estimate of fair in light of the abundance of high quality appearing sagebrush habitats present.

A grade of fair condition for Greater Sage Grouse habitat was estimated because sagebrush communities have become lignified (woodier). The balance between extent of sagebrush shrublands and pinyon woodlands is tipped to what is believed to be a far end of the spectrum with greater extent and cover by woody species. As canopy cover of pinyon pine has increased in sagebrush areas, such as along Cottonwood Creek's middle sections, sagebrush communities have declined in cover and species richness. In some sagebrush dominated areas, sagebrush cover has increased to the detriment of herbaceous and grass cover. Although cheatgrass is not a major problem at **Mount Grant**, there are a few areas where cheatgrass has been introduced and taken hold because of past disturbance. These areas include lower Cottonwood Canyon where a small (suppressed) fire occurred in the 1980s. Thus, both compositional and structural degradation of Greater Sage Grouse habitat led to the fair rank.

A fair landscape context was given because the natural fire regime in Greater Sage Grouse habitat has been altered by fire suppression over time. As discussed for the sagebrush/pinyon woodlands ecological system, infrequent low intensity fires that normally occurred in this landscape no longer occur under current HWAD management. It is unknown whether the birds have connected access to all habitats needed to complete their life cycle, although the team assumed so. Sage grouse experts believe that a broader corridor of sagebrush shrublands connecting higher elevation habitats at **Mount Grant** with lower elevation habitats in the Ninemile Flat area would benefit the birds (Mount Grant PMU 2002). Currently, a broad band of pinyon woodland vegetation occurs between Ninemile Flat and Mount Grant. Finally, although it is unclear to what degree predators are placing undue pressure on Greater Sage Grouse individuals, HWAD staff expressed concern for possible excessive predation. However, excessive numbers of predators have not been documented and an increase in numbers of perches for predators has not occurred at **Mount Grant**.

Subalpine and Alpine Systems

The subalpine and alpine systems were ranked with the highest—very good— overall viability. The current size of these systems are very good because they occupy essentially all of the potential extent for subalpine and alpine coverage. The team noted that the limited extent of subalpine and alpine habitat has the potential to be further reduced if mountain sagebrush or other montane vegetation types extended up in elevation as a result of global climate change.

The mountain top is in very good condition, excepting minor habitat disturbance from a few dirt roads and historic antennae structures on the summit. The composition and structure of these communities are intact and free of non-natives. Both conifers (whitebark and limber pine) and alpine plants are reproducing and with all age classes present. The landscape context was ranked as good only because fires have been suppressed historically at **Mount Grant** such that natural processes in the subalpine woodlands may have been modified somewhat. However, since subalpine conifers grow slowly, the woodlands appear to have not changed their structure significantly as a result of fire suppression.

Riparian Forests and Shrublands

Size of riparian was ranked very good because current management for surface water recharge has allowed them to remain at their potential extent. The width of riparian communities has not diminished. We did not evaluate the riparian system below diversions.

The riparian areas above points of diversions are in good condition because much of it has a native composition with good structure, including multiple canopy layers (Cottonwood Canyon near Sorhouet Spring is a good example). Only occasionally are exotics found in the riparian and they tend to occur in the lower reaches of the drainages. Roads along and across the riparian corridors are vectors for exotic plant dispersal, and in one known case in Cottonwood Canyon vehicles probably introduced hoary cress (whitetop) to the riparian system—however, management quickly treated the infestation. Occasionally, trespass cattle occur on Mount Grant via openings in the western boundary allotment fence line. When present on the east side of the fence, they tend to graze montane meadows and higher riparian corridors. Grazing is both spatially and temporally restricted though. In 2000, the riparian corridor in Cottonwood Canyon appeared heavily used by black bear based on scat observations within willow stands. But, it is unknown whether riparian use was excessive (diggings within the riparian indicated that willow roots, grubs, or small animals were being sought). HWAD personnel have noted increased bear use in recent years.

A good landscape context grade was given since there are roads that sometimes parallel or cross riparian drainages. The presence of roads impact hydrologic functioning of the riparian system to some degree but interference appears low at **Mount Grant**. Natural flooding events have occurred in the eastside drainages recently so this natural disturbance process appears intact and not compromised by the smaller-scale water developments.

Rodent diversity is high at **Mount Grant** in comparison to about 200 sites in the Walker River Basin. The reason for this is uncertain, but may be at least partially a result of the lack of livestock grazing. House Creek is notable for its unusually diverse array of rodents for Nevada. Nighttime small mammal trapping in 1996 caught nine species of rodents within 300 meters of the drainage. In addition, several ground squirrels, chipmunks, and antelope ground squirrels were observed during daylight hours (Boone *et al*. 1998).

Montane Meadows

There are few montane meadows at **Mount Grant**, and the majority of those present are at their full potential size. However, Lapon Meadows have been altered and somewhat reduced in extent by historic dredging and current water management. We gave an average overall good ranking.

Montane meadows are in good condition overall, including Lapon Meadows. Lapon Meadows were historically dredged for placer mining prior to Navy acquisition. Ponds were created along the drainage to control headcut damage to Lapon Creek. Today, the ponds are stock watering reservoirs for the Flying M Ranch cattle operation on the adjacent BLM allotment west of the west-most fence. The east side fence at Lapon Meadows lies further east than the Army boundary so the Lapon Meadows exclosure and ponds are on Army

property. On occasion, the exclosure is used by the Flying M to gather livestock from the Lucky Boy allotment at the end of a grazing season. The other meadows on Army lands in Cottonwood and Cat canyons are not in grazing allotments, although some are subject to trampling and herbivory on occasion by trespass cattle (Upper Cat Creek meadow) and by what appears to be increasing black bear use in stringer meadow areas of Cottonwood Creek. It is uncertain whether the black bear use is unnaturally high and increasing. Upper Cat Creek meadow vegetation may be reaching mat densities that could restrict Greater Sage Grouse chick movement (Mount Grant PMU 2002). Sagebrush is establishing along margins and is moving in to the meadow, which may be a result of fire suppression management. A field visit by the Mount Grant PMU Governor's Sage Grouse team concluded that Lapon Meadows appeared healthier than Upper Cat Creek meadow because of occasional grazing (Mount Grant PMU 2002).

Condition of montane meadows, as well as riparian corridors, on Mount Grant perhaps should be held to a higher standard because the area is promoted as a baseline reference to land managers for comparison with areas receiving different management (mainly livestock grazing). In the Great Basin and in Nevada, it is very rare for a large relatively intact landscape, such as **Mount Grant**, to have been excluded from livestock grazing for over seventy years.

Ecological processes in the montane meadows were ranked good overall. However, as noted above, Lapon Meadows has had its hydrology altered from a flowing system to an intermittently ponded and flowing system. It is unclear if the situation causing headcutting in this meadow has stabilized and whether removal of the water ponds would restore the flowing springbrook without jeopardizing soil stability. Also, lack of fire or other periodic disturbance may be missing from meadows on HWAD.

Springs and Seeps

Size of springs and seeps was ranked very good because current management for surface water recharge has allowed them to remain at their potential, albeit limited, size.

Most of **Mount Grant's** springs are in very good condition. The highest spring and springbrook on the mountain is slightly impacted by the main road to the summit and a pipe that captures water, but does not divert it from the drainage. Sorhouet Spring is slightly impacted by the main road in Cottonwood Canyon as well. The source spring at the head of Lapon Meadows is in fair to good condition because of historic livestock use and infrequent current use by livestock. Thus, an average rating of good was given.

Springs generally are in very good landscape context. However, the headwater spring and springbrook for Lapon Meadows has had its hydrology altered from past dredging and grazing so it is in fair condition. There are four water ponds located along the upper springbrook that were put in place to stop headcutting that started from an historic mining operation, and possibly as a result of historic grazing levels. The ponds have changed the creek hydrology from a flowing system to a ponded system with some flow between ponds. As a consequence, the rating was averaged to good.

Lakeshore Wetlands

The lakeshore wetlands are fairly small patch natural communities occurring along the interface between land and water. At least some of them are spring-fed and limited in extent by high water tables. It is unclear whether some have been reduced as a result of historic lake level modifications and eastside stream diversions. A conservative estimate of good for size of wetlands was made.

A ranking of fair condition was estimated because the composition and structure of lakeside wetlands are altered by the presence of several exotic plant species. There are bull thistle, tamarisk (salt cedar), and Russian olive present that have changed composition and added woody species to the otherwise herbaceous emergent wetlands vegetation.

A landscape context ranking of good was given because the wetlands have spatial connectivity to the lake and ground water table at this time. They are hydrologically fed by springs and it is uncertain whether the dominant processes driving wetland vegetation have been altered.

Because conservation targets ranked differently in their initial overall viability at **Mount Grant**, the assessment team was able to consider a relative priority order for addressing threats to those systems. In doing this, the team could focus on the conservation targets where taking actions would most effectively increase viability of the ecological systems and abate threats. Sagebrush/pinyon woodlands and Greater Sage Grouse are currently the highest priorities since they were assessed with the lowest (fair) overall viability. Surface water, lakeshore wetlands, montane meadows, riparian forests and shrublands, and springs and seeps are at medium levels of priority for taking action—they were each assessed with good overall viability with some aspects of viability improvement needed. Subalpine and alpine systems are low priority, since they were assessed with very good overall viability.

THREATS TO CONSERVATION TARGETS

GREAT BASIN CONTEXT

The late 1800s brought a series of ecological changes to the Great Basin that caused significant and widespread changes in ecosystem patterns and processes (Tausch 1999b). These changes included: 1) a reduction in fire frequencies; 2) heavy livestock grazing; 3) introductions of competitive exotic plant species; and, 4) increased atmospheric CO_2 levels, at a time experiencing climate changes at the end of the Little Ice Age. Interactions among these factors and possibly other ecological processes have changed the way Great Basin matrix communities—woodlands, in particular—respond to disturbance because ecological thresholds (significant changes in composition or community function) have been crossed. Over the last 150 years, woodlands have responded with an extraordinary increase in areal extent and density of pinyon and juniper trees. Much of the area once covered by sagebrush steppe, sagebrush semidesert, and desert grasslands, has been invaded by these trees.

Additionally, the complexity of Great Basin landscapes has declined overall—Great Basin shrublands and woodlands are more uniform, homogenous, and simplified now than at any other time during the Holocene (the last 11,000 years). When ecological thresholds are crossed in more homogenous vegetation, biotic responses are less spatially confined (Tausch 1999b). As more intense disturbances, more frequent disturbances, or new types of disturbances occur, Great Basin landscapes will continue to respond in new and different ways. This sets the stage for widespread changes in ecosystem structure and function that are likely to be much more difficult to successfully manage for biodiversity and ecosystem integrity.

Mount Grant Land Use History and Current Situation:

Military activities, including testing and training operations, have been fairly minor at **Mount Grant**—the bulk of military activities are restricted to active military zones at lower elevations where ammunition is stored or detonated. Historic activity occurred at Camp Dixie located at moderate elevations in Cottonwood Canyon. Recent, minor levels of special forces military training at higher elevations on Mount Grant have occurred and have the potential to increase in frequency and impact in the future as the military mission expands at HWAD.

Nevada's sagebrush ranges, including **Mount Grant**, received heavy, year-round, grazing pressure from cattle and sheep during the late nineteenth and early twentieth centuries (West 1983). The U.S. Naval Ammunitions Depot was constructed at Hawthorne shortly before the Taylor Grazing Act of 1934, which began an era of public land grazing management. In the early 1930s, the Department of Navy developed the primary drinking water system and put an end to grazing on Mount Grant. Past abuses heal at very slow rates in sagebrush ecological systems and simple removal of livestock does not result in dramatic change (Rice and Westoby 1978). The sagebrush plant communities on Mount Grant were altered by historic grazing and continue to change in response to historic and present environmental conditions. However, seventy years of grazing rest at **Mount Grant** has permitted recovery of matrix and riparian systems to a relatively very good condition. Today, only occasional trespass cattle from adjacent public lands break through the western boundary fence and have a slight trampling and grazing impact on the montane meadows and riparian systems.

Several exotic plant species have been introduced to the ecological systems at **Mount Grant**, but most of them pose few management challenges. Cheatgrass is present in limited areas and abundance where past disturbance and recent fires have provided opportunities for spreading. It is most notable at moderate elevations in Cottonwood Canyon and is the greatest landscape-scale challenge because of its aggressive response to fire. Salt cedar (*Tamarix ramosissima*) was present along eastside drainages, such as Cottonwood Creek and Rose Creek, but HWAD initiated an effective eradication effort west of Highway 95 in the 1990s, and eliminated it from the mountain. It persists in low elevations east of the highway. Local scale exotic species include African rue (*Peganum harmala*) in the vicinity of HWAD administrative and housing areas, tree of heaven (*Ailanthus altissima*) at lower Rose Creek, bull thistle (*Cirsium vulgare*) in the freshwater marshes on the shores of Walker Lake, and

hoary cress or whitetop (*Cardaria draba*) along the middle portion of Cottonwood Creek road (Nachlinger 2001).

There is limited recreational use of Mount Grant by both military and the public. Activities including camping, hiking, fishing, and hunting occur at Rose Creek Reservoir, Camp Dixie, and at higher elevations on Mount Grant. Public access was allowed under minor security regulations, but has been fully restricted since September 11, 2001.

Mount Grant Fire Regime:

There have been no studies specifically conducted at **Mount Grant** to understand the fire history and fire regime of the immediate area. We have pulled information from studies in similar ecological systems of the western Great Basin, but these studies typically are in systems that continue to receive livestock grazing use unlike **Mount Grant**.

Sagebrush steppe and sagebrush semi-desert vegetation types have a long-lived perennial grass component when in healthy condition. With periodic fire, a native perennial grass-dominated community prevails. Most species of sagebrush must re-establish from seed after fire, so grasses and herbs have an initial advantage over sagebrush. But in the absence of fire, a mix of sagebrush and long-lived grasses predominate. Eventually, grasses lose vigor with increasing sagebrush establishment, growth, and competition. With longer absence of fire, woody trees—specifically, single-leaf pinyon pine and Utah juniper, in the western Great Basin—establish at elevations moist enough for trees, and eventually predominate by successfully competing with sagebrush and bunchgrasses (Everett and Koniak 1981, Nowak *et al*. 1994, Tausch and Nowak 1999).

Trees eventually form a dense woodland, and because trees transpire greater amounts of water than shrubs this results in reduced available soil moisture. Diminished ground cover promotes soil instability and erosion, leading to increased opportunities for invasion by exotic species. Annual non-native grasses—cheatgrass in particular—are pervasive, and they have a competitive advantage with an early growth strategy when soil moisture is greater. Both sagebrush shrublands and pinyon-juniper woodlands lose viability as they lose perennial grass cover and increase cheatgrass cover. Annual grasses create dense fine fuels that readily burn and lead to more frequent and intense fires that preclude shrub establishment. Both physical and biotic thresholds are crossed that lead to these visible changes in ecosystem patterns (Miller and Tausch 2001, Young and Budy 1979).

Even when grazing is no longer present, as is the case at **Mount Grant**, past grazing plays a role in current vegetation conditions within the assessment area because woody growth had a competitive advantage over perennial grasses in the early 20th century. Fire suppression and poor historic grazing practices in the western Great Basin have resulted in expansion of pinyon and juniper woodlands into sagebrush steppe and sagebrush-semidesert ecological sites. It has resulted in greater tree densities, thus greater fuel loads, within pinyon and juniper woodland ecological sites as well.

Thus, woodland expansion and increased tree densities generally have resulted in: 1) reduced extent of sagebrush ecological systems; 2) a loss of biodiversity; 3) a loss of perennial ground cover and plant community structure; 4) increased soil instability and erosion; 5) exotic plant species invasions; 6) alterations in upland hydrologic regimes that diminish aquatic resources; and, 7) increased canopy fuels that increase the risk of catastrophic crown fires. Expanding pinyon and juniper woodlands at **Mount Grant** are a threat to both sagebrush shrublands and remnant old growth pinyon-juniper woodlands because woodland canopies become a dense, continuous fuel matrix. Old growth pinyon-juniper woodlands with historically sparse understories were fire-safe areas defined by topography and soil characteristics, and surrounded by sagebrush or montane shrublands. Fires that are ignited in dense, expanding woodlands will be larger in scale, with greater intensity, or more frequent intervals, which could eliminate old growth woodlands altogether.

STRESSES AND SOURCES OF STRESS

For each focal conservation target, the team evaluated known threats information and determined what stresses and sources of stress are present in the assessment area that have the potential to decrease focal target viability within the next ten years. For each stress, the team made an initial assessment of the severity of damage and its scope on the system target. Similarly, we determined sources for each stress and made an assessment of their relative contribution and irreversibility. Definitions of these terms follow.

For stresses, the **severity of damage** refers to the level of damage to the system that reasonably can be expected within ten years under current circumstances over some portion of the conservation target's occurrence at the site. The **scope of damage** refers to the geographic scope of impact on the system at the site that reasonably can be expected within ten years under current circumstances and given continuation of the existing situation.

For sources of stress, **contribution** refers to the expected contribution of the source, acting alone, to the full expression of a stress under current circumstances and given continuation of the existing management situation. **Irreversibility** refers to the degree of reversibility of the stress caused by the source of stress. Four values ranging from very high to low were used for each factor. Table 6 provides summary definitions of rankings for these four factors.

Table 6. Summary definitions of severity and scope of damage rankings for stresses, and contribution and irreversibility for sources of stress.

	Stresses		Sources	
	Severity of Damage	Scope of Damage	Contribution to the Stress	Irreversibility of the Stress
Very High	Likely to destroy or eliminate target within ten years	Likely to be very widespread or pervasive within ten years	Very Large	Not reversible

High	Likely to seriously degrade target within ten years	Likely to be widespread within ten years	Large	Reversible, but not practically affordable
Medium	Likely to moderately degrade target within ten years	Likely to be localized within ten years	Moderate	Reversible with a reasonable commitment of additional resources
Low	Likely to only slightly impair target within ten years	Likely to be very localized and affect a limited portion within ten years	Low	Easily reversible at relatively low cost

By ranking the relative severity and scope of damage for stresses, and contribution and irreversibility for sources of stress we were able to identify the most critical threats that require action to improve or at least maintain viability of the ecological systems and species at **Mount Grant**.

Sagebrush/Pinyon Woodlands

Two highly ranked stresses, altered fire regimes and altered composition/structure of vegetation, were identified for the sagebrush/pinyon woodlands ecological system (table 7). The mosaic of sagebrush shrublands and pinyon woodlands has been altered by increased cover of woody species throughout the system and cheatgrass invasion at lower elevations.

Table 7. Stresses and stress rank based on severity and scope of damage for sagebrush/ pinyon woodlands at Mount Grant.

Stresses	Severity	Scope	Stress Rank
Alteration of natural fire regimes	High	High	High
Altered composition/structure	Very High	High	High

Three sources of stress were identified for altered fire regime and composition/ structure of sagebrush/pinyon woodlands (table 8). Fire suppression and the future risk of catastrophic fire ranked high for both. Decades of fire suppression provided an opportunity for pinyon and sagebrush to increase in density and for an increase in overall fuels as pinyon encroaches into sagebrush systems. The increase in woody material could lead to larger and hotter fires than would occur normally in more open vegetation. The risk of catastrophic crown fire is great in some areas because of the present areal extent and density of pinyon pine and because steep eastside slopes have the potential to spread fire uphill. It is dangerous to fight pinyon crown fires and it is expensive to rehabilitate the system after fire. Understory species of grasses and herbs have probably decreased in cover as a result of more dense overstory layers.

Table 8. Sources of stress and source rank based on contribution and irreversibility for each identified stress in sagebrush/pinyon woodlands at Mount Grant.

Sources of Stress		Alteration of natural fire regimes		Altered composition/ structure	
		High		*High*	
Fire suppression/catastrophic fire	Contribution	Very High	High	Very High	High
	Irreversibility	High		High	
	Source	Very High		Very High	
Invasive/noxious species	Contribution	Medium	Medium	High	High
	Irreversibility	High		High	
	Source	Medium		High	
Grazing practices (historic source)	Contribution	Low	Medium	High	Medium
	Irreversibility	High		Low	
	Source	Medium		Medium	

Figure 23. Dense pinyon cover has altered both composition and structure within sagebrush/pinyon woodlands, which poses a fire threat to sagebrush communities and old growth pinyon woodlands at Mount Grant.
Photo: Jan Nachlinger

Invasive species were identified as a high source of stress for altered composition/ structure and a medium source for altered fire regimes. Cheatgrass is present in previously disturbed areas, but many areas are free of the annual grass. It changes composition by successfully depleting soil moisture and effectively competing with native grasses (Melgoza *et al.* 1990). With cheatgrass seed present in the system, it will move into other areas when

disturbed by fire or management practices. Cheatgrass decreases the fire return interval eventually to a frequency that native shrubs and grasses cannot tolerate (Miller and Tausch 2001).

Historic grazing practices were identified as a medium source of stress for both altered fire regime and composition/structure of sagebrush/pinyon woodlands. Past grazing was noted because of the long term impact on perennial grass composition and the role it may have played in initially introducing cheatgrass to the system.

Surface Water

Three stresses with high, medium and low ranks, were identified for the surface water system (table 9). The potential for catastrophic sedimentation (post fire) was ranked high, while less extreme levels of sedimentation (storm events) were separated out and ranked medium. Because HWAD relies on surface water for base operations, a catastrophic sedimentation event would temporarily shut down the water system. The assessment team only identified stresses to water quality and did not identify any stresses to water quantity at **Mount Grant**.

Table 9. Stresses and stress rank based on severity and scope of damage for surface water at Mount Grant.

Stresses	Severity	Scope	Stress Rank
Catastrophic sedimentation event	Very High	High	High
Sedimentation	Medium	Medium	Medium
Nutrient loading	High	Low	Low

Although five sources of stress were identified, only two were ranked high and medium for a catastrophic sedimentation event (table 10). Fire suppression and the future risk of a flash flood event were discussed by the team. The legacy of fire suppression increases the potential for vast and catastrophic crown fires, especially in the steep eastside canyons, that could result in massive runoff, erosion, and sedimentation problems. Nutrient loading is a water quality concern, however, source contributions and irreversibility by humans and trespass livestock are low—they can be easily managed.

Table 10. Sources of stress and source rank based on contribution and irreversibility for each identified stress for surface water at Mount Grant.

Sources of Stress		Catastrophic sedimentation event		Sedimentation		Nutrient loading	
		High		*Medium*		*Low*	
Fire suppression/ catastrophic fire	Contribution	Very High	High				
	Irreversibility	Very High					
	Source	Very High					

Road maintenance and use	Contribution			High	Low		
	Irreversibility			Low			
	Source			Medium			
Flash flood event	Contribution	High	Medium	High	Low		
	Irreversibility	Medium		Low			
	Source	Medium		Medium			
Human/ military training use	Contribution					Low	-
	Irreversibility					Low	
	Source					Low	
Livestock trespassing	Contribution					Low	-
	Irreversibility					Low	
	Source					Low	

Greater Sage Grouse

One highly ranked stress and four medium ranked stresses were identified for the Greater Sage Grouse focal species target (table 11). Altered habitat composition/structure scored high, while habitat disturbance, behavioral modification, extraordinary predation, and excessive herbivory were the medium ranked stresses. The mosaic of sagebrush shrublands, pinyon woodlands, and riparian meadows that provide habitat for Sage Grouse has been altered by increased cover of woody species throughout the landscape. Cheatgrass was identified as a factor involved in the altered composition of the bird's habitat only at lower elevations because it has yet to get a foothold in higher elevation habitats.

Table 11. Stresses and stress rank based on severity and scope of damage for Greater Sage Grouse at Mount Grant.

Stresses	Severity	Scope	Stress Rank
Altered habitat composition/structure	Very High	High	High
Habitat disturbance	High	Medium	Medium
Bird behavioral modifications	Medium	High	Medium
Extraordinary predation/parasitism/disease	Medium	High	Medium
Excessive herbivory	Medium	Medium	Medium

Eight sources of stress for Greater Sage Grouse were identified although only half of them translated to high or medium ranked threats for two of the five stresses (table 12). Because the sagebrush shrublands/pinyon woodlands matrix ecological system comprises the main habitat for Sage Grouse, fire suppression and risk of catastrophic fire were ranked high for altered habitat composition/structure as they were for the matrix system itself. Earlier discussion of threats to the sagebrush/pinyon woodlands system (Sage Grouse habitat) apply and are not repeated here. It is important to note that habitat fragmentation, a high ranking threat identified for the Greater Sage Grouse in general, was not identified for **Mount Grant**. Although a few roads occur at higher elevations on **Mount Grant**, habitat fragmentation is not a current issue. If military activities increased on the mountain in the future, it may become an issue for condition of the bird's habitat.

Three medium ranking sources for the high ranking altered habitat stress included invasive species, and past and present grazing. Permitted grazing occurs sporadically in Lapon Meadows when livestock are gathered and held within existing fences for short periods before being moved down canyon at the end of permitted use. This activity likely impacts Sage Grouse meadow habitat directly and possibly causes competition for vegetative resources indirectly. However, the Lucky Boy allotment, which is permitted from June 1 to October 15, is on a rest rotation schedule with complete rest on a three year cycle. Past and present grazing also was identified as a high source of excessive herbivory in (meadow and riparian) habitat, but this possibly double-counts impacts to altered habitat composition/structure. Several low or medium sources were identified for medium stresses, which drops them down to low ranked threats. There is little evidence of increased predation by ravens at **Mount Grant** and there are no additional perching opportunities. The recently increased number of bear observations might indicate a new source of nest and chick predation, however.

Table 12. Sources of stress and source rank based on contribution and irreversibility for each identified stress for Greater Sage Grouse at Mount Grant.

Sources of Stress		Altered habitat composition/ structure		Excessive herbivory		Habitat disturbance		Bird behavioral modifications		Extraordinary predation/ parasitism/ disease	
		High		*Medium*		*Medium*		*Medium*		*Medium*	
Fire suppression/ catastrophic fire	Contribution	Very High	High								
	Irreversibility	Medium									
	Source	High									
Invasive/noxious species	Contribution	Medium	Medium								
	Irreversibility	Medium									
	Source	Medium									
Grazing practices (historical)	Contribution	High	Medium	Very High	Medium						
	Irreversibility	Low		Low							
	Source	Medium		High							
Grazing practices	Contribution	High	Medium	Very High	Medium	High	Low	Medium	Low		
	Irreversibility	Low		Low		Low		Low			
	Source	Medium		High		Medium		Low			
Road maintenance and use	Contribution					Medium	Low	Medium	Low		
	Irreversibility					Low		Medium			
	Source					Low		Medium			
Human/military training use	Contribution					Low	Low	Medium	Low		
	Irreversibility					Low		Medium			
	Source					Low		Medium			
Increase in predators (ravens?)	Contribution									Medium	Low
	Irreversibility									Medium	
	Source									Medium	
Permitted hunting	Contribution									Medium	Low
	Irreversibility									Medium	
	Source									Medium	

Subalpine and Alpine Systems

Past and present stresses to the highest elevations at **Mount Grant** are low. However, because the subalpine and alpine systems are so restricted in distribution and disconnected from similar habitats, the team rated the potential stress of habitat loss from climate change as high (tables 13 and 14). Recent evidence of abrupt climate change indicates that it could impact this conservation target within a ten year timeframe (National Research Council 2002). There is no connectivity to similar habitats for alpine plants or pikas to move into if increasing temperatures or precipitation changes allow lower elevation mountain shrub communities to establish at higher elevations.

Table 13. Stresses and stress rank based on severity and scope of damage for subalpine and alpine systems at Mount Grant.

Stresses	Severity	Scope	Stress Rank
Habitat destruction or conversion	High	High	High
Habitat disturbance	Low	Low	Low

Table 14. Sources of stress and source rank based on contribution and irreversibility for each identified stress in subalpine and alpine systems at Mount Grant.

Sources of Stress		Habitat destruction or conversion		Habitat disturbance	
		High		*Low*	
Road maintenance and use	Contribution	Low	Low	Very High	Low
	Irreversibility	Medium		Medium	
	Source	Low		High	
Potential communications antennae, ground-based snow generators	Contribution	Low	Low	Medium	-
	Irreversibility	Medium		Low	
	Source	Low		Low	
Climate change	Contribution	Very High	High		
	Irreversibility	Very High			
	Source	Very High			

Riparian Forests and Shrublands

Four stresses were identified for riparian areas. Habitat disturbance was the highest ranked stress for riparian forests and shrublands, but it was ranked at medium level, all others were ranked low (table 15).

The team used the override feature in the workbook to change the stress rank for altered hydrology to medium because of impacts to riparian areas at and just above the surface water system's impoundments, catchment basins, and points of diversion into pipes. The greatest threat (medium ranked) was historical development of the diversion system

(table 16). All other sources of stress identified were low or medium, leading to low ranking threats.

Table 15. Stresses and stress rank based on severity and scope of damage for riparian forests and shrublands at Mount Grant.

Stresses	Severity	Scope	Stress Rank
Habitat disturbance	Medium	Medium	Medium
Altered hydrology	High	Low	Low
Altered composition/structure	Low	Medium	Low
Habitat destruction or conversion	Low	Low	Low

Table 16. Sources of stress and source rank based on contribution and irreversibility for each identified stress in riparian forests and shrublands at Mount Grant.

Sources of Stress		Habitat disturbance		Altered hydrology		Altered habitat composition/ structure		Habitat destruction or conversion	
		Medium		*Medium*		*Low*		*Low*	
Operation of drainage or diversion systems	Contribution	Medium	Low	Medium	Low				
	Irreversibility	Medium		Medium					
	Source	Medium		Medium					
Road maintenance and use	Contribution	Medium	Low	Medium	Low				
	Irreversibility	Low		High					
	Source	Low		Medium					
Invasive/noxious species	Contribution	High	Low			High	Low		
	Irreversibility	Medium				Medium			
	Source	Medium				Medium			
Development of diversion system and roads (historical)	Contribution			High	Medium			Medium	Low
	Irreversibility			High				Medium	
	Source			High				Medium	
Inappropriate wildlife use (relocated bears)	Contribution	High	Low						
	Irreversibility	Low							
	Source	Medium							
Livestock trespassing	Contribution	Low	Low			Medium	-		
	Irreversibility	Low				Low			
	Source	Low				Low			
Recreational use	Contribution	Low	Low						
	Irreversibility	Low							
	Source	Low							

Montane Meadows

Water flow modification, habitat disturbance, and altered composition/structure all were identified as medium ranked stresses to montane meadow systems (table 17). Lapon Meadows was disturbed by historic pond dredging which was done to prevent headcut damage to the meadow system. Headcutting on Lapon Creek was caused by historic placer mining. Similarly, North Fork Cat Creek headwater meadow has rock gabions placed to halt historic headcutting, and these structures have modified water flow patterns. It is unknown if headcutting was exacerbated by historic grazing practices. Montane meadows are somewhat altered in their composition and structure. There are a few exotics present, including cheatgrass.

Table 17. Stresses and stress rank based on severity and scope of damage for montane meadows at Mount Grant.

Stresses	Severity	Scope	Stress Rank
Modification of water levels; changes in natural flow patterns	High	Medium	Medium
Habitat disturbance	Medium	Medium	Medium
Altered composition/structure	Medium	Medium	Medium

Historic construction of the ponds and gabions was the only high ranked source of stress leading to a medium threat for this system. Three other sources of stress were all ranked low or medium (table 18).

Table 18. Sources of stress and source rank based on contribution and irreversibility for each identified stress in montane meadows at Mount Grant.

Sources of Stress		Modification of water levels		Habitat disturbance		Altered composition/ structure	
		Medium		*Medium*		*Medium*	
Construction of ditches, dikes, drainage or diversion systems (historical source)	Contribution	Very High	Medium	Medium	Low		
	Irreversibility	Medium		Medium			
	Source	High		Medium			
Livestock trespassing	Contribution			Medium	Low	High	Low
	Irreversibility			Low		Low	
	Source			Low		Medium	
Grazing practices	Contribution			Medium	Low	Medium	Low
	Irreversibility			Low		Low	
	Source			Low		Low	
Fire suppression/ catastrophic fire	Contribution					High	Low
	Irreversibility					Low	
	Source					Medium	

Since there is no permitted grazing of the montane meadows and fires currently are suppressed on the mountain, meadow vegetation may build up abundant litter from season to season, which alters meadow structure. This potentially has a negative impact on use by Greater Sage Grouse chicks and juveniles. Given the importance of meadows to Sage Grouse, the team may have under-ranked either the altered composition/structure stress or its several sources of stress.

Figure 24. Occasional trespass cattle, as seen here at headwater meadow of Cat Canyon, were identified as a low threat to montane meadows as well as to the surface water resource because they can be readily managed.
Photo: Jan Nachlinger

Springs and Seeps

Modified spring flow patterns was a high stress identified for spring systems because of impacts to Sorhouet Spring, Lapon Meadows spring source, and the summit road spring source (tables 19 and 20).

Table 19. Stresses and stress rank based on severity and scope of damage for springs and seeps at Mount Grant.

Stresses	Severity	Scope	Stress Rank
Modification of water levels; changes in natural flow patterns	High	High	High
Habitat disturbance	Medium	Low	Low

Table 20. Sources of stress and source rank based on contribution and irreversibility for each identified stress in springs and seeps at Mount Grant.

Sources of Stress		Modification of water levels		Habitat disturbance	
		High		*Low*	
Construction of ditches, dikes, drainage or diversion systems (historical source)	Contribution	Very High	High	Medium	Low
	Irreversibility	Medium		Medium	
	Source	High		Medium	
Grazing practices	Contribution			High	Low
	Irreversibility			Low	
	Source			Medium	
Road maintenance and use	Contribution			Medium	Low
	Irreversibility			Medium	
	Source			Medium	

Lakeshore Wetlands

Two stresses were identified in lakeshore wetlands: high ranking altered composition/structure and medium ranking modified water levels and flows (table 21). Invasive plant species and historic grazing were identified as the highest ranking sources of stress to wetlands (table 22).

Table 21. Stresses and stress rank based on severity and scope of damage for lakeshore wetlands at Mount Grant.

Stresses	Severity	Scope	Stress Rank
Altered composition/structure	High	High	High
Modification of water levels; changes in natural flow patterns	High	Medium	Medium

Table 22. Sources of stress and source rank based on contribution and irreversibility for each identified stress in lakeshore wetlands at Mount Grant.

Sources of Stress		Altered composition/ structure		Modification of water levels	
		High		*Medium*	
Invasive/noxious species	Contribution	Very High	High		
	Irreversibility	Medium			
	Source	High			
Grazing practices (historic source)	Contribution	Very High	High		
	Irreversibility	Low			
	Source	High			

Excessive groundwater withdrawal	Contribution			Very High	Medium
	Irreversibility			Very High	
	Source			Very High	

A summary of active major threats to the focal conservation targets at **Mount Grant** are shown in table 23. The most significant active threat is fire suppression and the consequent risk of catastrophic fire because it ranked high for three conservation targets. The second most significant active threat is invasive and noxious species invasions because it ranked high for two focal system targets. As a result these two threats ranked high overall and are recognized as the critical threats to five focal systems. Conservation strategies to abate these threats and to restore the health of the impacted systems are addressed below. **Mount Grant's** matrix system of sagebrush and pinyon woodlands ranked as the highest priority for conservation strategy development because two threats ranked high for the system.

Table 23. Summary of all active threats to Mount Grant focal conservation targets and their overall threat rank and scores.

Active Threats Across Systems	Surface Water	Riparian Forests and Shrublands	Montane Meadows	Springs and Seeps	Sagebrush/ Pinyon Woodlands	Greater Sage Grouse	Subalpine and Alpine	Lakeshore Wetlands	Overall Threat Rank	Total Score
Fire suppression/ Catastrophic fire	High	-	Low	-	High	High	-	-	High	3.02
Invasive/noxious species	-	Low	-	-	High	Medium	-	High	High	2.22
Climate change	-	-	-	-	-	-	High	-	Medium	1.00
Grazing practices	-	-	Low	Low	-	Medium	-	-	Low	0.26
Excessive groundwater withdrawal	-	-	-	-	-	-	-	Medium	Low	0.20
Flash flood event	Medium	-	-	-	-	-	-	-	Low	0.20
Road maintenance and use	Low	Low	-	Low	-	Low	Low	-	Low	0.15
Livestock trespassing	-	Low	Low	-	-	-	-	-	Low	0.06
Operation of drainage or diversion systems	-	Low	-	-	-	-	-	-	Low	0.03
Inappropriate wildlife use (relocated bears)	-	Low	-	-	-	-	-	-	Low	0.03
Recreational use	-	Low	-	-	-	-	-	-	Low	0.03
Human/Military training use	-	-	-	-	-	Low	-	-	Low	0.03
Potential communications antennae, ground-based snow generators	-	-	-	-	-	-	Low	-	Low	0.03
Increase in predators	-	-	-	-	-	Low	-	-	Low	0.03
Permitted hunting	-	-	-	-	-	Low	-	-	Low	0.03
Threat Status for Targets and Site	Medium	Low	Low	Low	High	Medium	Medium	Medium	High	

The two historic threats identified are summarized in table 24. The springs and seeps and lakeshore wetlands were ranked highest for historic threats, although they sum to medium ranks overall. These historic threats could be mitigated with restoration strategies that were not addressed in the abbreviated workshop sessions because of lack of time.

Table 24. Summary of historic threats to Mount Grant focal conservation targets and their overall threat rank and scores.

Historic Threats Across Systems	Surface Water	Riparian Forests and Shrublands	Montane Meadows	Springs and Seeps	Sagebrush/ Pinyon Woodlands	Greater Sage Grouse	Subalpine and Alpine	Lakeshore Wetlands	Overall Threat Rank	Total Score
Grazing practices	-	-	-	-	Medium	Medium	-	-	Medium	1.40
Construction of ditches, dikes, or diversions	-	Medium	Medium	High	-	-	-	-	Medium	1.40
Threat Status for Targets and Site	-	Low	Low	Medium	Low	Low	-	Medium	Medium	

CONSERVATION STRATEGIES

Strategic outcomes were developed by the team to address the highest ranked critical threats at **Mount Grant**. The highest ranked threats are likely to seriously impair one or several focal conservation targets within the next ten years. We focused on abating the sources of stress that would make the greatest difference because resources available to land managers are limited. Strategies were critiqued by workshop participants and further refined through interviews with experienced land managers, academics, and independent consultants. Strategies developed from this assessment are recommended for consideration by the responsible land managing agencies and they are not intended to be directives.

Focal conservation targets and their high ranking threats are listed first with outcomes, strategies, and action steps following each.

1. **<u>High risk of catastrophic crown fire to sagebrush/pinyon woodlands, Greater Sage Grouse, and surface water natural resource</u>**:

Outcome: Reduce amount and continuity of woody fuels (both sagebrush and pinyon pine) in sagebrush-pinyon woodland matrix and reinstitute a more natural fire regime at Mount Grant.

Strategy: Use a variety of fuels reduction methods (mechanical removal, helitorch and prescribed burns under non-catastrophic prescriptions) and allow prescribed natural fires to create thinned areas within the continuous woody matrix.

Action Steps:

a) Assess fire potential and identify areas that are most susceptible to catastrophic crown fire based on fuel loads, topography, and connectivity to dense woody patches;
b) Identify the range of "natural" fire regime (fire frequencies, scales, patterns, and intensities) for Mount Grant's ecological systems based on existing exportable information. (Fire history will provide a context to use natural fire under certain conditions or other appropriate management options).
c) Obtain expert input on mitigation options for prescriptive fire, natural fire, fuels thinning, and post-treatment rehabilitation with native seedings, including options for limiting direct damage from mitigation measures.
d) With above information, develop and implement a prescribed natural fire plan for Mount Grant.
e) Investigate potential funding sources for implementation including BLM's Great Basin Restoration Initiative, DoD compliance funds, and TNC's Fire Learning Network funds.
f) Institute a cooperative agreement with all relevant agencies (HWAD, USFS, BLM, NDF) and private landowners to implement recommended actions beginning with the most vulnerable areas.
g) Use adaptive management guidelines to develop and implement monitoring plans to periodically evaluate restoration of fire-damaged or treated habitats.
h) Provide outreach and education to build constituencies, and enlist partner and public support for these activities.

2. High risk of non-native plant invasions in sagebrush/pinyon woodlands, and lakeshore wetlands:

Outcome: Eradicate or manage priority non-native weeds, or restore native cover in sagebrush/pinyon woodlands, lakeshore wetlands, and other ecological systems as needed at Mount Grant.

Strategy: Develop and implement a weed plan for Hawthorne Army Depot and implement restoration projects to test methods of native plant re-establishment.

Action Steps:

a) Prioritize non-native invasive plant species present at HWAD based on scale of problem, invasive potential of weed, feasibility, and cost.
b) Conduct more intensive inventory surveys of weed occurrences on HWAD to map current extent and monitor invasions.
c) Continue monitoring salt cedar invasions in eastside drainages (west of Hwy 95) and eradicate new introductions as they are identified.
d) Support and bolster partnership between HWAD and Nevada Department of Agriculture on biocontrol program for salt cedar to address larger problem east of Hwy 95.
e) Secure funding to aggressively control weeds, such as bull thistles in wetlands and whitetop in Cottonwood Canyon.

f) Take measures to prevent reintroductions (wash vehicles to decrease dispersal potential, dispose of weed material properly, use best management practices).
g) Support local native seed industry by securing funding to collect native seed on Mount Grant for use in post-fire (or other disturbance) restoration.

3. Risk of inappropriate or unpermitted livestock grazing at HWAD in a variety of ecological systems:

Outcome: Eliminate inappropriate livestock use to reduce potential impacts to surface water quality and plant communities in montane meadows, springs and seeps, riparian forests and woodlands, and sagebrush/pinyon woodlands at Mount Grant.

Strategy: Implement the updated grazing plan for the Lucky Boy Allotment adjacent to HWAD lands.

Action Steps:
a) Implement appropriate grazing strategy updates for the Lucky Boy Allotment.
b) Maintain fence system on regular basis to omit trespass cattle on HWAD.
c) Continue monitoring surface water quality for sedimentation, coliform, and other agents.
d) Consider restoration action at montane meadows and springs and seeps impacted by historic grazing.

Strategies and specific action steps were scored for direct benefit to all conservation targets and then ranked through an analysis of feasibility, relative cost, and leverage value. Leverage was defined as the degree to which a particular strategy action facilitates successful implementation of another strategy. The broad strategies and their overall priority ranks are summarized in table 25.

Table 25. Summary of recommended management strategies at Mount Grant, focal conservation targets that benefit, and their overall priority rank.

Recommended Management Strategies for Mount Grant	Focal Conservation Targets Benefited	Priority Rank
Use fuels reduction methods and allow prescribed natural fire to create thinned areas within the continuous woody matrix.	Sagebrush/Pinyon Woodlands Surface Water Greater Sage Grouse	High
Develop and implement a weed plan to eliminate or manage invasives.	Sagebrush/Pinyon Woodlands Lakeshore Wetlands	High
Continue implementing and monitoring the updated grazing plan for the Lucky Boy Allotment.	Sagebrush/Pinyon Woodlands Surface Water Montane Meadows Springs and Seeps Riparian Forests and Woodlands	Medium

The fuels reduction and prescribed natural fire strategy to reduce the risk of catastrophic fire was downgraded from very high to high priority rank because action steps are untested at the necessary landscape-scale and are relatively costly. However, direct benefits, ease of implementation, capacity (leader/institution) ranked high, while leverage ranked very high to make it a high overall priority. The weed plan also ranked high because direct benefits, ease of implementation, capacity, and leverage ranked high.

The 5-S approach used here by the assessment teams to focus on the highest critical threats provided the opportunity to develop strategies that addressed the habitat of the Greater Sage Grouse only. During the course of workshop discussions and interviews with experts, several knowledge gaps regarding Greater Sage Grouse on Mount Grant were noted. Suggestions were made to address those concerns along with management recommendations, and although they do not fall into the high risk topics listed above, they are noted here because of their value to parallel conservation efforts specific to Greater Sage Grouse:

a) Improve Mount Grant data for size component of viability estimates.
b) Use radio telemeters or other technologies to better understand population movements between higher elevations on Mount Grant and adjacent areas (such as Ninemile Flat) at lower elevations.
c) Coordinate all military activity on Mount Grant along the west perimeter road, especially during early season lek use and summer use by hens and broods.
d) Minimize Cottonwood Creek road maintenance, and avoid maintenance of North Control Road, “turkey tracks” intersection, and road south to HWAD boundary fence where road maintenance is not needed.
e) Monitor potential impacts to populations by recent increased bear activity.
f) Regularly monitor western perimeter fence to avoid use of montane meadows by trespass livestock, especially in drier years when greater use of meadow habitat by chicks and juveniles is probable.
g) Take recommended actions to improve Mount Grant habitats by reducing fuel loads and reinstituting more natural fire regimes—especially in pinyon woodlands located between Ninemile Flat and higher elevations at Mount Grant, and in montane meadows.

MEASURES OF SUCCESS

Team participants of the associated Efroymson workshop series decided not to have a third workshop focused on measures of success because of time constraints. However, defining sampling methods, and selecting variables for each conservation target to measure before and after management actions are implemented is important. TNC is interested in working with DoD and specific installations in the Great Basin to develop adaptive management for areas with biodiversity issues.

Ideally, variables selected for monitoring should track functionality of each conservation target. For example, for sagebrush shrublands and pinyon woodlands, percent

perennial grass cover and cheatgrass cover are important variables to measure, but for riparian ecological systems, cover of mid-story shrubs is an important measurement. Whatever methods are used, they should not require large sample sizes to achieve at least 80% statistical power to detect a 10-20% change in variable mean. Additionally, sampling should conform to simple sampling designs with random selection of locations. When experimentation is not necessary because the effect of management actions are well known, change in selected variables can be monitored over time (Elzinga *et al.* 1998). When alternative management actions are possible and it is not certain how a given conservation target will respond to each, a formal experimental design to compare the effectiveness of methods while reducing sources of stress is needed to accomplish adaptive management (Wilhere 2002).

This initial assessment and accompanying documentation in the workbook should be updated periodically, perhaps every three to five years. It could be used to quickly assess effectiveness of military management, and to detect change in viability and threats status.

CAPACITY

In a brief session at the end of the second workshop, teams addressed five aspects of capacity to identify team needs for successful implementation of strategies that decrease or remove critical threats and enhance or maintain conservation targets in the Mount Grant area. Definitions of five key factors that may account for successful implementation follow.

Leadership and support includes three indicators, institutional, staff, and multidisciplinary team. **Institutional leadership** refers to a private entity, government agency, non-governmental organization, or some combination of institutions that is providing leadership for developing and implementing conservation strategies at the area. **Staff leadership** refers to a lead staff member from the lead institution(s) that has clearly assigned responsibility, authority, and accountability for conserving the area, with conservation experience and sufficient time to focus on developing and implementing conservation strategies. **Multidisciplinary team** indicates that the area receives support from an experienced, multidisciplinary team located on-site, within the lead institution, or in partner organizations, with expertise as needed for implementing conservation strategies. The team includes expertise with conservation science, protection, ecological management, government relations and public funding, operations, and an experienced conservation manager.

Strategic approach includes two indicators, conservation targets, threats, and strategies, and monitoring and adaptive management. **Conservation targets, threats, and strategies** indicates that the staff leader and multidisciplinary team have completed an assessment of conservation targets and their threats and have developed strategies that are directly linked to these identified priorities to improve biodiversity health and abate threats. The team understands key constituencies and the motivational forces operating on the constituencies and applies this information to development of conservation strategies. The area assessment has been open to review and critique by colleagues. **Monitoring and**

adaptive management refers to a team deploying an iterative, adaptive approach to developing and implementing conservation strategies. That is, baseline measures of conservation targets and threats, as well as conservation capacity indicators have been established. Key factors of ecological systems and threats are being monitored. The team meets regularly to evaluate results, assess progress and make strategic adjustments in conservation strategies at the area.

Legal framework for conservation refers to an appropriate combination of legally protected conservation areas and policy instruments that have been established at a level necessary to protect conservation targets. The legal protection can take many forms, including national, state, or local special designations; ownership by a conservation entity (in fee title or partial interest, such as a conservation easement); or a private reserve. Policy instruments vary, but may include zoning, permits and no-take zones, for example. Key policies are sufficiently enforced.

Adequate funding means that the area must have operational funding that is adequate to support the staff and operating costs, as well as program funding that is adequate to implement and sustain key strategies. Project managers and teams need to build a base of secure funding sources for the long-term. Funding may come from both private and pbulic sectors and be available through a variety of mechanisms and sources, such as appropriation of public funds, multi-year grants, endowments or donor contributions, and other sources.

Community and constituency support indicates that the team has developed strategies to gain the support of key constituencies, including those in the local community. The staff and program are favorably received and supported. There are no major obstacles to strategy implementation as a result of community or constituency opposition.

These five factors were initially ranked on a four-part scale from very good to poor for **Mount Grant**. Appendix 2 provides definitions for all ranks of each key factor, while table 26 summarizes the Mount Grant team's initial assessment of capacity factors only. Five indicators ranked good while three others ranked fair. The team agreed that the multidisciplinary team was in need of strengthening by including participation by Carson City BLM, Nevada Division of Forestry, and possibly others. There was acknowledgement that additional funding sources need to be secured to implement strategies needed to reduce the potential for catastrophic fire. Strategies aimed at returning more natural fire regimes are initially met with mixed support by local communities because of fear of property loss to fire, so the team felt a need to strengthen support through public outreach and education. Finally, the team actually ranked monitoring and adaptive management as not applicable (to a new action area during its first year), but a good rank readily applies to ongoing monitoring that HAWD currently conducts for some conservation targets and threats (surface water quality and invasive plant species monitoring).

Table 26. Summary of initial rankings of key capacity indicators for Mount Grant.

Key Capacity Indicators	Definition of selected initial rank of key capacity factor	Initial Rank
Institutional leadership	A lead institution has *two, but not all three* elements (conservation mission, responsibility, adequate capacity). If multiple institutions are involved, there are some difficulties in collaboration, but the difficulties are not seriously impeding implementation of key strategies.	Good
Staff leadership	A lead staff member has any two, but not all three elements of focused staff responsibility (responsibility, experience, time). If multiple staff leaders are involved, there are some difficulties in collaboration, but not seriously impeding implementation of key strategies.	Good
Multidisciplinary team	Sufficient/experienced support is not available in *2 or 3* important functions needed for successful strategy implementation.	Fair
Strategic approach: Conservation targets, threats, and strategies	Staff leader and multidisciplinary team have participated in a structured approach to conduct a "rapid" assessment of conservation targets (including their ecological integrity) and threats (including ranking of stresses and sources), and have developed strategies that are directly linked to the analysis, but documentation or mapping may be insufficient and/or the planning has not been open to review and critique by colleagues.	Good
Monitoring and adaptive management	Baseline measures of conservation targets and threats have been established and some key factors are being monitored, and the multidisciplinary project team has met within past two years to reassess threats, assess progress, evaluate results, review strategic hypotheses and make necessary strategic adjustments.	Good
Legal framework for conservation	A *meaningful degree* of legally protected areas have been established and/or policy instruments exist, but *need enhancement or increased enforcement* to protect the conservation targets.	Good
Adequate funding	Funding has been secured or pledged for core operations and initial conservation strategies for at least *one year* and some planning is underway to develop secure sources of long-term support for operations and conservation strategies.	Fair
Community and constituency support	The project staff and their program have *mixed* support from key constituencies and/or there is some significant opposition to key strategy implementation.	Fair

CONCLUSIONS AND NEXT STEPS

The matrix ecological systems at **Mount Grant** have been considered in excellent condition because of the lack of public access and livestock grazing for almost three quarters of a century. The area is used by Natural Resources Conservation Service for baseline vegetation management information because of favorable military management.

Yet, when landscape context, or properly functioning ecological processes, for matrix sagebrush shrublands and pinyon woodlands were assessed within the context of fire regime alterations in the Great Basin over the last 150 years, the three largest scale focal conservation targets only received fair ranks. Fire suppression and risk of catastrophic crown fires rose to the highest level threat for Mount Grant's ecological systems. Strategic

outcomes directed to reduce the risk of catastrophic fire and reinstitute a healthier fire regime scored high. Although action steps to accomplish this outcome remain untested at the scale (50,000–100,000 acres) appropriate for the Mount Grant area, there are favorable indications that, once demonstrated at smaller scales, action could be taken at more effective scales.

The core components of a multidisciplinary team have commenced working together for this initial assessment. With the addition of identified partners including USFS, BLM, and Nevada Division of Forestry, to the team of Hawthorne Army Depot (and DZHC), U.S. Fish and Wildlife Service, Nevada Division of Wildlife, University of Nevada, Walker River Paiute Tribe, and The Nature Conservancy, specific next steps and opportunities to fund them could be developed. To their credit, HWAD has already initiated steps to work with independent fire regime condition contractors and invasive weed specialists with Nevada Department of Agriculture. The Nature Conservancy has a vested interest in working with Hawthorne Army Depot to protect Mount Grant as a functioning landscape in the western Great Basin. Opportunities to accomplish the stated long-term vision through successful implementation of these conservation strategies will be sought.

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APPENDIX 1: NESTED CONSERVATION TARGETS WITHIN SEVEN FOCAL CONSERVATION SYSTEMS

Focal Conservation Target System	Nested Conservation Target	Global Rank, Trend, Species Listing*
Sagebrush/ Pinyon Woodlands	Singleleaf Pinyon Pine (*Pinus monophylla*) Woodlands	
	Pinyon Pine-Utah Juniper (*Pinus monophylla- Juniperus osteosperma*) Woodlands	
	Mountain Mahogany (*Cercocarpus ledifolius* var. *intermontanus*) Woodlands	
	Western Juniper (*Juniperus occidentalis*) Woodlands	
	Basin Big Sagebrush (*Artemisia tridentata* ssp. *tridentata*) Communities	
	Wyoming Big Sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) Communities	
	Mountain (Vasey) Sagebrush (*Artemisia tridentata* ssp. *vaseyana*) Communities	
	Black Sagebrush (*Artemisia nova*) Communities	
	Low Sagebrush (*Artemisia arbuscula*) Communities	
	Bodie Hills Rockcress (*Arabis bodiensis*)	G2
	Beatley Buckwheat (*Eriogonum beatleyae*)	G2Q
	Wassuk Beardtongue (*Penstemon rubicundus*)	G2G3
	Pinyon Jay	G5, specialist
	Juniper Titmouse	G5, declining
	Mountain Quail	
	Sagebrush Vole (*Lemmiscus curtatus*)	G5, declining
	White-tailed Jackrabbit (*Lepus townsendii*)	G5, declining
	Desert Bighorn Sheep (*Ovis canadensis nelsoni*)	T4G4
	White Mountains cloudy wing (*Thorybes mexicana blanca*)	T2G5
Surface Water	Aquatic Macroinvertebrate Assemblage	
	Lahontan Cutthroat Trout (*Oncorhynchus clarki henshawi*) – potential target	T3G4, LT, State Protected
Subalpine and Alpine Systems	Yellow Pine (*Pinus jeffreyi*)	
	Limber Pine (*Pinus flexilis*) Woodlands	
	Whitebark Pine (*Pinus albicaulis*) Woodlands	
	Prickly Phlox (*Leptodactylon pungens* var*. hallii*) Shrublands	
	Alpine Herbaceous Communities	
	Barren Talus Slopes	
	Gray Wavewing (*Cymopterus cinerius*)	G2G3
	Mono ragwort (*Senecio pattersonensis*)	G2
	Blue Grouse	
	Sagebrush Vole (*Lemmiscus curtatus*)	G5, declining
	Pika (*Ochotona princeps*)	G5, distinct?
	Desert Bighorn Sheep (*Ovis canadensis nelsoni*)	T4G4

	High Elevation Bumble Bee Assemblage	
Riparian Forests and Shrublands	Frémont Cottonwood (*Populus fremontii*) Forests or Woodlands	
	Arroyo Willow (*Salix lasiolepis*) Shrublands	
	Mixed Willow (*Salix geyeriana* and *S. lemmonii*) Shrublands	
	Aspen (*Populus tremuloides*) Stands	declining
	Riparian Resident Bird Assemblage	
	Riparian Migratory Bird Assemblage	
	Cooper's Hawk	G4, declining
	Lewis's Woodpecker	G5, declining
	Riparian Small Mammal Assemblage	
	Desert Bighorn Sheep (*Ovis canadensis nelsoni*)	T4G4
	Riparian Butterfly Assemblage	
	Apache silverspot (*Speyeria nokomis apacheana*)	T3G4
Montane Meadows	Sedge (*Carex* sp.) Meadow Communities	
	Grass (*Poa* sp. and others) Meadow Communities	
	White-tailed Jackrabbit (*Lepus townsendii*)	
	Small Mammal Assemblage	
Springs and Seeps	Desert Bighorn Sheep (*Ovis canadensis nelsoni*)	T4G4
	Aquatic Macroinvertebrate Assemblage	
Lakeshore Wetlands	Emergent Freshwater Cattail (*Typha domingensis*) Marsh	
	Alkaline Bulrush (*Scirpus nevadensis* and *S. pungens*) Marsh	
	Alkaline Grass (*Distichlis spicata* var. *stricta* and *Muhlenbergia asperifolia*) Meadow	
	Water Bird Assemblage	
	Western Snowy Plover	G4T3, State Protected
	Amphibian Assemblage	

* Global ranks are as follows: G1 – Globally critically imperiled because of extreme rarity, imminent threats, and/or biological factors, generally with 5 or fewer occurrences and/or less than 1,000 individuals, and/or less than 2,000 acres in extent;
G2 – Imperiled because of rarity and/or other demonstrable factors, generally with 6-20 occurrences and/or 1,000-3,000 individuals and/or 2,000-10,000 acres in extent;
G3 – Rare and local throughout its range, or with very restricted range, or otherwise vulnerable to extinction, generally with 21-100 occurrences and/or 3,000-10,000 individuals, and/or 10,000-50,000 acres in extent;
G4 – Apparently secure, though frequently quite rare in parts of its range, especially at its periphery, generally with greater than 100 occurrences, and/or greater than 10,000 individuals, and/or greater than 50,000 acres in extent;
G5 – Demonstrably secure, though frequently quite rare in parts of its range, especially at its periphery, with greater than 100 occurrences, and/or greater than 10,000 individuals, and/or greater than 50,000 acres in extent.
T1-T5 – Status identical to G rank, but applies to trinomial (subspecific) status.

LT is listed threatened under Endangered Species Act of 1973 as amended.

State protected refers to species protected under NRS 501.

APPENDIX 2: KEY CAPACITY FACTORS FOR LANDSCAPE CONSERVATION

Leadership and Support

Institutional Leadership: *A private conservation organization, government conservation agency, NGO or some combination is providing leadership for developing & implementing conservation strategies at the area. If multiple institutions, they have a shared vision of success & good collaboration mechanisms.*	
Very Good	There is clear leadership provided by one or a combination of institutions that have (1) a mission that includes conservation of biodiversity; (2 clear responsibility for conserving the area; and (3) adequate capacity to implement conservation strategies. If multiple institutions are involved they must also have a shared vision of success and successful collaboration mechanisms in place.
Good	A lead institution has *two, but not all three* elements (mission, responsibility, capacity). If multiple institutions are involved, there are some difficulties in collaboration, but the difficulties are not seriously impeding implementation of key strategies.
Fair	A lead institution has *only one* of the three elements (mission, responsibility, capacity). If multiple institutions are involved, there are serious difficulties in collaboration.
Poor	No institution has the mission, responsibility or capacity to implement conservation strategies.
Staff Leadership: *A lead staff member from the lead institution(s) has clearly assigned responsibility, authority, and accountability for conserving the area, with conservation experience and sufficient time to focus on developing and implementing conservation strategies.*	
Very Good	A lead staff member has (1) *clearly assigned responsibility*, authority, and accountability for conserving the area, (2) *experience* in implementing conservation strategies, and (3) sufficient *time* to focus on developing & implementing conservation strategies at the area. If multiple staff leaders, they also have a shared vision of success & successful collaboration mechanisms.
Good	A lead staff member has any two, but not all three elements of focused staff responsibility (responsibility, experience, time). If multiple staff leaders are involved, there are some difficulties in collaboration, but not seriously impeding implementation of key strategies.
Fair	A lead staff member has only one of the three elements of focused staff responsibility (responsibility, experience, time). If multiple staff leaders, there are serious collaboration issues
Poor	No staff leader with designated job responsibility for conserving the area.
Multidisciplinary Team: *The project receives support from an experienced, multidisciplinary team -- located on-site, within the lead institution, or in partner organizations – with expertise as needed for implementing conservation strategies -- e.g. conservation science, protection, ecological manage-ment, govern-ment relations/public funding, development, operations, and an experienced conservation manager*	
Very Good	The project receives sufficient/experienced support from a project team in all functions needed for successful strategy implementation.

Good	Sufficient/experienced support is not available in *one* important function needed for successful strategy implementation.
Fair	Sufficient/experienced support is not available in *2 or 3* important functions needed for successful strategy implementation.
Poor	The project receives insufficient support in *more than 3* important functions.

Strategic Conservation Approach

Conservation Targets, Threats, and Strategies: *Staff leader and multidisciplinary team have completed an assessment of conservation targets and their threats and have developed strategies that are directly linked to these identified priorities to improve biodiversity health and abate threats. The team understands key constituencies and the motivational forces operating on the constituencies and applies this information to development of conservation strategies. The area assessment has been open to review and critique by colleagues.*	
Very Good	Staff leader and multidisciplinary team: (1) have completed a thorough assessment of the conservation targets (including key factors relating to their ecological integrity) and threats (including ranking of stresses and sources), and have developed strategies that are directly linked to this analysis and take into account the interests of key constituencies; (2) documented the planning and developed appropriate maps; and (3) the planning has been open to review and critique by colleagues..
Good	Staff leader and multidisciplinary team have participated in a structured approach to conduct a "rapid" assessment of conservation targets (including their ecological integrity) and threats (including ranking of stresses and sources), and have developed strategies that are directly linked to this analysis—but documentation or mapping may be insufficient; and/or the planning has not been open to review and critique by colleagues.
Fair	Project staff have participated in a conservation area planning meeting or other effort —but have not gone through a structured approach to assess conservation targets, threats and/or strategies.
Poor	Project staff have not yet participated in strategic planning focused on the conservation targets, threats, and related strategy development.
Monitoring and Adaptive Management: Baseline measures of conservation targets and threats have been established and some key factors are being monitored, and the multidisciplinary project team has met within past two years to reassess threats, assess progress, evaluate results, review strategic hypotheses and make necessary strategic adjustments.	
Very Good	(1) Baseline measures of conservation targets and threats, as well as conservation capacity indicators have been established; (2) key factors of ecological systems and threats are being monitored; *and* (3) the multidisciplinary project team meets regularly (e.g. quarterly, biannually, or annually) to assess progress, evaluate results, review and test strategic hypotheses and make necessary strategic adjustments..
Good	Baseline measures of conservation targets and threats have been established and some key factors are being monitored, and the multidisciplinary project team has met within past two years to reassess threats, assess progress, evaluate results, review strategic hypotheses and make necessary strategic adjustments..
Fair	Baseline measures are incomplete, *and/or* monitoring is not focused on key factors; *and/or* project director has met only informally with others to assess progress and to re-assess the conservation plan (system, stresses, sources and strategies).

Poor	No baseline measures established; no monitoring; *and* no review or update of conservation plan is taking place.
N/A	This factor is not applicable to a new action area during its first year..

Legal Framework for Conservation

***Legal Framework for Conservation**: An appropriate combination of legally protected conservation areas and policy instruments have been established at the level necessary to protect conservation targets. The legal protection of conservation areas can take many forms, including national, state or local conservation areas; ownership by a conservation organization; or a private reserve. Conservation ownership can be in fee or through a partial interest such as a conservation easements, and is* held by an established conservation organization or agency. *Policy instruments will vary but may include zoning, permits and no-take fisheries zones, for example. Key policies are sufficiently enforced.*	
Very Good	An *effective combination* of legally protected conservation areas and/or policy instruments have been *authorized and implemented* at the level necessary to protect conservation targets.
Good	A *meaningful degree* of legally protected areas have been established and/or policy instruments exist, but *need enhancement or increased enforcement* to protect the conservation targets.
Fair	*Some* legally protected areas and/or policy instruments exist, or have been formally planned, but *need substantial enhancement or increased enforcement* to protect the conservation targets.
Poor	*No, or very few*, legally protected areas and/or policy instruments exist or have been formally planned, relative to protecting the conservation targets, or plans are largely inadequate.

Funding

***Funding** – A conservation area must have operational funding that is adequate to support the staff and operating costs, as well as program funding that is adequate to implement and sustain key strategies. For the long-term, project managers and teams need to build a base of secure funding sources. Funding may come from both private and public sectors and be available through a variety of mechanisms and sources, such as appropriation of public funds, contributions by donors, endowment, multi-year grants, and other sources.*	
Very Good	Funding to *implement* key conservation strategies and for core operations has been secured, pledged, or is highly probable for at least two years, *and* the project has developed likely sources of long-term funding to sustain core costs and key conservation strategies for the next 5 years.
Good	Funding to *develop and launch* key conservation strategies and for core operations has been secured, pledged, or is highly probable for at least two years, *and* the project has undertaken financial planning and achieved partial success in developing sources of long-term funding to sustain core costs and key conservation strategies for the next 5 years.
Fair	Funding has been secured or pledged for core operations and initial conservation strategies for at least *one year* and some planning is underway to develop secure sources of long-term support for operations and conservation strategies.

Poor	Funding has not been secured or pledged for core operations and strategies and no planning or implementation of long-term funding sources.

Community & Constituency Support

Community & Constituency Support: *The project team has developed strategies to gain the support of key constituencies, including those in the local community. The staff and program are favorably received and supported. There are no major obstacles to strategy implementation due to community or constituency opposition.*	
Very Good	The project staff and their program are favorably received and supported by key constituencies -- including those in the local community, and there are no major obstacles to key strategy implementation due to community or constituency resistance.
Good	The project staff and their program are favorably received and supported by *most* but not all key constituencies. If there is opposition to key strategy implementation due to community or constituency resistance, this opposition can likely be overcome.
Fair	The project staff and their program have *mixed* support from key constituencies and/or there is some significant opposition to key strategy implementation.
Poor	The project staff and their program have *very little* support from key constituencies and/or there is very significant opposition to key strategy implementation.