UTAH DNR
UTAH DIVISION OF
WILDLIFE RESOURCES

1594 West North Temple
Salt Lake City, Utah 84116

FINAL

Utah Wildlife Action Plan

A plan for managing native wildlife species and their habitats to help prevent listings under the Endangered Species Act.

2015–2025

DWR publication 15-14

Acknowledgements

A great number of people helped complete this plan. Some of these people were involved start to finish, while more were active during specific phases or for specific tasks. Some roles were occupied by a series of two or three people as retirements, promotions, relocations, and other changes occurred in people's lives. The following people are a subset of all who helped develop and refine this plan. Affiliations are given for the time when people were most active.

Whether or not a participant is listed here, their contributions are appreciated and live on in Utah's 2015-2025 Wildlife Action Plan.

Wildlife Action Plan Joint Team members

Brian Allen - US Fish and Wildlife Service

Lorien Belton - Utah State University

Paul Birdsey - Utah Division of Wildlife Resources

Casey Burns - Natural Resources Conservation Service

Chris Crockett - Utah Division of Wildlife Resources

Jimi Gragg - Utah Division of Wildlife Resources

Betsy Herrmann - US Fish and Wildlife Service

Kim Hersey - Utah Division of Wildlife Resources

Justin Jimenez - Bureau of Land Management

Allison Jones - Wild Utah Project

Chris Keleher - Utah Department of Natural Resources

Robbie Knight - US Army Dugway Proving Ground

Clint McCarthy - US Forest Service

Cassie Mellon - Utah Division of Wildlife Resources

Dean Mitchell - Utah Division of Wildlife Resources

Robin Naeve - Bureau of Land Management

Nicole Nielson - Utah Division of Wildlife Resources

Russ Norvell - Utah Division of Wildlife Resources

Mary Pendergast - Wild Utah Project

Mark Petersen - Utah Farm Bureau Federation

Jason Robinson - Utah Division of Wildlife Resources

Steve Slater - Hawkwatch International

Ben Sutter - Utah Division of Wildlife Resources

Tyler Thompson - Utah Division of Wildlife Resources

Joel Tuhy - The Nature Conservancy

Other partners and stakeholders in Wildlife Action Plan review and revision

Anis Aoude - Utah Division of Wildlife Resources

Carmen Bailey - Utah Division of Wildlife Resources

Phaedra Budy - Utah State University

Kevin Bunnell - Utah Division of Wildlife Resources

Tiffany Cummins - US Fish and Wildlife Service

Paul Cowley - US Forest Service

Keith Day - Utah Division of Wildlife Resources

Acknowledgements

Walt Donaldson - Utah Division of Wildlife Resources

Mark Farmer - Utah Division of Wildlife Resources

Karen Fullen - Natural Resources Conservation Service

Stephen Hansen - Utah Division of Wildlife Resources

Bob Hasenyager - Utah Wildlife in Need

Trina Hedrick - Utah Division of Wildlife Resources

Russ Lawrence - US Air Force Hill Air Force Base

Steve Madsen - Bureau of Land Management

Gavin Noyes - Round River Conservation Studies

Patsy Palacios - Utah State University

Jim Parrish - Utah Division of Wildlife Resources

Rory Reynolds - Utah Division of Wildlife Resources

Laura Romin - US Fish and Wildlife Service

John Shivik - US Forest Service

Holly Strand - Utah State University

Melissa Trammel - National Park Service

Jason Vernon - Utah Division of Wildlife Resources

Krissy Wilson - Utah Division of Wildlife Resources

Roger Wilson - Utah Division of Wildlife Resources

Recommended citation:

Utah Wildlife Action Plan Joint Team. 2015. Utah Wildlife Action Plan: A plan for managing native wildlife species and their habitats to help prevent listing under the Endangered Species Act. Publication number 15-14. Utah Division of Wildlife Resources, Salt Lake City, Utah, USA.

Road Map to the Required Elements, by Chapter (page number refers to beginning of chapter):

Foreword

The Utah Wildlife Action Plan was developed and written by a broad-based team of diverse stakeholders, non-governmental organizations (NGO's), and other governmental agencies. The Utah Division of Wildlife Resources (UDWR) compiled and edited the plan; however, it is not solely a UDWR product.

The goal of the Wildlife Action Plan is: "To manage native wildlife species and their habitats, sufficient to prevent the need for additional listings under the Endangered Species Act." The scope of work required to achieve this goal is beyond what any single organization can accomplish on its own. It will require collaborative, creative, solution-based partnerships. These partnerships will provide the mechanisms to develop jointly identified objectives and conservation actions, and the basis for investment of time and effort to pursue mutually-desired outcomes.

This plan should be viewed as the framework for an inclusive discussion of what the shared priorities and methods should be, focusing on solutions as well as respecting the vital importance of credible process in creating fair, enduring, satisfying outcomes.

The Wildlife Action Plan will guide partnership-driven, landscape-scale conservation work to help maintain the full array of Utah's wildlife, and also improve habitat health. The ultimate goal of reducing the number of listed wildlife species in Utah requires broad societal support. We invite you to get involved and help shape the future for these wildlife species of greatest conservation need.

Executive Summary

Recognizing the need to support states with additional wildlife management funding, and intending to help slow the rate of new listings under the Endangered Species Act (ESA), in 2001 Congress passed legislation authorizing the State Wildlife Grants program (SWG). To ensure that the funds would be well-spent, this legislation required that each participating state and territory develop a Wildlife Action Plan (WAP) by 2005. All 56 US states and territories chose to participate in this new conservation program, and each completed a WAP by the 2005 deadline. To date, the Utah Division of Wildlife Resources (UDWR) has received over $11 million in federal SWG appropriations to implement the 2005 Utah WAP, an amount which has been doubled by 1:1 matching with state funds. The 2005 Utah WAP has also brought together many partners who have contributed an even larger amount of private, state, and federal funding to help with its implementation.

In addition to requiring a first-edition WAP for states to receive SWG funds, Congress also conditioned ongoing participation in the SWG program on states' reviewing and revising their plans at least once every ten years. Accordingly, UDWR has led a conservation planning partnership to update Utah's WAP. This partnership includes state and federal natural resource agencies, academia, and conservation and agriculture advocates.

Among the 50 states, Utah ranks 10th in overall biological diversity and 5th for endemism (species found only in one state). Unfortunately it also ranked 5th in terms of species extinction risk, mainly among its fishes, and 17th in actual extinctions. Utah’s diversity of life is derived from its physical geography and its geologic history. High plateaus and mountain ranges are separated by low, dry basins, and its river systems have three very distinct outlets: they either drain into the north Pacific via the Columbia River, the Gulf of California via the Colorado River, or internally into the Great Basin's variety of saline lakes and playas. Utah’s borders encompass about 85,000 square miles, making it the 11th largest state. Various federal government agencies administer approximately 64% of the land surface, state agencies 10%, Native American tribal governments 5%, and private owners 21%.

Utah's arid climate and limited water resources present challenges for conservation, particularly in the context of flourishing growth of the state's human population. Water is essential for all life, and our extraction and consumption of water and the accompanying alteration of aquatic habitats are the single most significant source of stress to Utah's wildlife and habitats. Compounding this stress is periodic drought, which is expected to intensify in the future. Non-native species are the second-most critical problem for terrestrial and aquatic species and habitats in Utah. The third-most critical problem involves the combined effects of wildfire and, paradoxically, fire suppression. Fire is now occurring where it virtually never did before, and has been long-excluded from where it naturally occurred on a regular basis. Besides the issue of timing, the frequency and intensity of fire have also greatly diverged from long-term norms. Finally, a large number of “crucial data gaps” have been identified. These problems need to be understood better before effective conservation action can take place.

UDWR has been working with other conservation agencies and organizations to revise Utah's Wildlife Action Plan. Wildlife species most in need of conservation attention have been identified, as have the habitats they require for survival. Threats and limiting factors, as well as crucial data gaps have also been identified. This document provides strong, clear guidance for developing actions that could be effective for managing all of these problems. If this plan were effectively implemented, this would result in healthier habitats and wildlife populations, thereby reducing and preventing listings under the Endangered Species Act. The 2015 edition of the WAP is organized into 7 principal sections:

- introductory materials
- species of greatest conservation need
- key habitats
- threats, data gaps, and conservation actions
- monitoring
- implementation and partnerships
- reference materials

The introductory materials provide some state background and context, and discuss approaches to develop the plan as well as provisions for updating the plan and including public participation.

There are 141 species of greatest conservation need and 13 key habitat types identified. Threats to these species and habitats were assessed using consistent, standardized terminology and metrics. Threats across all species and habitats were collated. A ranking process was applied to the whole set of threats in order to identify the ones with the most negative effects on the most species and habitats. The threats and actions chapter is organized around these priority threats.

Potential conservation actions were designed to abate priority threats, using standardized terminology and metrics. Many of the priority threats are accompanied by a case study, describing successful real-life instances of partners developing actions to abate the threat. Each potential action includes at least one potential objective. Each potential objective lists potential indicators of progress, a number of potential program and project actions, and likely conservation authorities, stakeholders, and partners.

A monitoring chapter follows the threats and actions, and is organized around periodic status assessment and effectiveness monitoring (and its prerequisite, implementation monitoring). This content foreshadows the implementation chapter, and it also draws on the objectives and indicators from the potential conservation actions, and on the indicators for species, habitats, and threats.

The last major chapter identifies many of the partners, expectations, and mechanisms of WAP implementation. It also describes the collaboration among partners and stakeholders that will be required to create broadly-acceptable objectives, indicators, and actions to abate the priority threats. This may be the most important chapter in this plan.

TABLE OF CONTENTS

Table of Contents

Table of Contents

Table of Contents

Background and Context

In the United States of America, individual states hold primary management authority for most of the wildlife species found within their borders. Native migratory birds, marine mammals, and species listed under the Endangered Species Act constitute the major exceptions: the federal government holds the principal management responsibility for these species. There are also some exceptions based on land tenure: states do not hold primary management authority for wildlife within National Parks, National Wildlife Refuges, or on Indian reservations for example, though they very frequently partner with these entities to manage wildlife on their lands.

State and federal wildlife managers have developed a long and distinguished record of wildlife conservation successes since they began earnest work in the first half of the 20^th^ Century. This work followed the mid-19^th^ to early 20^th^ century extinctions of several species or subspecies of native North American wildlife, including the Eastern elk, passenger pigeon, heath hen, Carolina parakeet, spectacled cormorant, Caribbean monk seal, and Steller's sea cow. These extinctions preceded modern wildlife management, and helped trigger an expanding national awareness of -- and eventual response to -- the need for actively managing wildlife populations impacted by human activities, such as unregulated harvest or widespread modification / destruction of critically important wildlife habitats.

The record of conservation successes includes many species for which people hunt, trap, or fish, and some species which are not harvested by hunters or anglers. Many species pursued today by hunters and anglers would have been considered "endangered with extinction" if that phrase had been in common use during the early 20th Century. The fact that many then-diminished wildlife species have been so widely and successfully recovered serves as a testament to several important realizations:

- the fundamentally renewable nature of wildlife resources
- the wisdom and efficacy of the state-federal conservation partnership first created 77 years ago with passage of the Wildlife Restoration Act of 1937, later followed by the similarly modeled Sport Fish Restoration Act of 1950
- the dedication and commitment of generations of state and federal wildlife management professionals, and the public who supported them politically and financially, making their work possible
- the cumulative rate of return on the diverse and tremendous financial investments made in soil, water, air and land conservation
- the willingness and ability of states to successfully manage wildlife and habitats

Nationwide, much of the funding for these conservation successes has come from hunter and angler license fees and habitat stamps, and from federal excise taxes on shooting, boating, and fishing equipment. These excise taxes are collected at the point of sale, deposited into a dedicated trust fund, and distributed annually to the states in a formula-based process which is off-limits to annual Congressional appropriation. These federal distributions are matched with state revenues collected through the sale of hunting and fishing licenses, stamps, and tags to provide dependable support for wildlife conservation and management. Although the amount raised and distributed varies significantly year by year, and there are also longer-term trends at play (for instance, greater urbanization of the human population, and fewer license-buying hunters *per capita* in the population), the certainty that there will be some level of funding every year has proven critical to the perpetuation of long-term conservation.

In most states, the use of this excise tax and license funding has been directed mainly toward the conservation of hunted or fished species. The majority of wildlife species are not hunted or fished. While a few states have chosen to use these federal excise taxes to directly fund the management of diverse wildlife species, in general most wildlife species have not been the direct beneficiaries of this reliable funding mechanism (though they have often benefitted indirectly from such activities as habitat acquisition and management). Some states have developed local funding solutions to the challenge of funding wildlife management, such as sales taxes, impact fees, or dedicated proceeds from lottery sales. Such local funding solutions appear out of reach or impractical for many states.

Table 1. Alternative Funding Mechanisms Used by WAFWA Member States[1]

Mechanism Type	WAFWA States
Sales Taxes on Outdoor Gear	TX
Impact Fees	MT, NV
State Lottery	AZ, CO, NE, OR
Gaming Revenue	AZ
License Plates	UT, WA, ID, TX, OK, CA (more than 40 states)
Voluntary Conservation Stamp[2]	CA, TX, WA
Mandatory Conservation Stamp	HI, NM, NE, KS, WY, CO
Tax Check-off[3][4]	AZ, WA, MT, ID, OR, CA (more than 35 states)
Mandatory User Fee	CA, WA, NM, AK, CO, TX, OK
Voluntary Donation	NE
General Obligation Bond	NV

[1] From a 2012 WAFWA report, *Developing Alternative Funding From Non-Consumptive Sources*.
[2] Conservation stamps have been used by at least 10 WAFWA member states. Of those reporting, voluntary stamps raised between $5,000 and $100,000 annually, while mandatory stamps (attached to hunting/fishing licenses) raised up to $1 million annually.
[3] Nongame/Diversity Tax Check-offs generally raise between $50,000 and $250,000 annually.
[4] Utah had a Nongame Tax Check-off from 1980 to 2015. Though strong for its first decade, participation steadily declined as competing check-off causes were added. State law requires that tax check-offs that dip below annual contributions of $30,000 be monitored. After three years in a row below that mark, check-offs must be removed.

The shortage of dedicated "non-game" wildlife funding has inhibited the development, implementation, and sustenance of long-term state conservation programs for wildlife species which are not typically sought by hunters and anglers. One of the unintended consequences of this situation has been a long series of federal interventions, via the specific authority granted under the Endangered Species Act, to force attention onto these species which previously had not received adequate conservation focus.

In 1997, as part of the state water tax, the Utah Legislature created the Endangered Species Mitigation Fund[5] (ESMF) which significantly expanded the funding base for conservation of wildlife species which are designated as Utah Sensitive Species or are ESA-listed. The purpose of this fund is to avoid, reduce, and/or mitigate impacts of ESA listings on the people of Utah. The ESMF has contributed to the development, implementation, and continuance of sensitive species conservation in Utah, both directly and indirectly by supplying matching funds which enabled the funds to be leveraged for greater benefit to sensitive species management.

The need for a reliable source of funding for the conservation of all wildlife species was also recognized across the nation over the same period. In particular, many states desired to prevent additional wildlife species from becoming endangered. Throughout the mid- and late 1990's a national coalition of conservation-minded agencies, organizations, and businesses lobbied Congress for passage of legislation required to allow for such funding. This lobbying campaign, known as Teaming with Wildlife, was partially successful. The Department of the Interior and Related Agencies Appropriations Act of 2002[6], created the federal State Wildlife Grants program (SWG), which enables Congressional appropriators to consider funding wildlife and habitat conservation on a year-to-year basis. This law requires that each state have a current, approved Wildlife Action Plan (WAP) to remain eligible for any SWG funding that Congress appropriates to the federal program. States that choose to participate in the SWG program must review and revise their Wildlife Action Plans at least once every 10 years, if they want to maintain their eligibility. Utah's initial Wildlife Action Plan was completed and approved in 2005.

This amended Wildlife Action Plan was created with this explicit purpose and goal always in mind: *To manage native wildlife species and their habitats, sufficient to prevent the need for additional listings under the Endangered Species Act.* The intent is that Utah may continue to participate in the State Wildlife Grants program, as well as create a strategic path to maintaining wildlife and their habitats.

[5] Utah Code 63-34-14
[6] Public Law 107-63, Title 1

Overview of Utah

Utah is the 11th largest state and - after neighboring Nevada - the second driest. Elevation extremes in Utah range from a low of 2,350 feet in the Beaver Dam Wash, to a high of 13,528 feet in the Uinta Mountains. Most of the 29 counties in Utah have mountain peaks over 10,000 feet, with valley bottoms below 5,000 feet.

Utah's climate varies greatly with elevation and regional terrain, and to a lesser extent by latitude - generally speaking, the north receives more precipitation and has lower evapotranspiration than the south. Statewide, winter precipitation is more important and more abundant than summer precipitation; in Utah most precipitation falls as snow. Eastern Utah, and particularly southeastern Utah, receives more summer rain than the rest of the state, being more influenced by the North American monsoon.

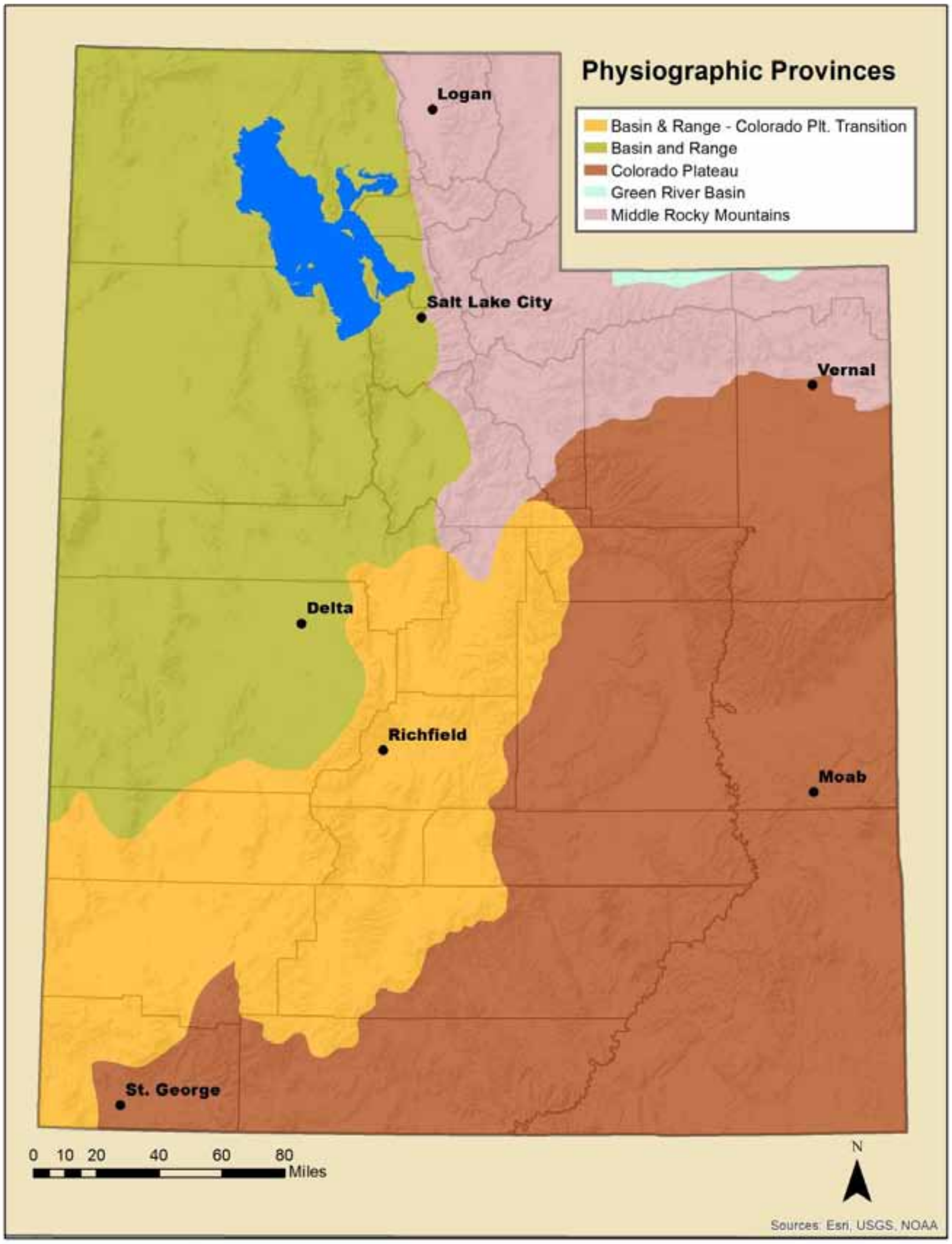
Local climates in all regions of the state range from desert to alpine, often with stark differences over just a few miles. Most of the state's precipitation falls in its mountainous regions, while more than two-thirds of the state receives less than 12 inches of total precipitation per year. Average annual precipitation at monitored stations around Utah ranges from less than six inches of water, to more than fifty. Drought, as measured by the Palmer Drought Severity Index, has varied substantially over the last few decades. In general, the period from 1977-86 did not have drought conditions while the period from 1987-2003 did. The subsequent decade saw a stretch of rather moderate, occasionally wet conditions from 2004-2011, and a return to drought since 2012.

Utah is comprised of parts of three major physiographic provinces, each with characteristic landforms and geology[7]. These include the Basin and Range Province, the Middle Rocky Mountains province, and the Colorado Plateau province. An overlapping of two of these provinces essentially forms a fourth physiographic region. The Basin and Range - Colorado Plateau transition zone extends through central and southwestern Utah, and contains physiographic and geologic features similar to both the Basin and Range and Colorado Plateau Provinces.

The Basin and Range Province in western Utah is noted for numerous north-south oriented, fault-tilted mountain ranges separated by intervening, broad, sediment-filled basins. The mountain ranges are typically 12 to 30 miles apart and 30 to 50 miles long. Typical mountain ranges are asymmetric in cross section, having a steep slope on one side and a gentle slope on the other. The steep slope reflects an erosion-modified fault scarp, and the range is a tilted fault block.

The Middle Rocky Mountains province in northeastern Utah consists of mountainous terrain, stream valleys, and alluvial basins. It includes the north-south trending Wasatch Range and the east-west trending Uinta Mountains.

[7] http://geology.utah.gov/emp/geothermal/physiography_utah.htm accessed January 28, 2014.



The Colorado Plateau province is a broad area of regional uplift in southeastern and south-central Utah characterized by essentially horizontal, ancient sedimentary rocks. Plateaus, buttes, mesas, and deeply incised canyons distinguish this province. Three much younger, intrusive volcanic mountain ranges[8] are present in southeastern Utah.

The Transition Zone is a broad region in central Utah containing geological characteristics of both the Basin and Range Province to the west, and the Colorado Plateau province to the east. The boundaries are the subject of some disagreement, resulting in various interpretations using different criteria. Essentially, east-west tectonic "stretching" of the Basin and Range has been superimposed upon the adjacent Colorado Plateau and Middle Rocky Mountains (with their very different rocks and terrains), forming a 60-mile wide zone of transitional geological and geographical characteristics.

Utah is globally renowned for the wildlife diversity associated with the Great Salt Lake ecosystem, which is a high-priority landscape for UDWR and many of our conservation partners. Over 75% of Utah's wetlands occur along the northern and eastern shorelines of Great Salt Lake, which is a desert oasis for migrating birds. The lake provides essential stopover habitat for a great diversity of shorebird and waterfowl species, numbering in the millions of individuals. The water elevation in this Great Basin lake varies with precipitation and evaporation, and since recordkeeping began in 1850 its surface elevation has fluctuated from 4192 to 4212 feet. This vertical displacement can shift the shoreline a dozen miles or more in some areas, which translates to a surface area ranging between approximately 600,000 and 1,500,000 acres. This lake-level fluctuation ensures the long-term survival of the lake's dynamic habitats and the bird species which frequent those habitats. The global conservation significance[9] of the Great Salt Lake ecosystem cannot be overstated.

The complexities of Utah's topography and climate result in biologically diverse habitats. Important habitat types in Utah include a diversity of wetlands, sagebrush steppe and shrublands, mountain shrub and pinyon-juniper woodlands, aspen-conifer forests, and desert grasslands and shrublands. Riparian areas are the richest habitat type in terms of species diversity and wildlife abundance. Aspen-conifer communities are second to riparian areas in wildlife species diversity and abundance.

Utah's habitats support approximately 920 species and subspecies of vertebrates, and thousands of species of invertebrates, all organized into diverse animal communities occupying the habitats mentioned above. State law[10] assigns UDWR the authority and responsibility to manage wildlife, defined as "crustaceans, mollusks, and vertebrate animals living in nature". Managing other members of the animal kingdom (e.g., insects and arachnids) lies beyond the authority granted to UDWR, unless the Legislature were to specifically direct otherwise.

---

[8] The Abajo, Henry, and La Sal mountain ranges. All rise prominently above their surrounding, relatively level landscapes, with maximum elevations exceeding 11,000 feet.

[9] For example Great Salt Lake is listed in the Western Hemisphere Shorebird Reserve Network as a site of hemispheric importance - the highest rank. GSL has also been nominated for recognition by the international Ramsar Convention on Wetlands.

[10] Utah Code 23-13-2(49), Appendix A

National Requirements and Guidance

The public law that introduced the Wildlife Conservation and Restoration Account (the source of State Wildlife Grants) was passed in 2000. Wildlife action plans (or " wildlife conservation strategies") are required of states attempting to gain their apportionment of Wildlife Conservation and Restoration Account funding[11]. Congress required that these plans be based upon the best available and appropriate scientific information and data, to determine or assess:

- wildlife distribution and abundance, especially for species of greatest conservation need
- the habitat extent and conditions essential to the conservation of rare and declining species
- the major problems impacting rare and declining wildlife species and their essential habitats
- the research or surveys needed for identifying and understanding the key factors in effective restoration and conservation
- prioritized actions to be taken to conserve rare and declining wildlife species and their habitats
- the need for periodic monitoring of selected species or their habitats, to gauge the effectiveness of conservation actions, and to adapt conservation to better information or changing conditions.

The law also provides for review and revision of wildlife action plans at least every ten years, and promotes coordination during all major phases of plan development and implementation with Federal, State, and local agencies or Indian tribes managing significant lands and waters or administering programs affecting the wildlife species identified as having the greatest conservation need.

The United States Fish and Wildlife Service (FWS) holds the responsibility for evaluating and approving wildlife action plans, and for managing federal apportionments granted to the states for implementation of approved wildlife conservation and restoration programs.

Within the specific boundaries of the formal guidance[12] required for participation in the program, the states have worked together in developing their own voluntary self-guidance, alongside guidance provided by the Association of Fish and Wildlife Agencies[13].

State Perspective on The Wildlife Action Plan

The WAP addresses an expansive array of wildlife and habitats across the entire state of Utah. It is intended to be a 10-year strategic plan rather than a prescriptive, short-term action plan. This plan aims to facilitate and guide coordinated action among the various members of Utah's wildlife conservation

---

[11] 16 U.S. Code § 669 *et seq*

[12] FWS developed guidance for states to develop Wildlife Action Plans to meet Congressional requirements. Browse http://fawiki.fws.gov/display/WTK/Toolkit+Homepage.

[13] Publications: Voluntary Guidance for States to Incorporate Climate Change into State Wildlife Action Plans and Other Management Plans, Measuring the Effectiveness of State Wildlife Grants, Best Practices for State Wildlife Action Plans - Voluntary Guidance to States for Revision and Implementation. http://www.fishwildlife.org/index.php?section=resources-other Accessed December 1, 2014.

community. These members include UDWR, other state and federal natural resource agencies, as well as interested local governments, individuals and NGOs. It also aims to motivate the wildlife conservation community towards deeper engagement with other sectors of society. These other sectors have their own mandates and interests for delivering crucial goods and services such as energy, water, food, and recreation. These other mandates and interests can be a source of conflicts with the needs of wildlife, and with the interests - and in some cases, the mandates - of the wildlife conservation community.

It is necessary to recognize that there are diverse, competing societal interests, viewpoints, and values in addressing the state's wildlife conservation. Understanding the relationships and valuing other valid perspectives is essential to effective conservation of wildlife. Even for the most successful conservation programs, such as recovery of the peregrine falcon or bald eagle, maintaining gains relies upon continued successful integration of conservation with other societal needs and values. Community attitudes determine how conservation proceeds. The WAP is conceived as a wildlife conservation guide for Utah's entire community: agricultural producers, wildlife enthusiasts, industry groups, advocacy organizations, and agencies. The guiding principles of this strategy are to:

- acknowledge and respect the pivotal role that local stakeholders play in conservation
- enhance and integrate, not replace or diminish, other planning efforts
- maintain an atmosphere of inclusiveness and cooperation among wildlife managers, landowners, private and public land managers, and other stakeholders while planning and implementing conservation actions
- maintain enough flexibility to incorporate research and management innovations into conservation actions
- manage for healthy habitats, for the benefit of all species
- identify and tackle the highest-priority conservation threats, and try not to get distracted by minor, inessential, or low-priority concerns

Representatives from agencies such as the Bureau of Land Management, U.S. Forest Service, Natural Resources Conservation Service, and FWS participated in the preparation of this plan. Nonetheless, those agencies will by necessity consider this plan as non-compulsory guidance as they follow their own planning processes and satisfy their own legal requirements while developing project proposals, preparing decision documents, and implementing collaborative conservation actions.

Utah's Wildlife Action Plan is not a singular plan for one agency or entity. The task of preserving and managing Utah's fish and wildlife is far too large, far too complex, for one agency to achieve alone. The intention of the Wildlife Action Plan is to facilitate cooperation with adjacent state wildlife agencies, as well as with local, state, and regional organizations, to more successfully achieve range-wide wildlife species conservation within Utah's area of influence.

The support of many long-term partners has been crucial to the implementation of the previous plan and the revision and development of this one. Over time, UDWR has tried to establish an inclusive and welcoming environment by developing and operating within a Team Charter establishing our purpose, roles, tasks, and decision-making procedures. An important part of those procedures has been offering partners equal voting powers when decisions cannot be made by consensus. The partnership, or team, operating under this charter is known as the Joint Team.

UDWR and its partners are already implementing some of the actions enumerated in this new plan. Over the next decade of WAP implementation, the Joint Team will apply new knowledge and skills to these ongoing tasks as they continue to learn about the wildlife and habitats at risk. However, there are also new actions that need to be initiated, or substantially expanded, to adequately abate the overarching threats to wildlife and habitats. Most of the actions in this category are ones for which the wildlife conservation community lacks the authority or the capacity to undertake. Identifying agencies and organizations that have the authority and capacity to undertake these actions will be vital to the successful employment of this plan.

This document identifies a set of primary conservation challenges, from a statewide perspective, and then offers a framework for addressing them. The framework can be used by anyone as a resource for planning, building partnerships, and designing projects. At a minimum, the framework will help direct the allocation of UDWR staff and funding. Ideally, it also will help guide conservation efforts undertaken by our partners, and thereby better focus statewide efforts to conserve fish and wildlife in Utah.

Public Participation in Developing, Revising, and Implementing the WAP

UDWR is subject to two legislated processes that encourage public participation in decisions regarding wildlife and habitat, including the development and approval of the WAP. These are:

- Regional Advisory Councils and Utah Wildlife Board (Board)
- Utah's Designation of State Species of Concern (SOC)

The SOC process is triggered on an as-needed basis. The Board process is continuous, with six meetings per year, and will continue providing Utah residents with opportunities to maintain their involvement in WAP implementation. For more information on these processes see the Partnerships and Implementation Mechanisms Chapter.

Besides formal public processes, UDWR and Joint Team member organizations will continue to engage stakeholders and the public in the development and implementation of conservation actions to abate priority threats, as well as address data gaps. In addition, while there is no requirement for the WAP to specifically address education and outreach activities, UDWR and partners recognize the strategic importance of these efforts, and many potential conservation actions have been suggested to address this need. See the Threats and Actions chapter for more details.

Summary of Plan Changes from 2005 to 2015

In 2012, members from the Joint Team and other partner organizations[14] developed and approved a plan to review and revise the 2005 WAP, and thereby develop the 2015 edition. In sum, the 2005 edition was discarded and the 2015 edition was built from the ground up. Principal changes are:

- we developed and used comprehensive, transparent, and systematic processes for defining the lists of species of greatest conservation need and key habitats
- we adopted and used standardized methods and measures for defining the status of all species and for terrestrial habitats; these measures are integrated into our effectiveness monitoring
- we adopted and extended a comprehensive, standard lexicon for defining threats, data gaps, and conservation actions
- we adopted and used a standardized method of measuring threat impacts to each species and habitat, and prioritized threats across the entire target set
- we included an implementation chapter

In 2013, WAP developers completed threat assessments across all WAP species and habitats. These assessments have identified some overarching threats that significantly affect many species and habitats, over a large portion of their range in Utah. By focusing on abating these overarching threats, the team can work more efficiently to improve the health of wildlife populations and their habitats. Finite resources can be directed in areas where they generate larger, more concentrated conservation accomplishments. The ultimate goal is to ensure the continued presence and health of native wildlife and habitats.

Future Review and Revision of the Wildlife Action Plan

Reviewing and revising the 2005 edition of the WAP required approximately three years of hard work by many individuals in many organizations. The Joint Team has labored to develop a 2015 edition whose review will be greatly facilitated by a short, clear list of performance indicators for species, habitats, data gaps, and threats. Nevertheless, we recommend that comprehensive review and revision of the 2015 WAP be initiated no later than June of 2022. Specifically, we recommend the next review and revision process be directed by the WAP Joint Team or a similar collaborative, interagency oversight body, and begin by:

- updating all species and habitat threat assessments[15]
- updating all species and habitat status assessments[16]
- comparing results of those updates with the initial conditions provided herein

[14] See the Acknowledgements section.
[15] See the Threats and Actions chapter and appendix for more detail.
[16] See the Monitoring chapter for more detail, particularly the Indicators and Measures accounts for SGCNs and Key Habitats.

Chapter Introduction

Utah has over 1025 species of vertebrate and invertebrate wildlife, as defined by the Utah Code[17]. An essential feature in the development and evaluation of any Wildlife Action Plan is the equitable prioritization of conservation targets, as not all wildlife species warrant the same degree of conservation concern or effort. Finite funding and limited personnel availability to carry out conservation work further focuses conservation funding and effort on the wildlife species most in need of protection. Many prioritization schemes already exist for individual taxonomic groups: species are often classified to their relative degree of imperilment, their trends, how secure their habitat is, and the breadth of their distributions. The challenge is to discover an equitable, transparent, and credible approach that spans all taxa.

A crucial early task in rewriting this WAP was deciding which species to include[18]. Working closely with partners, UDWR led the development and implementation of a process to identify our Species of Greatest Conservation Need (SGCNs). The group sought to consider three fundamental factors with our process: the likelihood of an Endangered Species Act listing, the consequences of such a listing, and our ability to influence a listing decision.

The purpose of this chapter is to present a summary of the "distribution and abundance" information on the 141 SGCNs identified by our selected process. Specifically, this chapter presents state and national NatureServe ranks, which provide an integrated, weighted index of rarity, trends, and threats, with rarity (the inverse of "abundance") assigned most of the weight. Besides these ranks, more Utah-specific information about rarity, trends, and distribution is presented in this chapter (threats are handled in the Threats and Actions chapter). A few points are worth making about these ranks and the way they were used to identify SGCNs in Utah:

- No single rank, index, or score can possibly give "the whole picture", but the NatureServe method provides a uniform, credible, and documented approach.
- This approach translates seamlessly across taxonomic groups, across states, and jurisdictional boundaries.
- NatureServe ranks are updated periodically with new inventory and assessment data from UDWR and many partners.
- See the SGCN Methods appendix for more information on the SGCN identification process.

[17] Only such "jurisdictional wildlife" were considered for inclusion in Utah's Wildlife Action Plan. Organisms that were determined to be outside the scope of this planning effort include plants, fungi, and all invertebrate animals other than mollusks and crustaceans. These organisms are all beyond the management jurisdiction of the Utah Division of Wildlife Resources, therefore it was felt they were inappropriate for inclusion in a UDWR-led conservation planning effort.

[18] See the SGCN Methods appendix for full documentation of this process.

To help interpret the material presented in this chapter, here is a brief explanation[19] of the various levels and ranks.

Global, national, and subnational levels

NatureServe conservation statuses may be applied at any or all of three geographical levels. The WAP uses two of these levels, N and S:

- G - Ranks designated at the global (or range-wide) level (G-rank).
- N - Ranks designated at a national level (N-rank) for a particular nation.
- S - Ranks designated at a subnational or state level (S-rank).

Commonly encountered conservation status ranks

Conservation status ranks primarily consist of numbers, which are sometimes replaced by or used in conjunction with letters or punctuation marks. The numbers used are:

- 1 - Critically imperiled (typically having 5 or fewer occurrences, or 1,000 or fewer individuals).
- 2 - Imperiled (typically having 6 to 20 occurrences, or 1,001 to 3,000 individuals).
- 3 - Vulnerable (rare; typically having 21 to 100 occurrences, or 3,001 to 10,000 individuals).
- 4 - Apparently secure (uncommon but not rare, but with some cause for long-term concern; typically having 101 or more occurrences, or 10,001 or more individuals).
- 5 - Secure (common, widespread, abundant, and lacking major threats or long-term concerns).

Thus, for example, an N3 species is "nationally vulnerable", and an S2 species is "state imperiled" for the particular state the rank is assigned. According with NatureServe convention, a state numerical rank cannot imply that the species is more secure at the state level than it is nationally or globally (e.g., a rank of N1/S3 cannot occur). However, in a few cases we have violated this convention, for these reasons:

- State ranks are assigned and maintained by state natural heritage programs and conservation data centers. The Utah Natural Heritage Program (UNHP) is located within UDWR, which updates state ranks periodically - every 5 years or so.
- National and Global ranks are assigned and maintained by NatureServe, a non-profit organization and also a network of over 80 state, provincial, and other "subnational" (e.g., Navajo Nation, Tennessee Valley Authority) natural heritage programs. NatureServe updates its National and Global ranks at much longer intervals - often 15-20 years - than many state programs.
- Logic dictates that a species' actual (versus reported) conservation status would change more quickly in smaller areas (e.g., states) than in much larger ones (e.g., nations). State programs may prefer to maintain, report, and use current information, rather than communicate

[19] Derived from material found at 1) http://en.wikipedia.org/wiki/NatureServe_conservation_status and 2) http://explorer.natureserve.org/nsranks.htm, both accessed January 29, 2015.

information they know to be outdated and incorrect, while waiting for NatureServe to update their ranks. This is the case in Utah.

The letters and punctuation marks used in our conservation status ranks are listed below. These (and others not currently applicable in Utah) can be applied at the Global, National, and State levels. They can be used in conjunction with numbers, or they may stand alone:

- B – Breeding, conservation status refers to the breeding population of the species. Follows the numeric part of the rank, if used.
- N – Nonbreeding, conservation status refers to the non-breeding population of the species in the nation or state/province. Along with "B", used here for migratory birds and bats. If a conservation status rank does not include "B" and/or "N" after the number, or after one of the letters or marks below, the species resides within that level (whether G, N, or B) all year.
- H - Of historical occurrence but not known recently extant. Possibly extinct or extirpated, but with some reasonable hope of rediscovery. Routinely applied after 20 years of no observations (whether or not any surveys were conducted). *Used instead of a number*.
- NR – Not ranked, i.e. not yet assessed. *Used instead of a number*.
- U – Unrankable, due to conflicting or inadequate information. *Used instead of a number*.
- X - Presumed extinct or extirpated, with rediscovery not reasonably expected. Not located despite extensive and intensive searches. Extinction is a global (range-wide) phenomenon, while extirpation applies to loss within a particular national or subnational area, with the entity still extant elsewhere. *Used instead of a number*.
- #/# – Range of ranks due to uncertainty, e.g. S2/S3 indicates a state rank ranging from S2 to S3. Limited to two ranks of difference, beyond which the status would be U for Unrankable (e.g. S1/S4 would instead be listed as SU).
- ? - Recorded within a nation or state, but local status not available, not yet determined, or 'Indeterminate'. *Used instead of a number*.

The 2015 list of SGCNs is presented in Table 2. See the Species Accounts appendix for more information on their abundance and distribution.

Summary Table

Table 2. Utah Species of Greatest Conservation Need.

Common Name	Scientific Name	S Rank	N Rank[20]	T&E Status
Amphibians				
Arizona Toad	*Anaxyrus microscaphus*	S3	N3/N4	
Columbia Spotted Frog	*Rana luteiventris*	S3	N2/N3	
Great Plains Toad	*Anaxyrus cognatus*	S1	N5	
Mexican Spadefoot	*Spea multiplicata*	S1	N5	
Northern Leopard Frog	*Lithobates pipiens*	S3	N5	
Plains Spadefoot	*Spea bombifrons*	S1	N5	
Relict Leopard Frog	*Lithobates onca*	SX	N1/N2	Candidate
Western Toad	*Anaxyrus boreas*	S3	N4	Under review
Birds				
American Bittern	*Botaurus lentiginosus*	S3/S4B,S3N	N4B, N4N	
American White Pelican	*Pelecanus erythrorhynchos*	S3B	N4	
Bald Eagle	*Haliaeetus leucocephalus*	S2B,S4N	N5B, N5N	
Band-tailed Pigeon	*Patagioenas fasciata*	S3B	N4B,N4N	
Bendire's Thrasher	*Toxostoma bendirei*	SU	N4B,NNRN	
Black Rosy-finch	*Leucosticte atrata*	S1	N4	
Black Swift	*Cypseloides niger*	S2B	N4B	
Boreal Owl	*Aegolius funereus*	S2	N4	
Burrowing Owl	*Athene cunicularia*	S3B	N4B, N4N	
California Condor	*Gymnogyps californianus*	S1	N1	Endangered: 10-j nonessential[21], in part[22]
Caspian Tern	*Hydroprogne caspia*	S3B	N4/N5B,N4N	
Columbian Sharp-tailed Grouse	*Tympanuchus phasianellus*	S2	N4	
Ferruginous Hawk	*Buteo regalis*	S3B	N4B,N4N	
Flammulated Owl	*Psiloscops flammeolus*	S3/S4B	N4B	
Golden Eagle	*Aquila chrysaetos*	S4	N5B, N5N	
Greater Sage-grouse	*Centrocercus urophasianus*	S3	N3N4	Candidate
Gunnison Sage-grouse	*Centrocercus minimus*	S2	N1	Threatened
Lewis's Woodpecker	*Melanerpes lewis*	S3	N4B,N4N	

[20] N (national) and S (state) Conservation Status Ranks.
[21]Under ESA Section 10(j), the Secretary of Interior can designate reintroduced populations established outside the species' current range, but within its historical range, as "experimental." On the basis of the best available information, FWS determines whether an experimental population is "essential" or "nonessential" to the continued existence of the species. A "nonessential" designation for a 10(j) experimental population means that the experimental population is not considered essential for the continued existence of the species. Regulatory restrictions are considerably reduced under a Nonessential Experimental Population (NEP) designation.
[22] http://ecos.fws.gov/docs/federal_register/fr2927.pdf accessed February 17, 2015.

Mexican Spotted Owl	*Strix occidentalis lucida*	S2	N3	Threatened
Northern Pygmy-owl	*Glaucidium gnoma*	S3/S4B	N4N5	
Olive-sided Flycatcher	*Contopus cooperi*	S3/S4B	N4B	
Peregrine Falcon	*Falco peregrinus*	S3B	N4B,N4N	
Snowy Plover	*Charadrius nivosus*	S3B	N3B, N3N	
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	S1B	N1B	Endangered
White-faced Ibis	*Plegadis chihi*	S2/S3B	N4B, N4N	
Western Yellow-billed Cuckoo	*Coccyzus americanus occidentalis*	S2B	N3B	Threatened

Crustaceans

Pilose Crayfish	*Pacifastacus gambelii*	S2	N4/N5	
Utah Amphipod	*Stygobromus utahensis*	SNR	N1/N2	

Fishes

Bear Lake Sculpin	*Cottus extensus*	S1	N3	
Bear Lake Whitefish	*Prosopium abyssicola*	S1	N1	
Bluehead Sucker	*Catostomus discobolus*	S3	N4	
Bonneville Cisco	*Prosopium gemmifer*	S1	N3	
Bonneville Cutthroat Trout	*Oncorhynchus clarkii utah*	S4	N4	
Bonneville Whitefish	*Prosopium spilonotus*	S1	N3	
Bonytail	*Gila elegans*	S1	N1	Endangered
Colorado Pikeminnow	*Ptychocheilus lucius*	S3	N1	Endangered
Colorado River Cutthroat Trout	*Oncorhynchus clarkii pleuriticus*	S3	N2/N3	
Desert Sucker	*Catostomus clarkii*	S3	N3/N4	
Flannelmouth Sucker	*Catostomus latipinnis*	S3	N3/N4	
Humpback Chub	*Gila cypha*	S2	N1	Endangered
June Sucker	*Chasmistes liorus*	S2	N1	Endangered
Least Chub	*Iotichthys phlegethontis*	S2	N1	Candidate
Northern Leatherside Chub	*Lepidomeda copei*	S2?	N3	
Razorback Sucker	*Xyrauchen texanus*	S2	N1	Endangered
Roundtail Chub	*Gila robusta*	S2	N3	
Southern Leatherside Chub	*Lepidomeda aliciae*	S2	N2	
Virgin Chub	*Gila seminuda*	S1	N1	Endangered
Virgin Spinedace	*Lepidomeda mollispinis*	S2	N2	Petitioned
Woundfin	*Plagopterus argentissimus*	S1	N1	Endangered
Yellowstone Cutthroat Trout	*Oncorhynchus clarkii bouvieri*	S3	N2	

Mammals

[a Race of the] Botta's Pocket Gopher	*Thomomys bottae robustus*	S2	N2	
[a Race of the] Montane Vole	*Microtus montanus rivularis*	SH	N2	
Allen's Big-eared Bat	*Idionycteris phyllotis*	S3	N3/N4	
American Bison	*Bos bison*	S2	N4	

American Pika	*Ochotona princeps*	S4	N5	
Big Free-tailed Bat	*Nyctinomops macrotis*	SU	N3/N4	
Bighorn Sheep	*Ovis canadensis*	S3?	N4	
Black-footed Ferret	*Mustela nigripes*	S1	N1	Endangered: 10-j nonessential
Canadian Lynx	*Lynx canadensis*	S2	N4?	Threatened
Chisel-toothed Kangaroo Rat	*Dipodomys microps celsus*	S1?	N4	
Dark Kangaroo Mouse	*Microdipodops megacephalus*	S3	N4	
Dwarf Shrew	*Sorex nanus*	S3	N4	
Fringed Myotis	*Myotis thysanodes*	S2B	N4	
Gray Wolf	*Canis lupus*	SX	N4	Endangered
Gunnison's Prairie Dog	*Cynomys gunnisoni*	S3	N5	
Idaho Pocket Gopher	*Thomomys idahoensis*	SH	N4	
Kit Fox	*Vulpes macrotis*	S3	N4	
Little Brown Myotis	*Myotis lucifugus*	S4	N3	
Preble's Shrew	*Sorex preblei*	S2	N4	
Pygmy Rabbit	*Brachylagus idahoensis*	S3	N4	
Spotted Bat	*Euderma maculatum*	S3	N3/N4	
Townsend's Big-eared Bat	*Corynorhinus townsendii*	S4	N3/N4	
Utah Prairie Dog	*Cynomys parvidens*	S2	N1	Threatened
Western Red Bat	*Lasiurus blossevillii*	SU	N3	
White-tailed Prairie Dog	*Cynomys leucurus*	S3	N4	
Wolverine	*Gulo gulo*	S2	N4	Candidate

Mollusks

[a Race of the] Yavapai Mountainsnail	*Oreohelix yavapai cummingsi*	S1	N3	
[a species of] Fossaria	*Fossaria techella*	SH	N3/N4	
Bear Lake Springsnail	*Pyrgulopsis pilsbryana*	S1	N2	
Bifid Duct Pyrg	*Pyrgulopsis peculiaris*	S1	N2	Under review
Black Canyon Pyrg	*Pyrgulopsis plicata*	S1	N1	
Brian Head Mountainsnail	*Oreohelix parawanensis*	S1	N1	
California Floater	*Anodonta californiensis*	S2	N3	
Carinate Glenwood Pyrg	*Pyrgulopsis inopinata*	S1	N1	
Cloaked Physa	*Physa megalochlamys*	S1?	N3	
Coarse Rams-horn	*Planorbella binneyi*	SH	N3/N4	
Cross Snaggletooth	*Gastrocopta quadridens*	SH	N2/N3	
Deseret Mountainsnail	*Oreohelix peripherica*	S2	N2	
Desert Springsnail	*Pyrgulopsis deserta*	SH	N2	
Desert Tryonia	*Tryonia porrecta*	S2?	N2	
Eureka Mountainsnail	*Oreohelix eurekensis*	S1	N1	
Fat-whorled Pondsnail	*Stagnicola bonnevillensis*	S3	N1	
Green River Pebblesnail	*Fluminicola coloradoensis*	S2/S3	N2/N3	
Hamlin Valley Pyrg	*Pyrgulopsis hamlinensis*	S1	N1	Under review

Kanab Ambersnail	*Oxyloma kanabense*	S1	N1	Endangered
Lamb Rams-horn	*Planorbella oregonensis*	SH	N1	
Longitudinal Gland Pyrg	*Pyrgulopsis anguina*	S1	N1	Under review
Lyrate Mountainsnail	*Oreohelix haydeni*	S2	N2/N3	
Mill Creek Mountainsnail	*Oreohelix howardi*	SH	N1	
Mitered Vertigo	*Vertigo concinnula*	SH	N4	
Montane Snaggletooth	*Gastrocopta pilsbryana*	SH	N4/N5	
Mountain Marshsnail	*Stagnicola montanensis*	SH	N3	
Ninemile Pyrg	*Pyrgulopsis nonaria*	S1	N1	
Northwest Bonneville Pyrg	*Pyrgulopsis variegata*	S1	N2	
Otter Creek Pyrg	*Pyrgulopsis fusca*	S1	N1	
Ribbed Dagger	*Pupoides hordaceus*	SH	N4	
Rocky Mountain Duskysnail	*Colligyrus greggi*	S1	N4	
Rustic Ambersnail	*Succinea rusticana*	SH	N2/N3	
Sierra Ambersnail	*Catinella stretchiana*	SH	N3	
Sluice Snaggletooth	*Gastrocopta ashmuni*	SH	N4/N5	
Smooth Glenwood Pyrg	*Pyrgulopsis chamberlini*	S1	N1	
Southern Bonneville Springsnail	*Pyrgulopsis transversa*	S1	N2	
Southern Tightcoil	*Ogaridiscus subrupicola*	SH	N1	
Striate Gem	*Hawaiia neomexicana*	SH	N2	
Sub-globose Snake Pyrg	*Pyrgulopsis saxatilis*	S1	N1	Under review
Thin-lip Vallonia	*Vallonia perspectiva*	SH	N4/N5	
Top-heavy Column	*Pupilla syngenes*	S3/S4	N4	
Utah Physa	*Physella utahensis*	S1	N2	
Western Pearlshell	*Margaritifera falcata*	S1	N4	
Wet-rock Physa	*Physella zionis*	S1	N1	
Widelip Pondsnail	*Stagnicola traski*	SH	N3	

Reptiles

Black-necked Gartersnake	*Thamnophis cyrtopsis*	S3	N5	
Desert Night Lizard	*Xantusia vigilis*	S2	N5	
Gila Monster	*Heloderma suspectum*	S2	N4	
Many-lined Skink	*Plestiodon multivirgatus*	S1	N5	
Midget Faded Rattlesnake	*Crotalus oreganus concolor*	SNR	N4	
Mojave Desert Tortoise	*Gopherus agassizii*	S2	NNR	Threatened
Pyro Mountain Kingsnake	*Lampropeltis pyromelana*	S3	N4	
Smith's Black-headed Snake	*Tantilla hobartsmithi*	S3	N5	
Spotted Leaf-nosed Snake	*Phyllorhynchus decurtatus*	S1	N5	
Utah Banded Gecko	*Coleonyx variegatus utahensis*	S3	N4	
Utah Milksnake	*Lampropeltis triangulum taylori*	S3	N4	
Western Threadsnake	*Rena humilis*	S3	N5	

Chapter Introduction

"Habitat" is an apparently simple term, often used to mean the place where an animal normally lives. However, the task of defining - let alone protecting, restoring, and managing - adequate habitat is more complicated. People are often surprised to learn there is no single universally-accepted definition of habitat[23]. There isn't, because there are multiple concepts of habitat, some of which partially overlap. We often think and talk about habitat for a species, or for groups ("guilds") of species, as though they each have similar, static requirements. But even within a single species, the relationships between animals and their habitat differ across scales of space and time – at the distributional scale of an entire species, or just a distinct population; at the home-range scale of individual animals, at different times of year, and often by age class (e.g., larval vs. adult toad or trout, and chick vs. adult grouse or tern).

Within the realm of wildlife managers and stakeholders, the traditional concept of habitat encompasses all the biological and physical resources (food and water, shelter and security, space to roam, etc.) - as well as a sense of place - that wildlife require to survive and reproduce. This concept is useful, but other associated terms and concepts (such as functional niche, potential niche, realized niche, ecotope, biotope, and environment) need to be taken into consideration on a case-by-case basis, per individual species and life stage.

In this chapter habitats are considered and presented at a large geographic scale – the entire state of Utah – and in this sweeping presentation, some generalization and pooling of differences must occur. For example, the terrestrial habitats are named after coarse-scale physical vegetation units that generally meet the needs of most SGCNs and other wildlife species, when those habitats are intact and appear to be functioning normally.

The way that broad-scale habitats are named requires a little explanation. For example, the approach taken here says that greater sage-grouse and boreal toad share mountain sagebrush habitat. But those two species' food, cover, and space needs are very different, even though the animals can at times be found in the same spot. The chemical and physical processes, and the biological inhabitants that all come together on our landscapes and result in the vegetative expression that we call "mountain sagebrush," are also the factors that together meet the needs of greater sage-grouse and boreal toad, for at least some part of their life cycles. So, mountain sagebrush is a key habitat for sage-grouse and boreal toad, but the individuals use the habitat differently and on different scales.

Working closely with partners, UDWR led the development and implementation of two distinct processes to identify the WAP Key Habitats (terrestrial and aquatic). See the Habitat Methods appendix for full documentation of these processes. Eight terrestrial and five aquatic Key Habitats were identified. This chapter presents summary information on their "extent and condition," drawing from the processes described in the Habitat Methods appendix.

<u>Terrestrial Key Habitats</u>

---

[23] See for example Whittaker et al. 1973. Niche, Habitat, and Ecotope. The American Naturalist 107(955):321-338. Despite numerous treatments of the subject in the intervening 40+ years, the issue appears unsettled.

The method used to identify and assess the Terrestrial Key Habitats (described in detail in the Habitat Methods appendix) followed a logical, step-wise process:

- Evaluate existing sets of habitat data that are available for Utah, and select the data set that best meets the requirements of WAP Element 2 (extent and condition). The national LANDFIRE data set was selected.[24]
- Using the LANDFIRE data, identify all habitats that occur in Utah.
- For all such habitats that occur in Utah, design and apply a process to pick out the *Key* Habitats.
- Determine and display the current condition of the Key Habitats, using an integrated metric known as Ecological Departure. This metric quantifies discrepancies (surpluses and deficits) between current and historical, or *reference*, age-class distributions of the Key Habitats.

For each Terrestrial Key Habitat, a short account in this chapter presents acreage values and general assessment of condition, based on how distant the habitat appears to be from its natural age-class distribution. Each write-up also contains a map depicting the location of the Terrestrial Key Habitat within Utah. Summary statistics of the eight Terrestrial Key Habitats appear in Table KH1:

Table KH 1. Summary of the eight Terrestrial Key Habitats in Utah.

Terrestrial Key Habitat	Acres	% of Utah's Land Area
Aspen-Conifer	2,988,620	5.50%
Desert Grassland	331,185	0.61%
Gambel Oak	2,042,775	3.76%
Lowland Sagebrush	11,695,319	21.52%
Mojave Desert Shrub	482,009	0.89%
Mountain Meadow	74,419	0.14%
Mountain Sagebrush	2,338,378	4.30%
Mountain Shrub	1,436,147	2.64%
TOTAL	**21,388,852**	**39.36%**

Within each Terrestrial Key Habitat write-up, condition descriptions and bar graphs refer to units known as Biophysical Settings (BpS) and Vegetation (Veg) Classes. These units are described in more detail in the Habitat Methods appendix. A short summary of each is provided here:

Biophysical Settings are physical, abiotic units. Each one expresses a particular set of soils, precipitation, climate, elevation, exposure, etc., which leads to a dominant type of vegetation that is expected in a given physical environment, under a natural disturbance regime

[24] The LANDFIRE Program is a vegetation-mapping and -modeling partnership of the US Forest Service, Bureau of Land Management, and The Nature Conservancy.

characteristic of that physical environment. Though defined and named by the dominant vegetation expected to inhabit them, Biophysical Settings are not units of existing vegetation. The LANDFIRE program named the Biophysical Settings, and assigned a five-digit BpS code to each one; these names and codes are listed within each Key Habitat write-up.

Vegetation Classes are units within Biophysical Settings defined by factors of vegetation age (succession), structure, and naturalness. The naturalness factor broadly separates Vegetation Classes into two categories: (1) Reference (natural) conditions, and (2) Uncharacteristic (unnatural) conditions.

Reference Classes generally reflect site/vegetation conditions as they were prior to European settlement. Reference Classes are designated by the letters A, B, C, D, and E (though D/E are not always used), and generally correspond with advancing classes of stand age and structure (i.e., closed or open structure), or succession status; i.e.,

A → B → C → D → E = Young → Middle-Aged → Old = Early → Mid → Late Succession

Uncharacteristic Classes, designated by the letter U, reflect severely altered ecological conditions resulting from post-settlement human disturbances or management.

No single rank or score can show all relevant details, but this method provides a reasonably accurate, concise description that translates across terrestrial Key Habitats and across state boundaries. Also, this system is updated periodically with new disturbance[25] and monitoring data. These data are provided to the national LANDFIRE program by organizations and agencies including UDWR and partners.

For questions or issues about Terrestrial Key Habitats that are not adequately addressed in this sub-section, or within the Terrestrial Key Habitat write-ups below, the reader is referred to the Habitats Methods Appendix.

A working hypothesis taken up here is that the reference age-class distribution of the habitats – a product of natural succession and disturbance agents – is the best condition for each habitat itself, and also for the entire suite of wildlife species dependent upon it. This is particularly applicable to those species referred to as "landscape species" such as sage-grouse, golden eagles, bison, and wolverines.

A corollary proposition of this working hypothesis is that the best way to help all the species dependent on these coarse-scale habitats is to manage the habitats towards their expected age-class distribution. This would occur by means of a very large-scale (perhaps even statewide) program of stewardship and restoration. Some important points to keep in mind while considering this large-scale approach to managing terrestrial habitats include:

[25] Disturbances include natural and anthropogenic events. These include land-use conversions, extreme weather events, insect activity, wildfire, prescribed fire, timber harvest, range manipulations, and more.

- This management approach is not meant to be applied to the management of those species with very specific and narrow ecological niches and habitat requirements, or with very restricted geographic distributions, such as mountainsnails, shorebirds, and most of our aquatic SGCNs.
- This management approach is not meant to replace or diminish management consideration of fine-scale habitats or habitat features embedded within the coarse-scale vegetation units, such as springs, talus slopes, and rock outcrops.
- These specialist species, and these fine-scale habitats and habitat features, will still need to be managed on a localized case-by case basis, and care will need to be taken to not overlook and potentially harm them, as we focus our large-scale stewardship and restoration program on the more coarse-scale habitats by manipulating vegetation classes.

Individual Terrestrial Key Habitat accounts also include some management recommendations, intended to help project developers focus on activities that will help reduce departure and improve landscape-scale habitat condition.

Aquatic Key Habitats

To identify and name Aquatic Key Habitats in Utah, a process generally similar to that used for the terrestrial ones was developed and used, but with some specific, significant differences. Most importantly, it was found that 1) the geospatial data sets and associated vegetation models, and consequently 2) the process used to determine extent and condition, of Terrestrial Key Habitats (outlined above) were not available and/or applicable to make those determinations for aquatic habitats in Utah. An entirely different route had to be followed. This companion process is described in detail in the Habitat Methods appendix.

This chapter presents a short list of points giving each Aquatic Key Habitat's extent in Utah, including acreage value and percent of land area. Following these lists are maps that depict the location of each Aquatic Key Habitat within Utah. Additional maps of these Aquatic Key Habitats are available online by searching the UDWR website[26]. Summary statistics of the five Aquatic Key Habitats appear in Table KH-2:

Table KH-2. Summary of the five Aquatic Key Habitats in Utah.

Aquatic Key Habitat	Acres	% of Utah's Land Area
Aquatic-Forested	4,460	0.01%
Aquatic-Scrub/Shrub	54,428	0.10%
Riverine	120,256	0.22%
Emergent	375,399	0.69%

[26] http://wildlife.utah.gov/

Open Water	882,641	1.62%
TOTAL	**1,437,184**	**2.64%**

Condition Inference from Threats

On a statewide basis, little is known about the overall current condition of Utah's aquatic habitats. The general impression among resource professionals is, "poor and declining." Detailed site-specific condition assessment is available for localized areas, such as the wetlands associated with Great Salt Lake and Snake Valley (Menuz et al. 2014[27]; Jones et al. 2014[28]). However, no comprehensive statewide-scale assessment has yet been implemented.

Despite the continuing lack of statewide-scale aquatic habitat condition assessment, it is worth noting some of the progress towards that end, which has been made since the 2005 WAP was approved.

- National Wetlands Inventory (NWI) data are now available for the entirety of the state of Utah.
- The Utah Geological Survey (UGS) has developed a functional classification protocol which has been adopted for the 2015 WAP (Emerson and Hooker 2011[29]; Emerson 2014[30])
- The creation of a landscape scale aquatic habitat assessment (EPA Tier I) tool has been initiated by UGS with funding support from WAP partners.
- UGS is currently refining an EPA Tier II style Rapid Wetland Assessment[31] to assist in the determination of aquatic habitat condition.

Historic data suggest that approximately 30% of the state's wetlands and aquatic habitats were destroyed prior to the 1980's, but no comprehensive condition assessment has been implemented to evaluate condition of extant habitat (Dahl 1990[32]). Ongoing stressors associated with urbanization, resource development, and climate change are anticipated to further exacerbate the loss and/or degradation of Utah's aquatic habitat.

---

[27] Menuz, D., R. Sempler and J. Jones. 2014. Great Salt Lake wetland condition assessment. Utah Geological Survey. Available from UGS online library, http://geodata.geology.utah.gov/pages/themes.php?header=Wetlands.
[28] Jones, J., Menuz, D., Emerson, R., and Sempler, R. 2014 Characterizing condition in at-risk wetlands of western Utah: Phase II. Available from UGS online library, http://geodata.geology.utah.gov/pages/themes.php?header=Wetlands.
[29] Emerson,R. and T. Hooker. 2011. Utah wetland functional classification and landscape profile generation within Bear River Bay, Great Salt Lake, Utah. Utah Geological Society. Available from UGS online library, http://geodata.geology.utah.gov/pages/themes.php?header=Wetlands.
[30] Emerson,R. 2014. Utah wetland functional classification. Utah Geological Society. Available from UGS online library, http://geodata.geology.utah.gov/pages/themes.php?header=Wetlands.
[31] Menuz, D., J. Jones, and R. Sempler. 2014. Utah rapid assessment procedure: method for evaluating ecological integrity in Utah wetlands: User's Manual, Version 1.0- Draft. Utah Geological Survey. Also see the Periodic Status Assessments of Key Habitats section of the Monitoring chapter for more details on current and emerging aquatic habitat condition assessment methodologies.
[32] Dahl, T.E. 1990. Wetlands--Losses in the United States, 1780's to 1980's. U.S. Fish and Wildlife Service Report to Congress, 13 pp. Available from https://www.fws.gov/wetlands/Documents/Wetlands-Losses-in-the-United-States-1780s-to-1980s.pdf

None of the datasets proposed for mapping aquatic habitat "extent" adequately address current condition (see Habitat Methods appendix for more detail). LANDFIRE analysis does provide "ecological departure" assessment for a very limited set of aquatic habitats, but it is hampered by its coarse pixel resolution (30m x 30m) and its inability to capture characteristic spatial features of various aquatic habitats, such as small, narrow polygons (e.g. small to moderate streams and springs, narrow riparian margins, etc. (see Habitat Methods appendix for a further discussion)).

Despite the lack of quantitative data, some inferences regarding condition can be made based on the quantity and intensity of threats facing aquatic habitats (see the Threats and Actions chapter, and the Threats Methods appendix for more details). Criteria for identification and scoring of threats included the evaluation of current or foreseeable future threats, and do not assess historic threats that have already impacted aquatic habitat condition (for example, historic practices of draining wetlands prior to establishment of protective legislation). In addition, current/future threats do not necessarily represent a direct impact to condition, as aquatic habitats may face a valid threat that never materializes into an actual impact upon its condition (for example, a groundwater withdrawal request that is declined by regulators). Nonetheless a cursory examination of prominent threats to aquatic habitats in Utah can help one better understand the primary stressors which are likely to impact current aquatic habitat condition (Table KH3; see Threats and Actions chapter for more details).

Table KH3. Summary of Very High, High, and Medium-Impact Threats to Aquatic Key Habitats.

Priority Level-2 Threats	Threat Impact (Scope x Severity)			
	Very High	High	Medium	Grand Total
Improper Livestock Farming and Ranching		2	2	4
Droughts		5		5
Invasive Non-native Species			5	5
Dams and Water Management / Use	11	7	14	32
Other Ecosystem Modifications		3	3	6
Fire and Fire Suppression			2	2
Housing and Urban Areas			4	4
Roads and Railroads			4	4
Grand Total	**11**	**17**	**35**	**63**

Note that 100% of the highest-impact threats to aquatic key habitats are associated with Dams and Water Management / Use suggesting that alterations to natural water, sediment, and temperature regimes have severely impacted aquatic habitat within the state (Table H1).

Ongoing and Planned Condition Data Collection and Analysis

The lack of aquatic habitat condition data was identified by the WAP partners Utah Geological Survey (UGS) and Utah Division of Water Quality (UDWQ), as a primary obstacle to the effective management of wetlands in the state of Utah in 2011. A plan was developed to create an integrated wetland monitoring and assessment program, to facilitate state environmental and natural resource goals (Hooker and Gardberg 2011[33]). The approach, known as "Utah's Wetland Program Plan" (UWPP) identified four main components to be implemented in the years 2011 to 2016 including the following:

1) Develop a scientifically valid and successfully-tested approach to evaluating the condition (i.e., health) of Utah's various wetland systems.
2) Develop methods and approaches to evaluate the extent, abundance, and condition of spring-fed wetlands.
3) Develop a sustainable strategy to map the remainder of Utah's wetlands.
4) Build the scientific information needed to characterize how wetland ecosystems function, and how they respond to natural disturbances as well as management practices.

A significant amount of progress has been made implementing the UWPP, and on achieving complementary (and parallel) goals identified by other WAP partners. This progress has resulted in the development and validation of a more resource-manager-friendly classification of NWI data into eight functional classifications: Emergent, Open Water, Riverine, Forested, Scrub/Shrub, Lacustrine Fringe, Water Pocket, and Playa (Emerson 2014; Emerson and Hooker 2011). The functional classification protocol was evaluated against five other data sets, determined to be the one most appropriate for the purposes of the WAP, and subsequently used to identify Aquatic Key Habitats (see the Habitat Methods Appendix for further discussion).

In addition to mapping and classification, UGS has evaluated and tested three EPA Tier II-style rapid assessment monitoring protocols capable of determining wetland condition (UGS 2014). UGS has recently drafted a protocol specific to Utah aquatic habitats, and utilized it to assess the condition of wetlands adjacent to the Great Salt Lake and in Snake Valley (Menuz et al., 2014; Jones et al. 2014). The most recent protocol, known as the Utah Rapid Assessment Procedure, is near completion and UGS plans to expand analysis to the Weber and Jordan River watersheds in the next three years. Development and implementation of a landscape-scale integrity model has also been initiated to map the distribution and intensity of stressors on wetland and aquatic resources in Utah (Emerson and Menuz 2014). The next version of the UWPP (2016-2021) is currently in development, and scheduled for release in spring 2016.

An essential conservation action in the 2015 WAP is the application of both the landscape-scale integrity model and the rapid assessment methodology to the remaining watersheds in Utah. The current lack of condition-assessment data is also identified as a crucial data gap and further discussed in the Data Gaps section of the Threats and Actions chapter. The WAP Aquatic Habitat Subcommittee was initially formed to help identify aquatic key habitats, and will be retained to provide technical advice and resource support to the UWPP partners to help implement those goals common to both the WAP and UWPP. It will also be utilized to identify additional actions to facilitate addressing the current lack of

[33] Hooker, T. and J. Gardberg. 2011. Utah's Wetland Program Plan. Utah Geological Society. Available from UGS online library, http://geodata.geology.utah.gov/pages/themes.php?header=Wetlands.

statewide aquatic habitat-condition assessment. A number of projects (summarized below) are currently in progress, to determine aquatic habitat condition in Utah and guide future habitat monitoring (Table KH4). See the Periodic Status Assessment of Key Habitats section of the Monitoring chapter for more discussion.

Table KH4: Recommended projects to be implemented to assess aquatic habitat condition in Utah.

Project Name	Lead Agency	EPA Tier	Addresses Data Gap	Indicators[34]	Status
Landscape Integrity Model Related to Wetland and Aquatic Resources in Utah	UGS	I	Aquatic Habitat Condition	Stressors	Preliminary design complete, pending funding
Riverine Riparian Area Mapping to Support ESM for the State of Utah	USU	I	Riparian Extent and Condition	Geomorphic based river classification, mapping, and riparian condition	Ongoing, Colorado Plateau Region nearing completion
Utah Rapid Assessment Procedure	UGS	II	Aquatic Habitat Condition	Multiple Categories: 1) Landscape Context 2) Hydrological Condition 3) Physical Structure 4) Vegetation Structure 5) Plant Species Composition 6) Habitat Calculates Rapid Condition Assessment Scores/Grades	Ongoing, GSL and Snake Valley wetlands complete

[34] Each of the projects have detailed protocols clarifying the indicators and measures to be used.

Location and Condition of Terrestrial Key Habitats

Aspen-Conifer

Extent: Total, and Component Biophysical Settings (LANDFIRE v2010, HUC8 units within Utah boundary)

- Total current mapped area: 2,988,620 acres; 5.5% of state surface area (Figure 2-1).
  - Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland (BpS 10610): 48,298 acres.
  - Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland - High Elevation (BpS 10612): 1,197,004 acres.
  - Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland - Low Elevation (BpS 10611): 485,456 acres.
  - Rocky Mountain Aspen Forest and Woodland (BpS 10110): 1,257,861 acres.
- Distribution: mapped in 66 of 67 HUC8s that overlap Utah.
- Elevation range: Most common between 6,000-11,000 feet. Generally above pinyon-juniper woodlands, and mingling at similar elevations with mountain sagebrush, montane mixed conifer, and subalpine spruce-fir communities – though the latter extend higher than aspen.
- Occurs in a variety of topographic situations, in patch sizes of tens to thousands of acres.

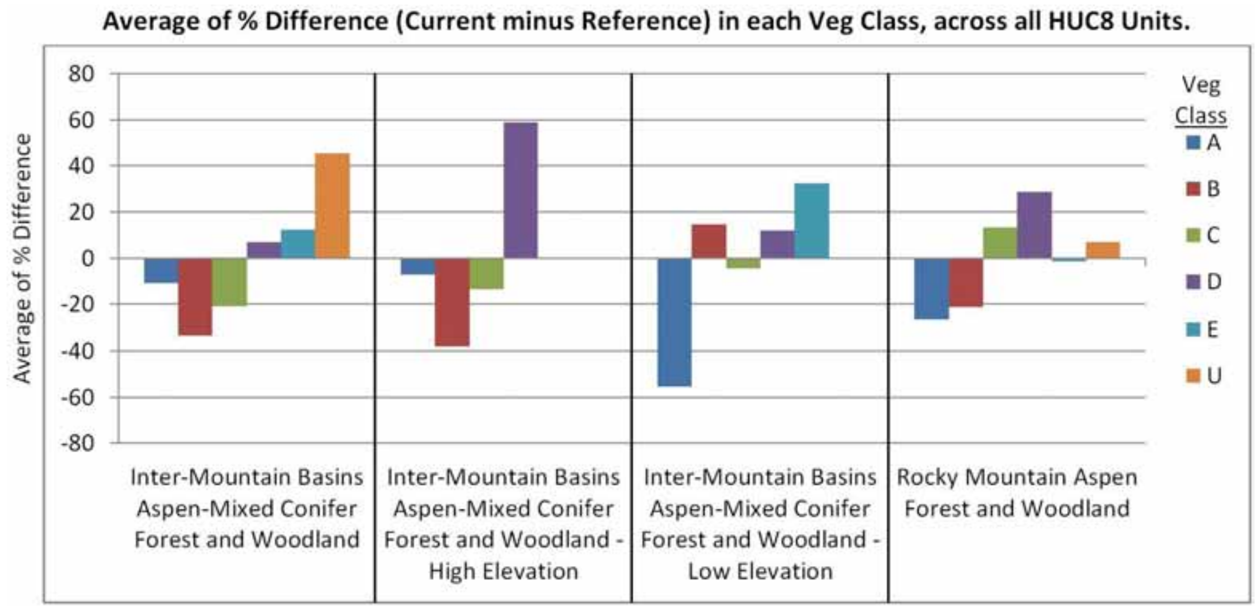
Condition

While the Aspen-Conifer physical (abiotic) habitat remains largely intact in Utah, coverage of aspen itself within that setting has declined greatly for two main reasons: (1) departure from natural fire regime (reduction in disturbance), resulting in widespread forest succession to conifer dominance; and (2) heavy ungulate browsing on young aspen stems, following disturbance.

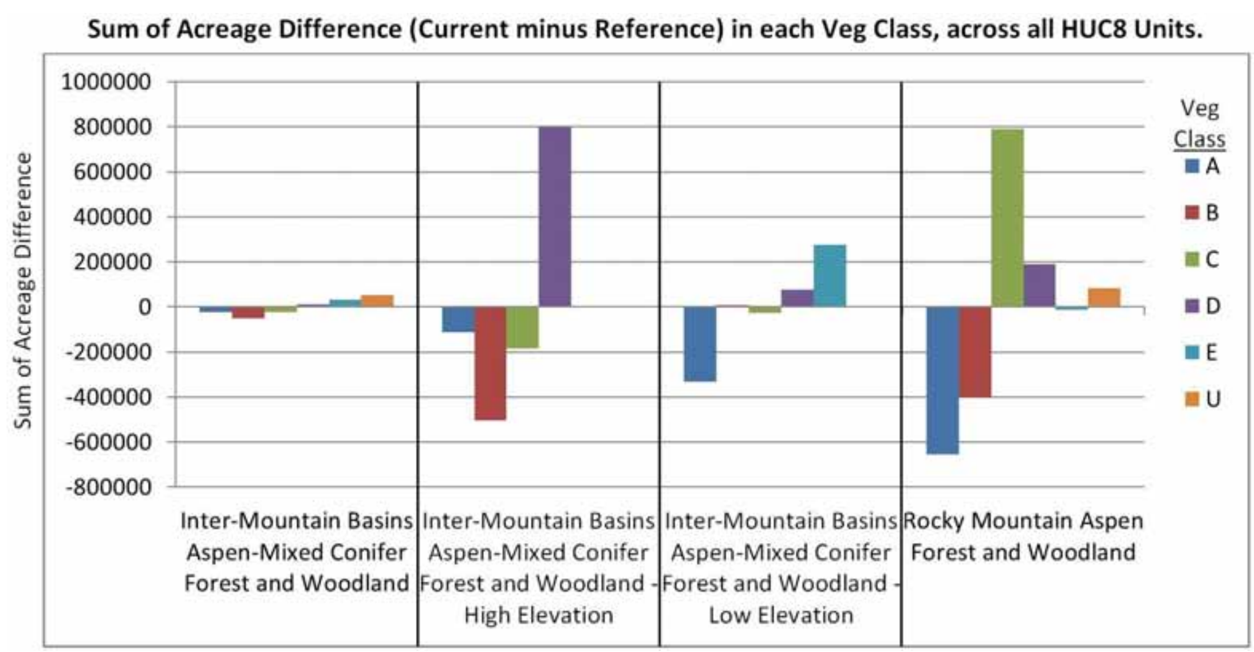
As shown in the chart below, in relative terms the four Biophysical Settings of the Aspen-Conifer Key Habitat on average have:

1. Deficits of young and mid age classes A and B, such that replenishment of aspen-dominated stands is being inhibited; and

2. Surpluses of older and/or conifer-encroached classes C, D, and E, which if left unaddressed, can lead to widespread permanent loss of aspen clones.



In the chart below, the 2nd and 4th Biophysical Settings are by far the most extensive of the Aspen-Conifer Key Habitat. In absolute terms, these two BpSs contain more than 1.5 million surplus acres (greater than expected reference amounts) of older and/or conifer-dominated classes C and D that would be good targets for mechanical treatments, prescribed fire, etc., aimed at converting their acres back into classes dominated by young aspen.



Threats

The following threats to Aspen-Conifer were identified in a statewide assessment described in more detail in the Threats and Actions chapter. Yellow rows indicate WAP priority threats - those that negatively impact many species and habitats including Aspen-Conifer. White rows indicate threats that are important to Aspen-Conifer, but not to as many other species and habitats as the priority threats. The Threats and Actions chapter focuses exclusively on the WAP priority threats.

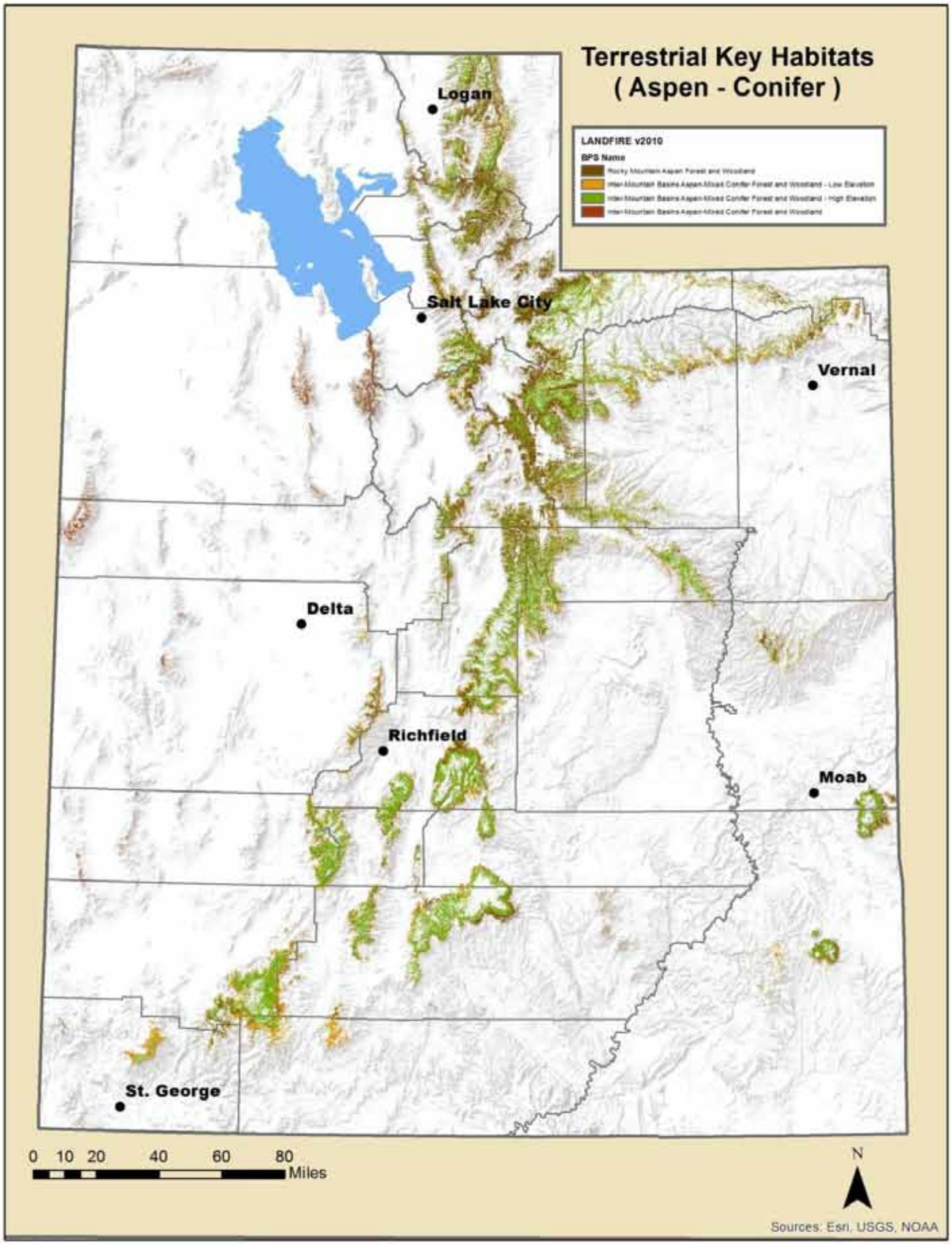
Threats to Aspen-conifer	Threat Impact (Scope x Severity)			
	Very High	High	Medium	Grand Total
Problematic Insects – Native		1		1
Inappropriate Fire Frequency and Intensity	1			1
Seeding Non-native Plants		1		1
Droughts			1	1
Problematic Animal Species – Native			1	1
Habitat Shifting and Alteration			1	1
Problematic Plant Species – Native Upland	1			1
Improper Grazing (current)		1		1
Cabin Communities / Development			1	1
Improper Grazing (historic)	1			1
Grand Total	**3**	**3**	**4**	**10**

Improving Condition

A good strategy for management may include the following elements:

- Increasing disturbance from either prescribed or natural fire. Recent studies have shown that larger scale burns (e.g., 5,000 acres) that burn more intensely have been the most successful in terms of aspen regeneration. Higher-intensity burns stimulate higher numbers of young aspen per unit area, than lower-intensity burns. A larger treatment area distributes ungulate browse pressure, allowing most young aspen stems to reach a safe height.
- Applying mechanical disturbance agents such as timber harvest. This can also be used to stimulate aspen regeneration and avoid or reduce resource losses to conifer beetles. As with fire, larger mechanical treatment areas serve to distribute browsing pressure and reduce damage to individual stems, increasing regeneration success.
- Monitoring smaller, naturally-occurring or human-created disturbances for ungulate damage, and taking follow-up actions such as fencing, hazing, hunting, and/or domestic grazing management, may be required to prevent or reduce damage caused by domestic, wild, or feral ungulates.
- Promoting policies that reduce improper browsing and grazing by domestic livestock and wildlife.

Figure KH-1. Extent of Aspen-Conifer Terrestrial Key Habitat (4 BpSs) in Utah.



Desert Grassland

Extent: Total, and Component Biophysical Settings (LANDFIRE v2010, HUC8 units within Utah boundary)

- Total current mapped area: 331,185 acres; 0.6% of state surface area (Figure 2-2), all in one Biophysical Setting – Inter-Mountain Basins Semi-Desert Grassland (BpS 11350).
- Distribution: mapped in 63 of 67 HUC8s that overlap Utah.
- Elevation range: Most common between 4,500-7,500 feet. Generally adjacent to desert shrub, salt desert shrub, and lowland sagebrush communities.
- Occurs on a variety of landforms generally on gentle topography, usually on xeric sites, mostly in patches of small size.

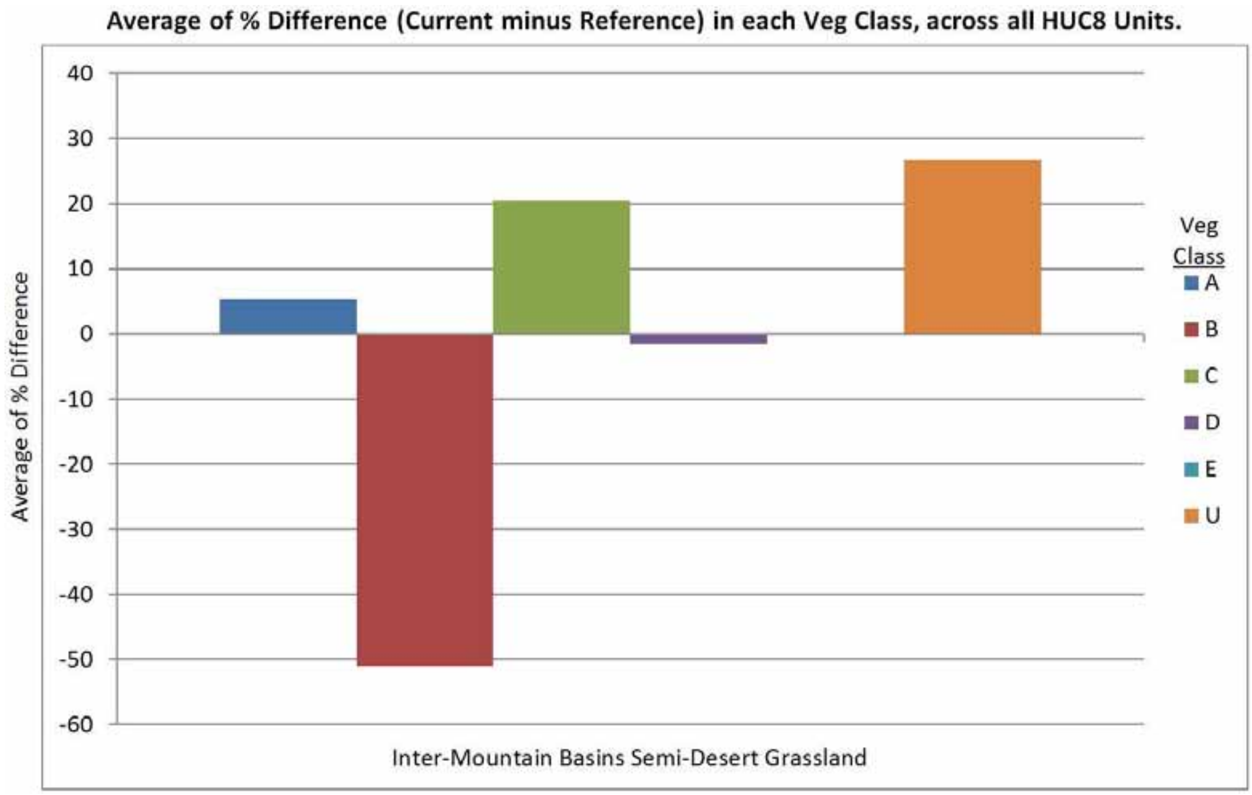
Condition

Widespread, long-term, and probably at times improper grazing[35] by domestic livestock following European human settlement, in conjunction with a departure from a more natural fire regime, have resulted in dominance of shrubs in desert grassland sites. This shrub dominance is accompanied by soil compaction, invasion by non-native grasses and forbs, and further disruption of the fire regime.

As shown in the chart below, in relative terms the single Biophysical Setting of the Desert Grassland Key Habitat on average has:

1. Large deficit of the mid-age herbaceous, grass-dominated class (B),
2. Surplus of an older class (C) that contains moderate to high shrub coverage, and
3. Appreciable amount of the Uncharacteristic class that reflects abundance of invasive non-native annual grasses and forbs.

[35] Improper in relation to a site's capacity to accommodate the duration, intensity, and/or timing of the grazing regime that was or is actually applied. Improper grazing can result from use by livestock, wildlife, and/or feral animals.



Threats

The following threats to Desert Grassland were identified in a statewide assessment described in more detail in the Threats and Actions chapter. Yellow rows indicate WAP priority threats - those that negatively impact many species and habitats including Desert Grassland. White rows indicate threats that are important to Desert Grassland, but not to as many other species and habitats as the priority threats. The Threats and Actions chapter focuses exclusively on the WAP priority threats.

Threats to Desert Grassland	Threat Impact (Scope x Severity)			
	Very High	High	Medium	Grand Total
Inappropriate Fire Frequency and Intensity		1		1
OHV Motorized Recreation			1	1
Invasive Plant Species – Non-native		1		1
Improper Grazing (current)			1	1
Housing and Urban Areas			1	1
Improper Grazing (historic)		1		1
Grand Total		**3**	**3**	**6**

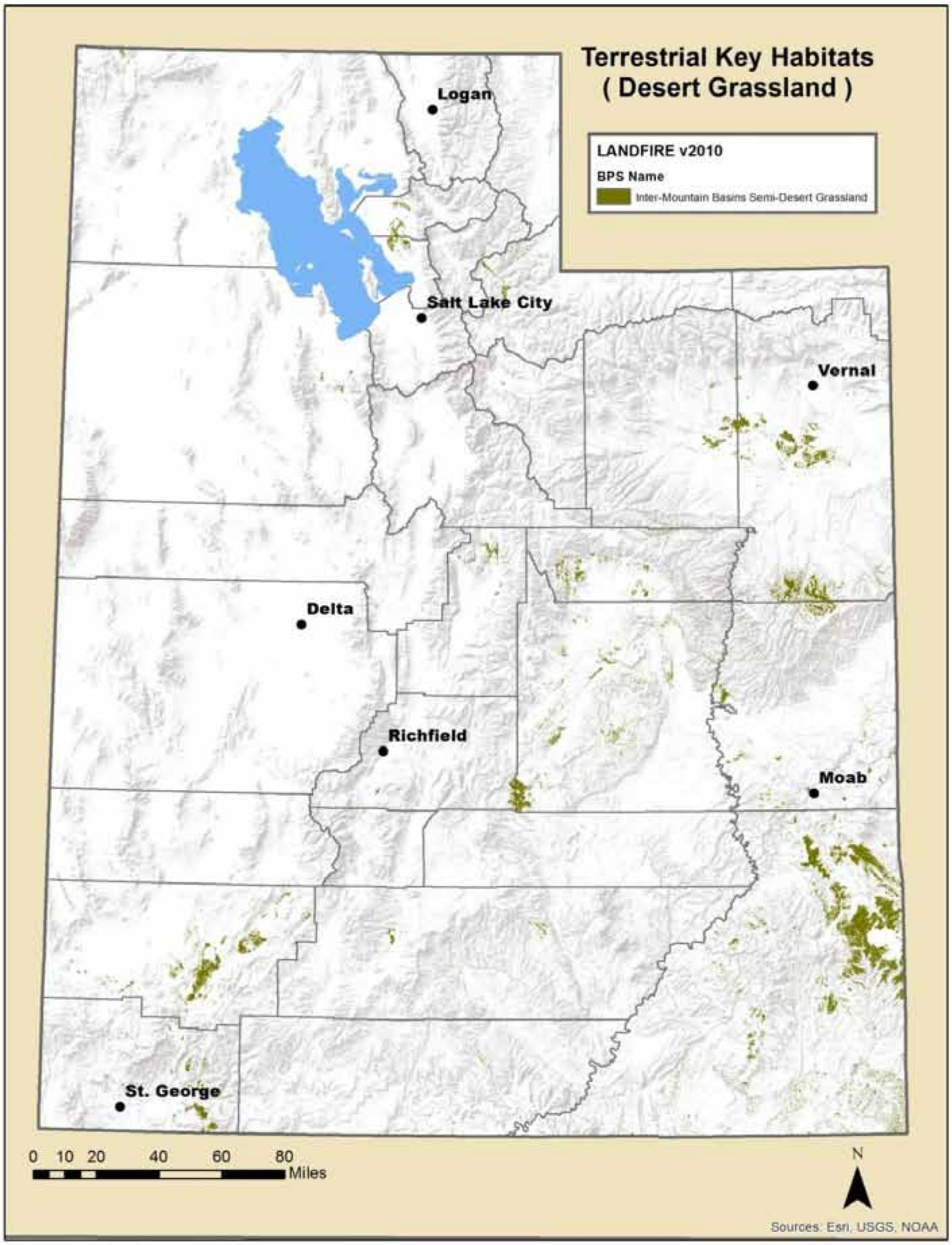
Improving Condition

A good strategy for management may include the following elements:

- Promoting policies and management that allow fire to return to a more natural regime.

- Promoting policies that reduce inappropriate grazing by domestic livestock and wildlife.
- Continuing the use of appropriate methods for reducing the spread and dominance of invasive weeds and annual grasses, including “early detection – rapid response” programs.
- Continuing the development of plant materials suited to this habitat.

Figure KH-2. Extent of Desert Grassland Terrestrial Key Habitat (1 BpS) in Utah.



Gambel Oak

Extent: Total, and Component Biophysical Settings (LANDFIRE v2010, HUC8 units within Utah boundary)

- Total current mapped area: 2,042,775 acres; 3.8% of state surface area (Figure 2-3).
    - Rocky Mountain Gambel Oak-Mixed Montane Shrubland (BpS 11070): 564,279 acres.
    - Rocky Mountain Gambel Oak-Mixed Montane Shrubland – Continuous (BpS 11071): 1,304,878 acres.
    - Rocky Mountain Gambel Oak-Mixed Montane Shrubland – Patchy (BpS 11072): 173,618 acres.
- Distribution: mapped in 66 of 67 HUC8s that overlap Utah.
- Elevation range: Most common between 6,500-8,000 feet; locally lower or higher depending on aspect. Generally occurs above pinyon-juniper woodlands and below aspen and mixed-conifer forests, mingling at similar elevations with other mountain shrub communities or mountain sagebrush.
- Occurs in a variety of topographic situations on all aspects, often in drier sites than adjacent vegetation, in patch sizes of tens to thousands of acres (usually toward the latter).

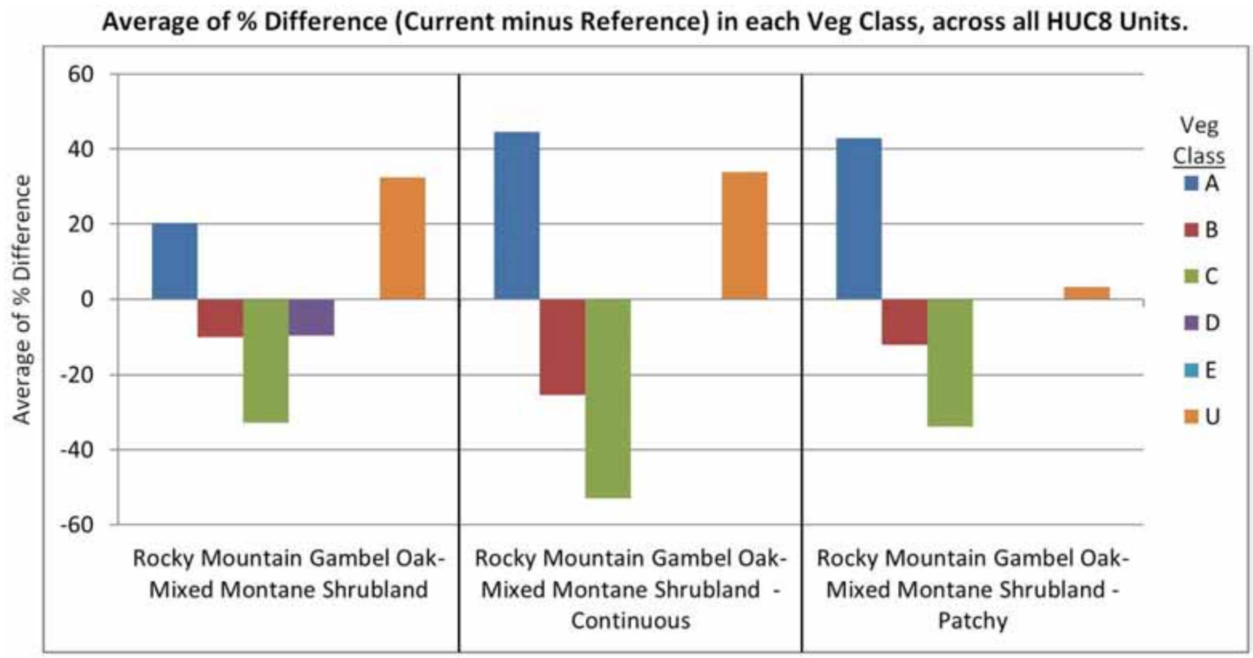
Condition

Gambel oak resprouts after fire, so other types of vegetation generally do not replace it following burning. Gambel oak stands are susceptible to cheatgrass invasion, especially on drier sites. Changes in fire regime may not replace the dominant oaks, but are likely to have effects on other important members of the plant community that defines this key habitat.

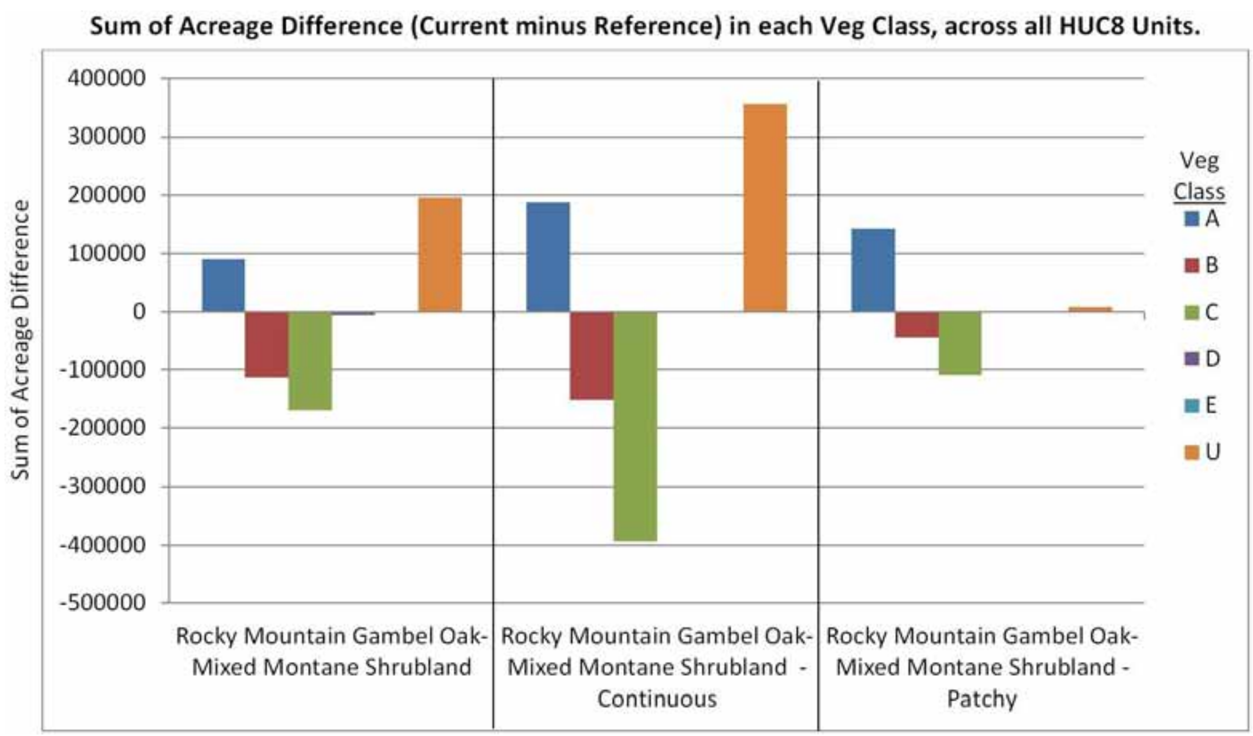
As shown in the chart below, in relative terms the three Biophysical Settings of the Gambel Oak Key Habitat on average have:

1. Surpluses of the youngest class (A) that is generally characterized by resprouting Gambel oak; given enough time between fires, these will grow into older classes (B and C) that currently show deficits.

2. Appreciable amounts of the Uncharacteristic class that reflect abundance of invasive non-native annual grasses.



In the chart below, the 1st and especially the 2nd Biophysical Settings are the most extensive of the Gambel Oak Key Habitat. In absolute terms, these two BpSs contain more than 500,000 acres of the Uncharacteristic class (U) that would be good targets for treatments aimed at reducing invasive annual grasses.



Threats

The following threats to Gambel Oak were identified in a statewide assessment described in more detail in the Threats and Actions chapter. Yellow rows indicate WAP priority threats - those that negatively impact many species and habitats including Gambel Oak. White rows indicate threats that are important to Gambel Oak, but not to as many other species and habitats as the priority threats. The Threats and Actions chapter focuses exclusively on the WAP priority threats.

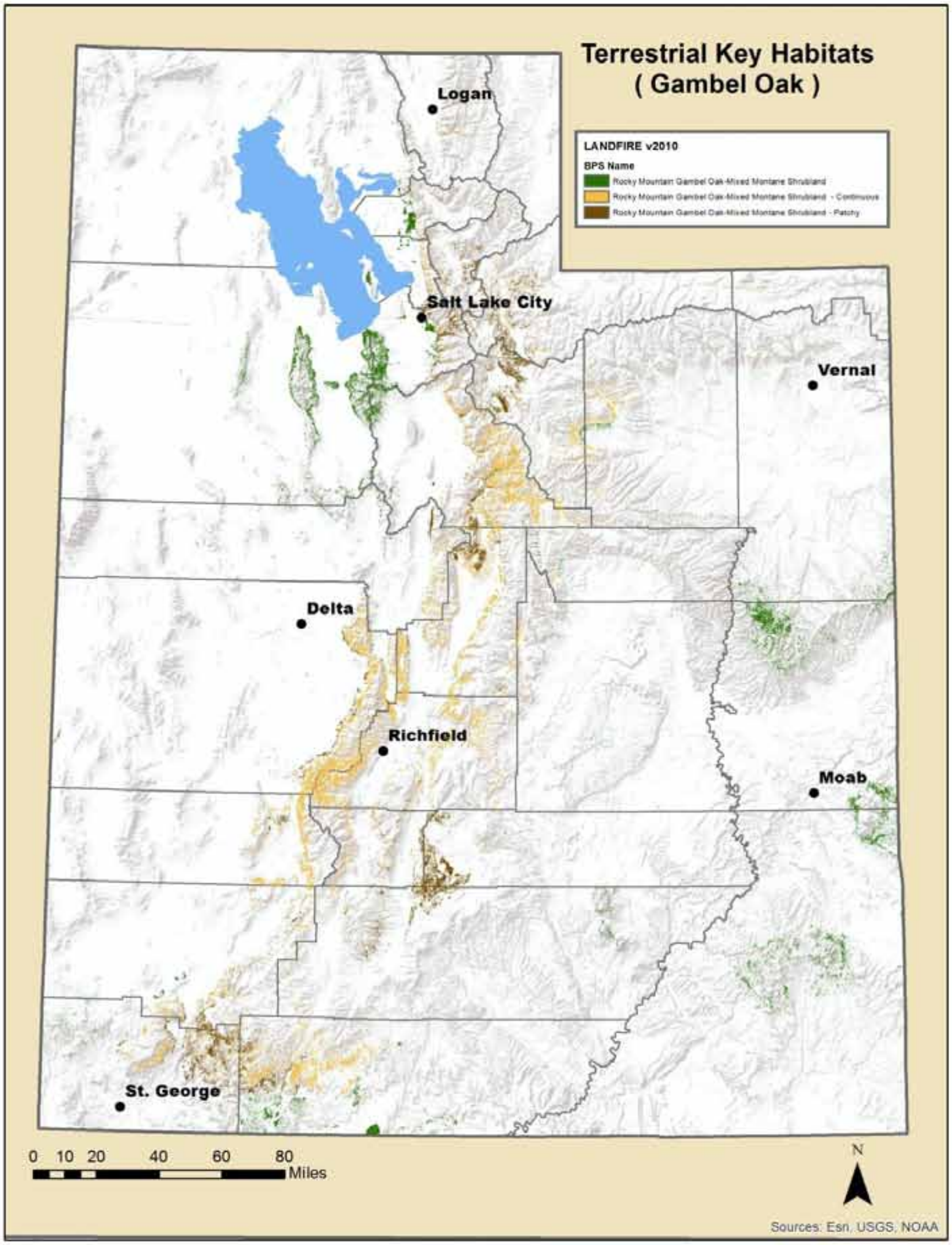
Threats to Gambel Oak	**Threat Impact (Scope x Severity)**			
	Very High	**High**	**Medium**	**Grand Total**
Cabin Communities / Development			1	1
Invasive Plant Species – Non-native			1	1
Inappropriate Fire Frequency and Intensity		1		1
Grand Total		**1**	**2**	**3**

Improving Condition

A good strategy for management may include the following elements:

- Promoting policies and management that allow fire to return to a more natural regime.
- Promoting and funding restoration that reduces the Uncharacteristic class, including cutting/mulching of invading pinyon and juniper trees, and herbicide or mechanical treatment of non-native invasive species such as cheatgrass and smooth brome.
- Continuing the funding and support for weed abatement programs, including “early detection – rapid response” programs.

Figure KH-3. Extent of Gambel Oak Terrestrial Key Habitat (3 BpSs) in Utah.



Lowland Sagebrush

Extent: Total, and Component Biophysical Settings (LANDFIRE v2010, HUC8 units within Utah boundary)

- Total current mapped area: 11,695,319 acres; 21.5% of state surface area (Figure 2-4).
  - Colorado Plateau Mixed Low Sagebrush Shrubland (BpS 10640): 454,899 acres.
  - Great Basin Xeric Mixed Sagebrush Shrubland (BpS 10790): 2,440,957 acres.
  - Inter-Mountain Basins Big Sagebrush Shrubland (BpS 10800): 8,340,512 acres.
  - Inter-Mountain Basins Big Sagebrush Shrubland – Basin Big Sagebrush (BpS 10801): 28,139 acres.
  - Inter-Mountain Basins Big Sagebrush Shrubland – Wyoming Big Sagebrush (BpS 10802): 265,794 acres.
  - Inter-Mountain Basins Big Sagebrush Steppe (BpS 11250): 151,006 acres.
  - Wyoming Basins Dwarf Sagebrush Shrubland and Steppe (BpS 10720): 14,013 acres.
- Distribution: mapped in all 67 HUC8s that overlap Utah.
- Elevation range: Largely between 3,000-7,000 feet, locally higher on warm aspects. Generally above various salt-desert shrublands, mingling at similar elevations with pinyon-juniper woodlands (which can extend higher), and below montane sites with mountain sagebrush, mountain shrubs, mixed-conifer and aspen forests.
- Occurs in a variety of upland topographic situations on all aspects, often in well-drained soils, though some expressions (e.g., basin big sagebrush) occupy alluvial valley bottoms and terraces. Patch sizes are variable, but for some Biophysical Settings can be very large (10,000s to 100,000s of acres).

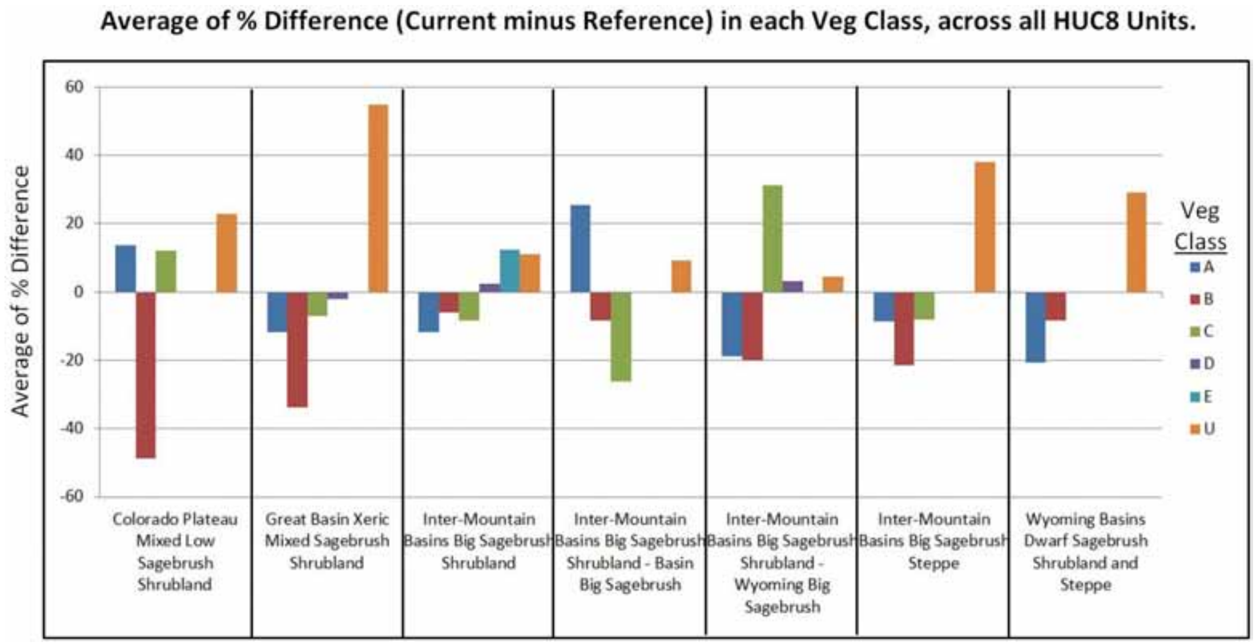
Condition

The Lowland Sagebrush Key Habitat comprises a relatively broad array of abiotic settings. Alterations from reference conditions that have occurred in many, but not all, of these settings include invasion by non-native annual grasses (mainly cheatgrass), widespread encroachment by juniper and pinyon pine, and understory depletion.

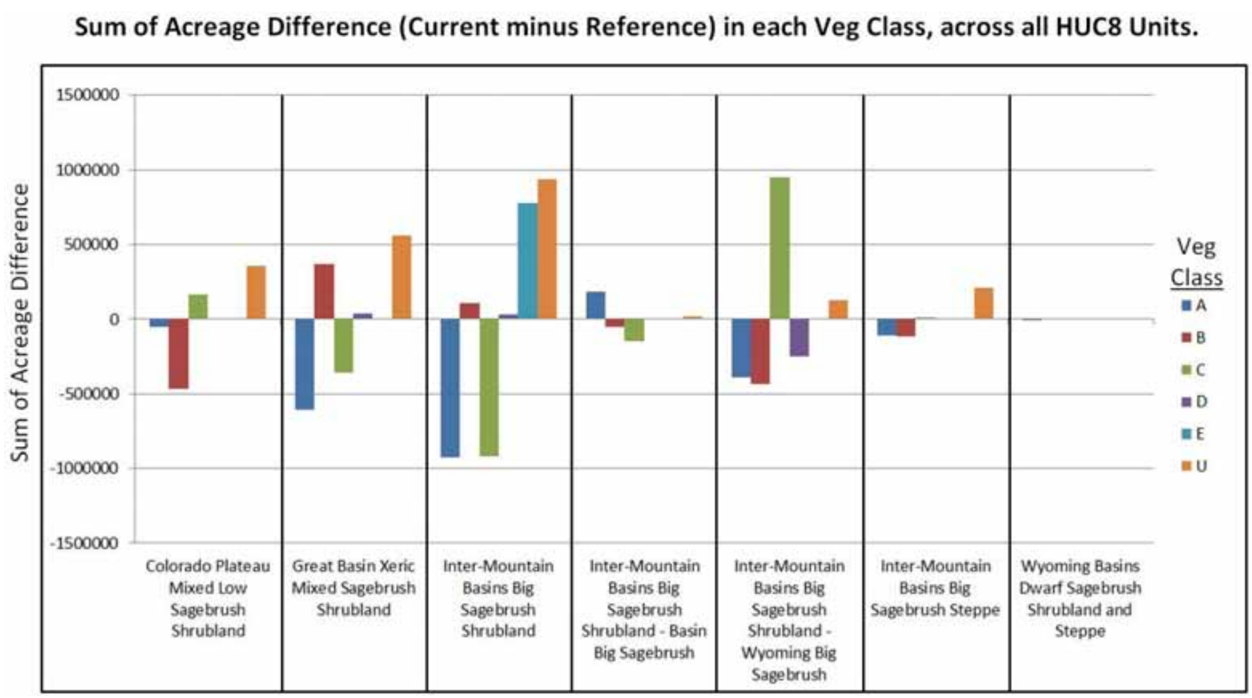
As shown in the chart at the top of the next page, the multiple Biophysical Settings of the Lowland Sagebrush Key Habitat differ from each other in terms of how much their component vegetation classes are in currently in surplus or deficit relative to their expected (reference) amounts. In general, however, common threads include:

1. Deficits of some young and mid age classes; and

2. Surpluses of older and especially the Uncharacteristic class, the latter reflecting abundance of invasive non-native annual grasses and encroachment by conifers.



In the chart below, the Great Basin Xeric Mixed Sagebrush Shrubland BpS and the three “flavors” of Inter-Mountain Basins Big Sagebrush Shrubland BpS are the most extensive of the Lowland Sagebrush Key Habitat. In absolute terms, these four BpSs contain more than 2 million surplus acres (greater than expected reference amounts) of older and/or Uncharacteristic classes that would be good targets for treatments aimed at reducing invasive annual grasses and/or encroaching conifers.



Threats

The following threats to Lowland Sagebrush were identified in a statewide assessment described in more detail in the Threats and Actions chapter. Yellow rows indicate WAP priority threats - those that negatively impact many species and habitats including Lowland Sagebrush. White rows indicate threats that are important to Lowland Sagebrush, but not to as many other species and habitats as the priority threats. The Threats and Actions chapter focuses exclusively on the WAP priority threats.

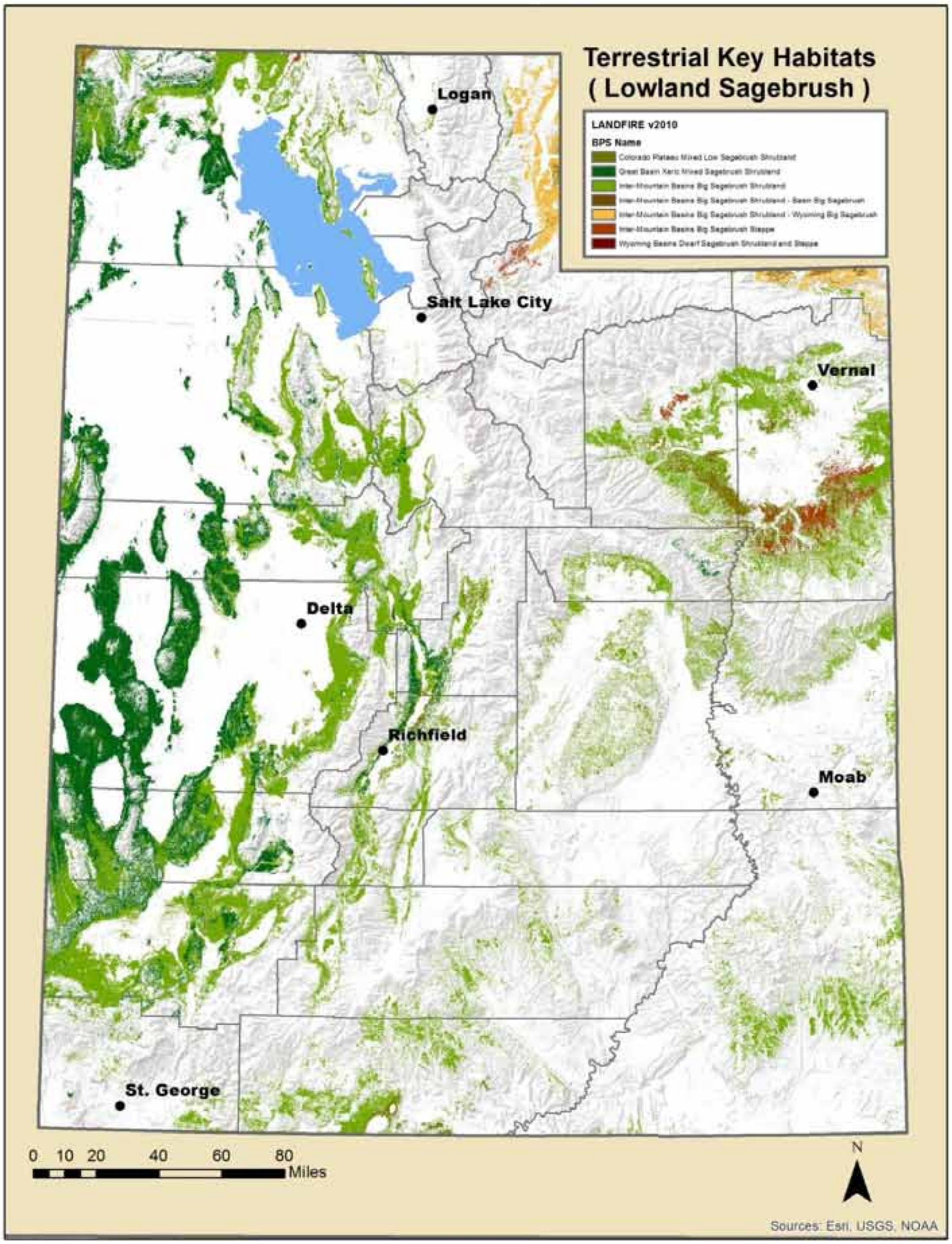
Threats to Lowland Sagebrush	Threat Impact (Scope x Severity)			
	Very High	High	Medium	Grand Total
Problematic Plant Species – Native Upland			1	1
Inappropriate Fire Frequency and Intensity	1			1
Brush Eradication / Vegetation Treatments			1	1
Droughts		1		1
Invasive Plant Species – Non-native	1			1
Habitat Shifting and Alteration		1		1
Seeding Non-native Plants		1		1
Housing and Urban Areas			1	1
Improper Grazing (historic)		1		1
Grand Total	**2**	**4**	**3**	**9**

Improving Condition

A good strategy for management may include the following elements:

- Promoting policies and management that allow fire to return to a more natural regime.
- Promoting policies that reduce inappropriate grazing by domestic livestock, feral domesticated animals, and wildlife.
- Promoting and funding restoration that reduces the Uncharacteristic class, including cutting/mulching/chaining of invading pinyon and juniper trees, herbicide or mechanical treatment of non-native invasive species such as cheatgrass and secondary perennial weed species, and rehabilitation of burned areas following wildfire.
- Continuing the development of new plant materials and restoration techniques suited to this habitat.
- Developing and deploying techniques to diversify the understory species composition and age classes of decadent even-aged sagebrush stands.
- Developing and deploying techniques to diversify species composition in monoculture or near monoculture stands of seeded non-native plants (e.g. crested wheatgrass).
- Promoting management that includes seeding a diversity of grasses, forbs and shrubs that will lead to increased resiliency and resistance in the plant community.

Figure KH-4. Extent of Lowland Sagebrush Terrestrial Key Habitat (7 BpSs) in Utah.



Mojave Desert Shrub

Extent: Total, and Component Biophysical Settings (LANDFIRE v2010, HUC8 units within Utah boundary)

- Total current mapped area: 482,009 acres; 0.9% of state surface area (Figure 2-5).
  - Mojave Mid-Elevation Mixed Desert Scrub (BpS 10820): 365,732 acres.
  - Sonora-Mojave Creosotebush-White Bursage Desert Scrub (BpS 10870): 115,929 acres.
  - Sonoran Mid-Elevation Desert Scrub (BpS 10910): 289 acres.
  - Sonoran Paloverde-Mixed Cacti Desert Scrub (BpS 11090): 59 acres.
- Distribution: mapped in 42 of 67 HUC8s that overlap Utah, though most common and extensive in 13 HUC8s along the southern edge of Utah.
- Elevation range: Most common between 2,200-4,000 feet; locally up to 6,500 feet on warm aspects. Generally below various types of lowland sagebrush shrublands and pinyon-juniper woodlands; no habitats are lower than this one within Utah.
- Occurs on xeric flats and slopes, generally where soils are well-drained, in patch sizes that vary from relatively small (thousands of acres) to very large (>100,000 acres).

Condition

The Mojave Desert did not evolve with frequent fire, so its native vegetation is neither adapted to nor tolerant of fire. Invasion and dominance of non-native annual grasses (cheatgrass and red brome) have drastically altered the fire regime to one of more frequent and often catastrophic fires, resulting in abundance of early-seral shrubs such as rabbitbrush and snakeweed, or a permanent loss of shrubs and native forbs and grasses, in areas where multiple burns have occurred.

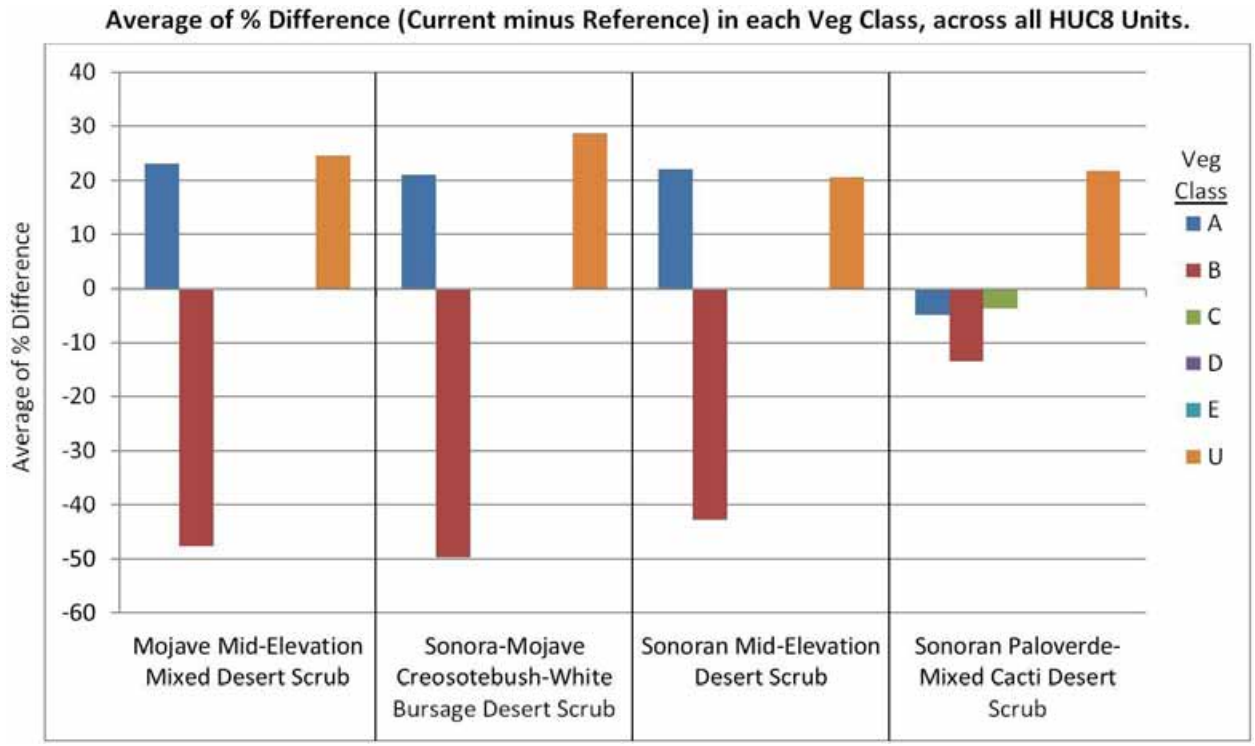
In the chart below, the 1st and 2nd Biophysical Settings are the main components of the Mojave Desert Shrub Key Habitat; the other two BpSs have only minor acreage in the state.

As shown in the next chart, the two major (in terms of acreage) BpSs on the left have:

1. Large deficits of the older reference age class (B); in reality this may also be the case for the young reference class (A), although the chart shows it to be in surplus; and

2. Surplus of the Uncharacteristic class, likely reflecting abundance of invasive non-native annual grasses or just wholly-depleted (multiple-burned) conditions. The surplus may actually be greater than depicted, if the currently-classified acreage in reference class A is actually in the Uncharacteristic condition, but is misclassified.

The mutually-reinforcing degradation caused by invasive annual grasses and frequent fires has created an intractable situation for restoration in what is the hottest and driest Terrestrial Key Habitat in Utah.



Threats

The following threats to Mojave Desert Shrub were identified in a statewide assessment described in more detail in the Threats and Actions chapter. Yellow rows indicate WAP priority threats - those that negatively impact many species and habitats including Mojave Desert Shrub. White rows indicate threats that are important to Mojave Desert Shrub, but not to as many other species and habitats as the priority threats. The Threats and Actions chapter focuses exclusively on the WAP priority threats.

Threats to Mojave Desert Shrub	Threat Impact (Scope x Severity)			
	Very High	High	Medium	Grand Total
Invasive Plant Species – Non-native	1			1
Inappropriate Fire Frequency and Intensity	1			1
Housing and Urban Areas			1	1
Improper Grazing (historic)		1		1
Grand Total	**2**	**1**	**1**	**4**

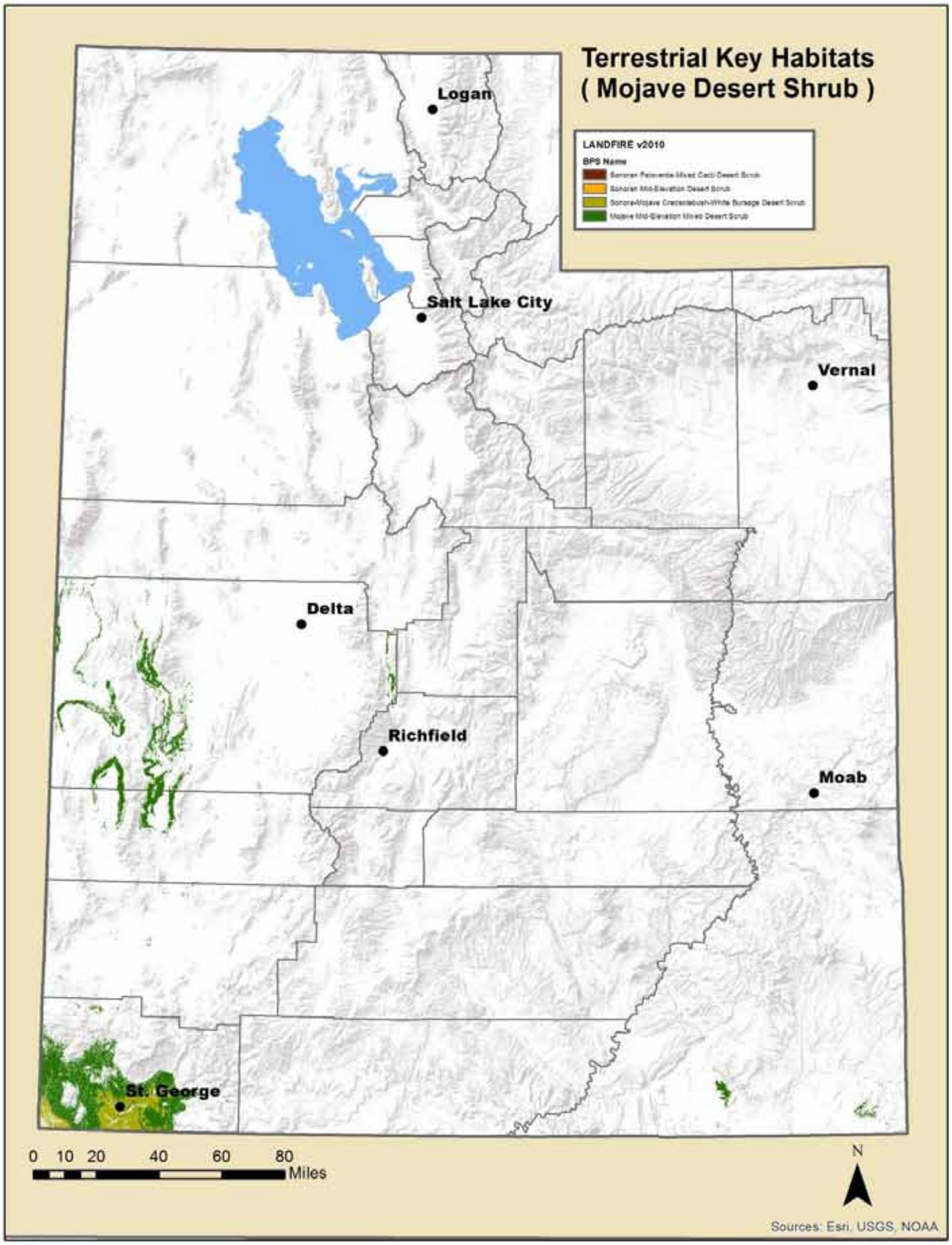
Improving Condition

A good strategy for management may include the following elements:

- Creating and maintaining fuel breaks to prevent fire from reaching remaining unburned acres.
- Enhancing the prevention and suppression of ignitions in these unburned areas.

- Enhancing the prevention and suppression of ignitions in areas that have burned once, which often retain a component of recovering native vegetation and are good candidates for otherwise-passive restoration.
- Continuing the search for herbicidal agents and biological controls to use against invasive annual grasses.
- Continuing the search for effective plant-restoration materials and methods that can be affordably translated from the research plot scale, to the operational project scale.

Figure KH-5. Extent of Mojave Desert Shrub Terrestrial Key Habitat (4 BpSs) in Utah.



Mountain Meadow

Extent: Total, and Component Biophysical Settings (LANDFIRE v2010, HUC8 units within Utah boundary)

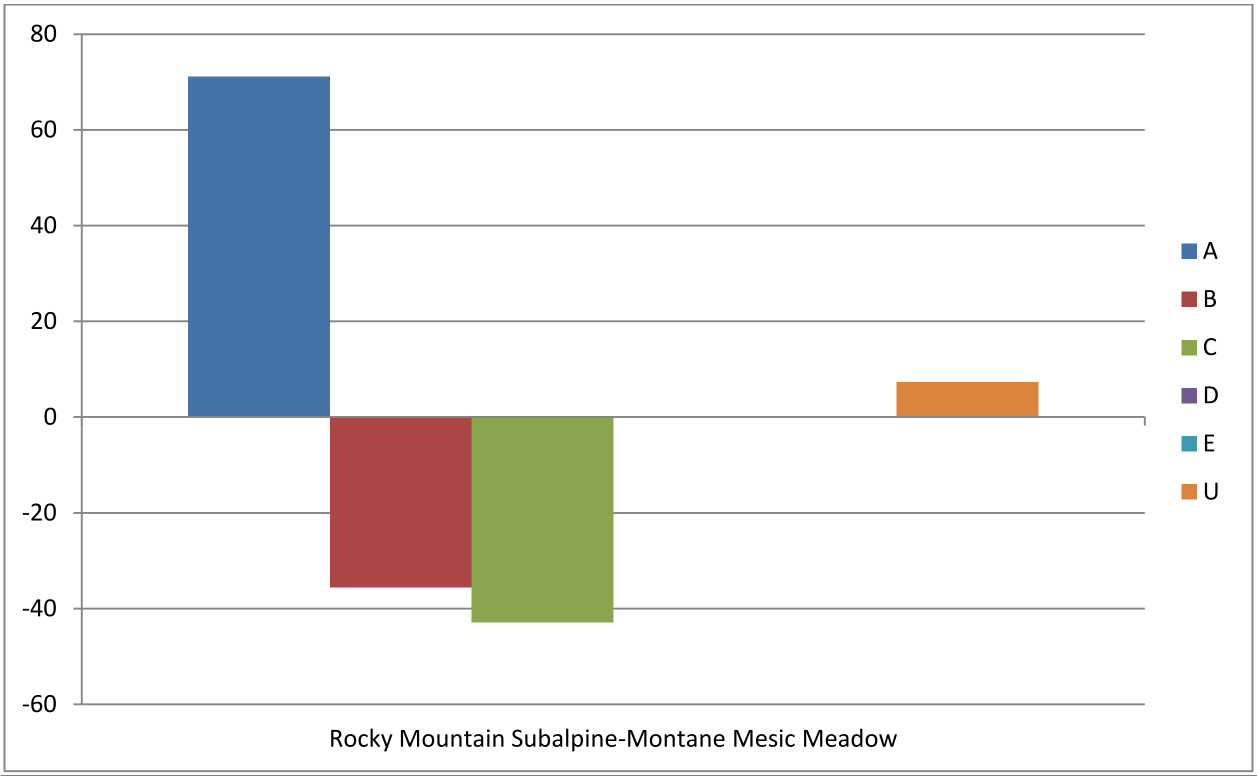
- Total current mapped area: 74,419 acres; 0.1% of state surface area (Figure 2-6), all in one Biophysical Setting – Rocky Mountain Subalpine-Montane Mesic Meadow (BpS 11450).
- Distribution: mapped in 38 of 67 HUC8s that overlap Utah.
- Elevation range: Generally between 6,000-11,000 feet in Utah (depending on latitude), mingling with mountain shrub communities, mountain sagebrush, and aspen-conifer forests.
- Occurs on gentle to moderate gradient slopes, in patches of small to moderate size.

Condition

Historic patterns of heavy grazing by domestic livestock altered the herbaceous species composition of mountain meadows in various ways, from a reference-condition predominance of tall forbs into alternate stable states. Composition was skewed toward greater abundance of forbs or grasses depending on class of livestock (cattle or sheep) doing the grazing. Also, in general, the overall herbaceous composition was shifted to greater amounts of unpalatable or undesirable species typified by thistles, coneflower, tarweed, dandelion, and in some cases, aggressive perennial exotic grasses.

Unfortunately, these major compositional shifts have not been reversed by passive restoration methods which have been applied, such as reducing the intensity or changing the class of domestic livestock use. If the current stable state is unacceptable, it appears that active restoration approaches will be required to change it. The technical knowledge of specific restoration methodologies for this habitat type may still need to be developed. The plant materials which would be needed for such an effort may not exist at present, and would have to first be brought into a reasonable scale of commercial production.

The LANDFIRE models mainly address woody succession, which is not a major factor in mountain meadows, and the coarse LANDFIRE data do not readily detect shifts in herbaceous species composition. For these reasons, the vegetation class surpluses and deficits shown in the chart below may not reflect finer scale species-composition indicators of condition in Mountain Meadow habitats.



Threats

The following threats to Mountain Meadow were identified in a statewide assessment described in more detail in the Threats and Actions chapter. Yellow rows indicate WAP priority threats - those that negatively impact many species and habitats including Mountain Meadow. White rows indicate threats that are important to Mountain Meadow, but not to as many other species and habitats as the priority threats. The Threats and Actions chapter focuses exclusively on the WAP priority threats.

Threats to Mountain Meadow	Threat Impact (Scope x Severity)			
	Very High	High	Medium	Grand Total
Soil Erosion / Loss		1		1
Grand Total		**1**		**1**

Improving Condition

A good strategy for management may include the following elements:

- Continuing the use of appropriate methods for reducing the spread and dominance of invasive weeds and annual grasses, including "early detection – rapid response" programs.
- Promoting and funding restoration that chemically or mechanically reduces introduced aggressive perennial grasses such as smooth brome and bulbous bluegrass.
- Promoting policies that reduce inappropriate grazing by domestic livestock and wildlife.

- Promoting policies and management that allow fire to return to a more natural regime.

Figure KH-6. Extent of Mountain Meadow Terrestrial Key Habitat (1 BpS) in Utah.

Mountain Sagebrush

Extent: Total, and Component Biophysical Settings (LANDFIRE v2010, HUC8 units within Utah boundary)

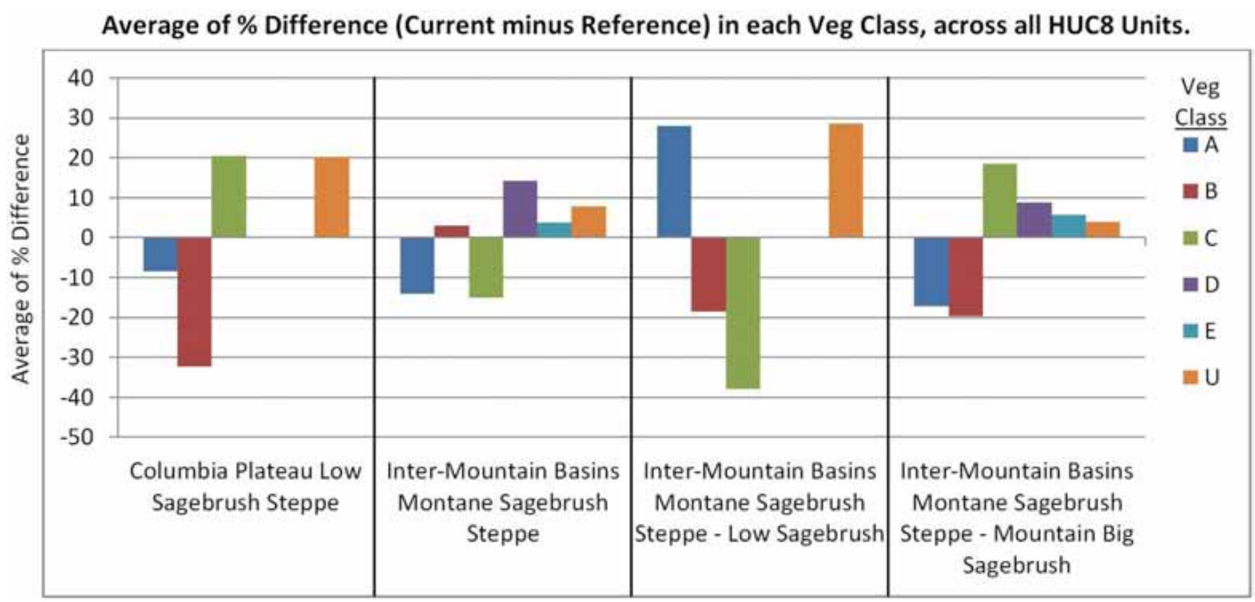
- Total current mapped area: 2,338,378 acres; 4.3% of state surface area (Figure 2-7).
  - Columbia Plateau Low Sagebrush Steppe (BpS 11240): 61,533 acres.
  - Inter-Mountain Basins Montane Sagebrush Steppe (BpS 11260): 675,812 acres.
  - Inter-Mountain Basins Montane Sagebrush Steppe – Mountain Big Sagebrush (BpS 11261): 1,210,540 acres.
  - Inter-Mountain Basins Montane Sagebrush Steppe – Low Sagebrush (BpS 11262): 390,493 acres.
- Distribution: mapped in all 67 HUC8s that overlap Utah.
- Elevation range: Largely between 5,000-9,000 feet, locally higher on warm aspects. Generally above lowland sagebrush and pinyon-juniper communities, mingling at similar elevations with Gambel oak woodlands, mountain shrubs, mixed-conifer and aspen forests.
- Occurs on a range of topography such as flats, mountain slopes, and ridge crests, on all aspects. Patch sizes range from small (tens of acres) to relatively large (tens of thousands of acres).

Condition

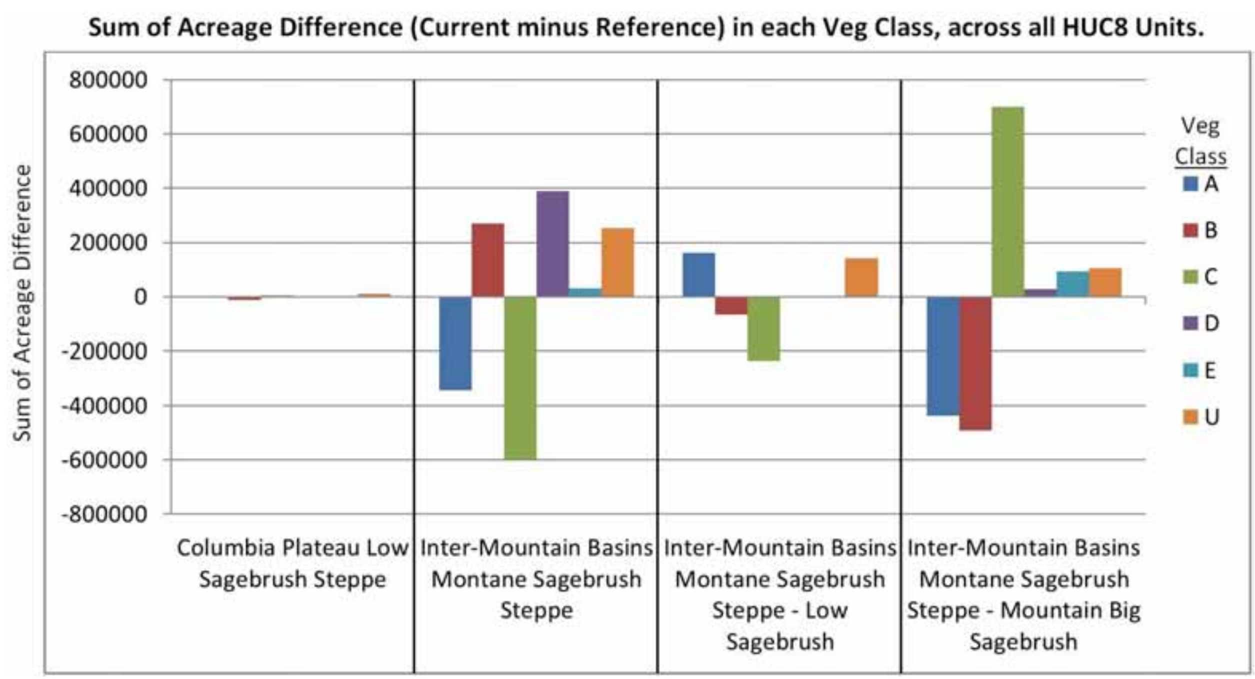
The Mountain Sagebrush Key Habitat includes Biophysical Settings characterized by montane sagebrush species of two distinct heights: low and moderate. Alterations from reference conditions that have occurred in many, but not all, of these settings include encroachment by juniper, pinyon pine and montane conifers, invasion by non-native annual grasses (mainly cheatgrass), and understory depletion.

As shown in the next chart, the various Biophysical Settings of the Mountain Sagebrush Key Habitat differ from each other in terms of how much their component vegetation classes are in currently in surplus or deficit relative to their expected (reference) amounts. In general, however, common threads include:

1. Deficits of some young and mid age classes; and
2. Surpluses of older and Uncharacteristic classes, the latter reflecting abundance of invasive non-native annual grasses and encroachment by conifers.



In the chart below, the 2nd and 4th BpSs are characterized by moderate-height sagebrush shrubs (mainly mountain big sagebrush), and are the most extensive of the Mountain Sagebrush Key Habitat. In absolute terms, these BpSs contain more than 1 million surplus acres (greater than expected reference amounts) of vegetation classes that would be good targets for treatments aimed at reducing encroaching conifers and/or invasive annual grasses.



Threats

The following threats to Mountain Sagebrush were identified in a statewide assessment described in more detail in the Threats and Actions chapter. Yellow rows indicate WAP priority threats - those that negatively impact many species and habitats including Mountain Sagebrush. White rows indicate threats that are important to Mountain Sagebrush, but not to as many other species and habitats as the priority threats. The Threats and Actions chapter focuses exclusively on the WAP priority threats.

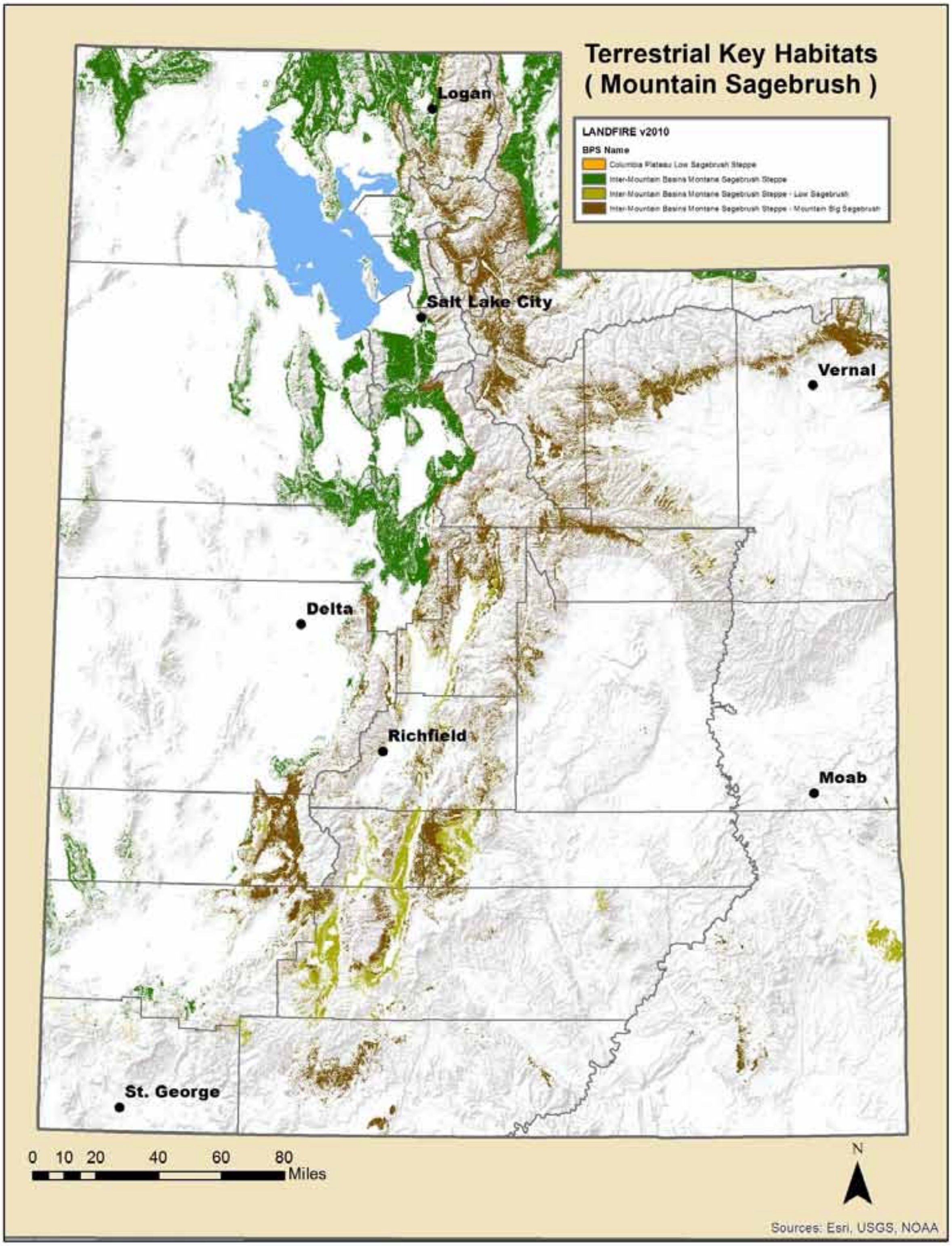
Threats to Mountain Sagebrush	Threat Impact (Scope x Severity)			
	Very High	High	Medium	Grand Total
Invasive Plant Species – Non-native			1	1
Brush Eradication / Vegetation Treatments			1	1
Roads – Transportation Network			1	1
Droughts		1		1
Inappropriate Fire Frequency and Intensity			1	1
Habitat Shifting and Alteration			1	1
Problematic Plant Species – Native Upland	1			1
Housing and Urban Areas			1	1
Seeding Non-native Plants			1	1
Improper Grazing (current)		1		1
Improper Grazing (historic)	1			1
Grand Total	**2**	**2**	**7**	**11**

Improving Condition

A good strategy for management may include the following elements:

- Promoting policies and management that allow fire to return to a more natural regime.
- Promoting policies that reduce inappropriate grazing by domestic livestock and wildlife.
- Promoting and funding restoration that reduces the Uncharacteristic and surpluses of older age class, including: Dixie/chain harrow, brush mowing or other treatments that reduce the older age class and stimulate the younger/mid age classes; herbicide or mechanical treatment of non-native invasive species such smooth brome; single tree mulching/cutting of invading conifer.
- Continuing the development of new plant materials, especially native forbs.
- Promoting zoning/policies/laws that lead to responsible human/energy intrusion and development.
- Promoting management that includes seeding a diversity of grasses, forbs and shrubs that will lead to increased resiliency and resistance in the plant community.

Figure KH-7. Extent of Mountain Sagebrush Terrestrial Key Habitat (4 BpSs) in Utah.



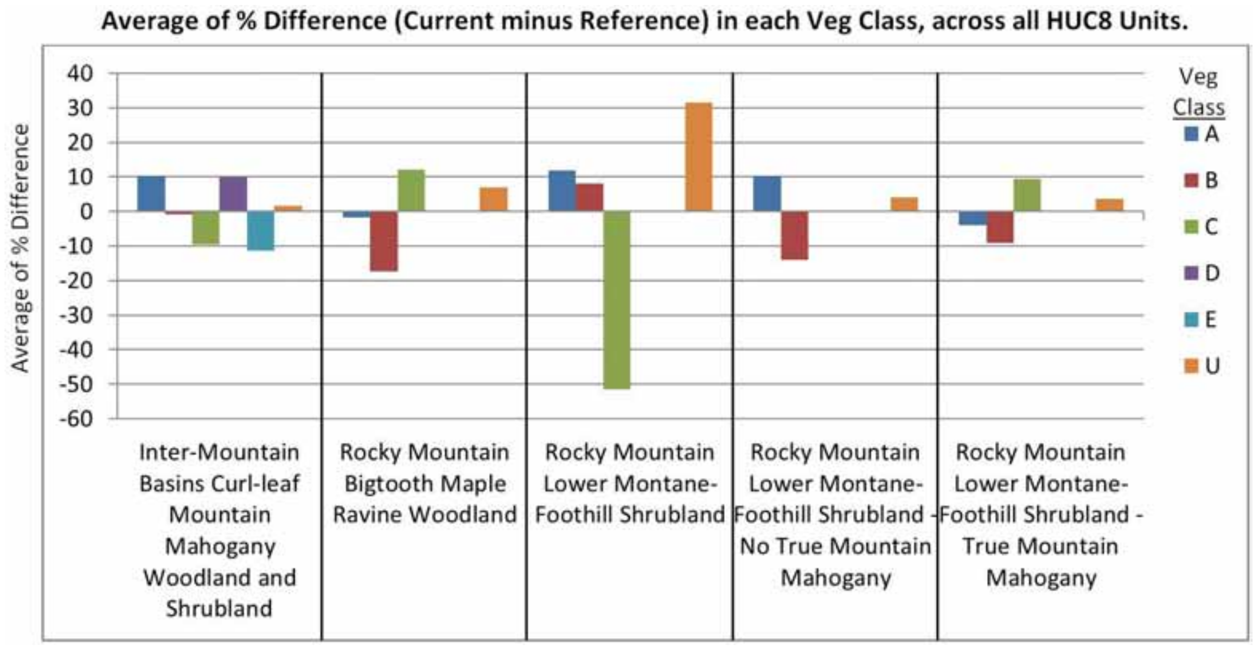
Mountain Shrub

Extent: Total, and Component Biophysical Settings (LANDFIRE v2010, HUC8 units within Utah boundary)

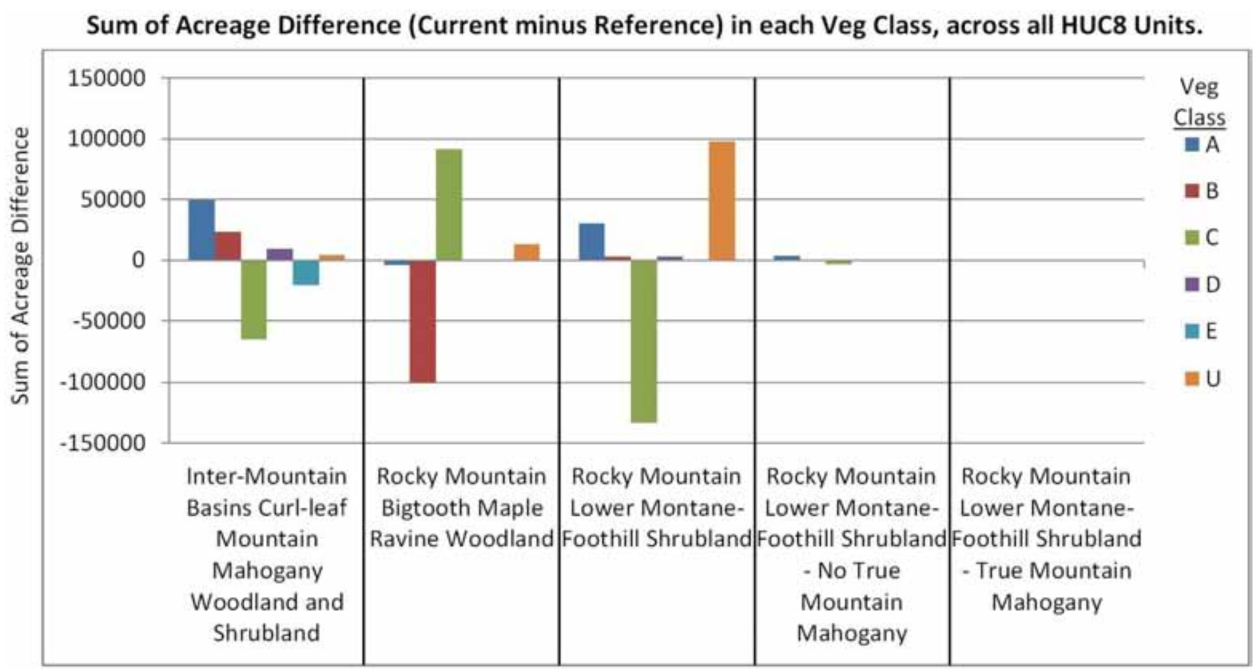
- Total current mapped area: 1,436,147 acres; 2.6% of state surface area (Figure 2-8).
  - Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland (BpS 10620): 553,795 acres.
  - Rocky Mountain Bigtooth Maple Ravine Woodland (BpS 10120): 481,240 acres.
  - Rocky Mountain Lower Montane-Foothill Shrubland (BpS 10860): 389,274 acres.
  - Rocky Mountain Lower Montane-Foothill Shrubland – No True Mountain Mahogany (BpS 10861): 8,680 acres.
  - Rocky Mountain Lower Montane-Foothill Shrubland – True Mountain Mahogany (BpS 10862): 3,158 acres.
- Distribution: mapped in 66 of 67 HUC8s that overlap Utah.
- Elevation range: Most common between 5,000-9,500 feet, occasionally higher depending on aspect. Generally above pinyon-juniper woodlands and below aspen and mixed-conifer forests, mingling at similar elevations with Gambel oak or mountain sagebrush.
- Occurs on foothills, canyon and mountain slopes, and ridges on all aspects, in patch sizes of tens to thousands of acres.

Condition

The Biophysical Settings that comprise the Mountain Shrub Key Habitat differ from each other in terms of their vegetation ecology, particularly responses of the dominant shrubs to fire – some species are vigorous resprouters, whereas others do not resprout at all. Other than some risk of cheatgrass invasion on drier sites, however, mountain shrub communities are not susceptible to the major stressors or threats which affect several other Key Habitats. Among the five BpSs in the chart below, only the 3rd has a major deficit of an older reference class (C) and corresponding surplus of the Uncharacteristic class.



In the chart below, the 3rd Biophysical Setting contains nearly 100,000 acres of the Uncharacteristic class (U) that could be good targets for treatments aimed at restoring more native conditions.



Threats

The following threats to Mountain Shrub were identified in a statewide assessment described in more detail in the Threats and Actions chapter. Yellow rows indicate WAP priority threats - those that negatively impact many species and habitats including Mountain Shrub. White rows indicate threats that are important to Mountain Shrub, but not to as many other species and habitats as the priority threats. The Threats and Actions chapter focuses exclusively on the WAP priority threats.

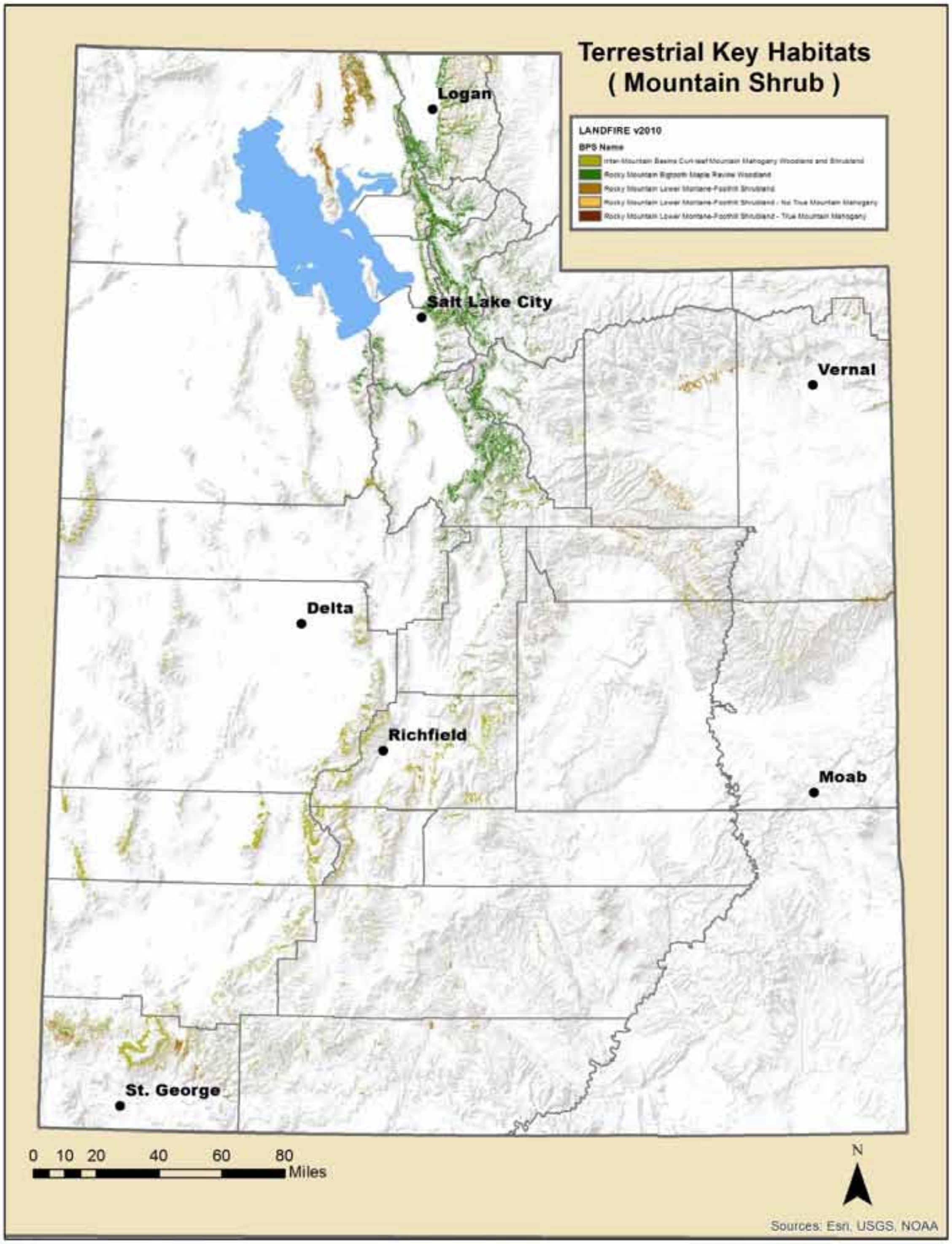
Threats to Mountain Shrub	Threat Impact (Scope x Severity)			
	Very High	High	Medium	Grand Total
Invasive Plant Species – Non-native			1	1
Seeding Non-native Plants			1	1
Grand Total			**2**	**2**

Improving Condition

A good strategy for management may include the following elements:

- Promoting policies that reduce inappropriate grazing by domestic livestock and wildlife.
- Continuing the use of appropriate methods for reducing the spread and dominance of invasive weeds and annual grasses, including “early detection – rapid response” programs.
- Continuing the development of new plant materials (especially native forbs) and restoration techniques suited to this habitat.

Figure KH-8. Extent of Mountain Shrub Terrestrial Key Habitat (5 BpSs) in Utah.



Location and Condition of Aquatic Key Habitats

Aquatic - Forested

Extent and Brief Description

- Total current mapped area: 4,460 acres; 0.01% of state surface area (Figure 2-9).
- Distribution: mapped in 39 of 67 HUC8s that overlap Utah.
- Characterized by woody vegetation greater than 6 meters in height, commonly found around the margins of rivers, montane lakes, or springs (Emerson 2014).
- Can include both intermittent and perennially flooded areas.

Threats

The following threats to Aquatic - Forested were identified in a statewide assessment described in more detail in the Threats and Actions chapter. Yellow rows indicate WAP priority threats - those that negatively impact many species and habitats including Aquatic - Forested. White rows indicate threats that are important to Aquatic - Forested, but not to as many other species and habitats as the priority threats. The Threats and Actions chapter focuses exclusively on the WAP priority threats.

Threats to Aquatic - Forested	Threat Impact (Scope x Severity)			
	Very High	High	Medium	Grand Total
Presence of Dams		1		1
Sediment Transport Imbalance			1	1
Roads – Transportation Network			1	1
Channel Downcutting (indirect, unintentional)		1		1
Improper Grazing (current)			1	1
Channelization / Bank Alteration (direct, intentional)		1		1
Presence of Diversions	1			1
Dam / Reservoir Operation			1	1
Salinity Alteration (of water)			1	1
Droughts		1		1
Water Allocation Policies	1			1
Housing and Urban Areas			1	1
Agricultural / Municipal / Industrial Water Usage	1			1
Invasive Plant Species – Non-native			1	1
Grand Total	**3**	**4**	**7**	**14**

Improving Condition

A good strategy for management may include the following elements:

- Promoting policies that maintain or restore natural water and sediment flow regimes.
- Promoting policies that reduce inappropriate grazing by domestic livestock and wildlife.
- Promoting policies that reduce inappropriate siting of roads in riparian zones.
- Promoting policies that reduce inappropriate residential and commercial development in floodplains.
- Continuing the use of appropriate methods for reducing the spread and dominance of invasive weeds, including “early detection – rapid response” programs.

Figure KH-9. Extent of Aquatic-Forested Aquatic Key Habitat in Utah.

Aquatic - Scrub/Shrub

Extent and Brief Description

- Total current mapped area: 54,428 acres; 0.10% of state surface area (Figure 2-10).
- Distribution: mapped in 53 of 67 HUC8s that overlap Utah.
- Characterized by woody vegetation less than 6 meters in height, and can include those areas adjacent to lotic (flowing-water) systems dominated by woody vegetation.
- Can include both intermittent and perennially flooded areas.

Threats

The following threats to Aquatic - Scrub/Shrub were identified in a statewide assessment described in more detail in the Threats and Actions chapter. Yellow rows indicate WAP priority threats - those that negatively impact many species and habitats including Aquatic - Scrub/Shrub. White rows indicate threats that are important to Aquatic - Scrub/Shrub, but not to as many other species and habitats as the priority threats. The Threats and Actions chapter focuses exclusively on the WAP priority threats.

Threats to Aquatic - Scrub/Shrub	Threat Impact (Scope x Severity)			
	Very High	High	Medium	Grand Total
Sediment Transport Imbalance			1	1
Roads – Transportation Network			1	1
Channel Downcutting (indirect, unintentional)		1		1
Improper Grazing (current)		1		1
Channelization / Bank Alteration (direct, intentional)		1		1
Presence of Diversions	1			1
Dam / Reservoir Operation			1	1
Salinity Alteration (of water)			1	1
Brush Eradication / Vegetation Treatments			1	1
Inappropriate Fire Frequency and Intensity			1	1
Droughts		1		1
Water Allocation Policies	1			1
Housing and Urban Areas			1	1
Agricultural / Municipal / Industrial Water Usage	1			1
Invasive Plant Species – Non-native			1	1
Grand Total	**3**	**4**	**8**	**15**

Improving Condition

A good strategy for management may include the following elements:

- Promoting policies that maintain or restore natural water and sediment flow regimes.
- Promoting policies that reduce inappropriate grazing by domestic livestock and wildlife.
- Promoting policies that reduce inappropriate siting of roads in riparian zones.
- Promoting policies that reduce inappropriate residential and commercial development in floodplains.
- Continuing the use of appropriate methods for reducing the spread and dominance of invasive weeds, including "early detection – rapid response" programs.

Figure KH-10. Extent of Aquatic-Scrub/Shrub Aquatic Key Habitat in Utah.

Emergent

Extent and Brief Description

- Total current mapped area: 375,399 acres; 0.69% of state surface area (Figure 2-12).
- Distribution: mapped in 58 of 67 HUC8s that overlap Utah.
- Palustrine (marsh-like) wetlands with emergent vegetation, often associated with groundwater discharge or shallow surface flow.

Threats

The following threats to Emergent were identified in a statewide assessment described in more detail in the Threats and Actions chapter. Yellow rows indicate WAP priority threats - those that negatively impact many species and habitats including Emergent. White rows indicate threats that are important to Emergent, but not to as many other species and habitats as the priority threats. The Threats and Actions chapter focuses exclusively on the WAP priority threats.

Threats to Emergent	Threat Impact (Scope x Severity)			
	Very High	High	Medium	Grand Total
Channel Downcutting (indirect, unintentional)			1	1
Channelization / Bank Alteration (direct, intentional)			1	1
Groundwater Pumping			1	1
Temperature Extremes			1	1
Droughts		1		1
Water Allocation Policies		1		1
Agricultural / Municipal / Industrial Water Usage			1	1
Invasive Plant Species – Non-native			1	1
Grand Total		**2**	**6**	**8**

Improving Condition

A good strategy for management may include the following elements:

- Promoting policies that maintain or restore natural water and sediment flow regimes.
- Promoting policies that reduce inappropriate grazing by domestic livestock and wildlife.
- Continuing the use of appropriate methods for reducing the spread and dominance of invasive weeds, including “early detection – rapid response” programs.

Figure KH-11. Extent of Emergent Aquatic Key Habitat in Utah.

Open Water

Extent and Brief Description

- Total current mapped area: 882,641 acres; 1.62% of state surface area (Figure 2-13).
- Distribution: mapped in 58 of 67 HUC8s that overlap Utah.
- Perennial bodies of standing water, including natural lakes, reservoirs, and ponds.

Threats

The following threats to Open Water were identified in a statewide assessment described in more detail in the Threats and Actions chapter. Yellow rows indicate WAP priority threats - those that negatively impact many species and habitats including Open Water. White rows indicate threats that are important to Open Water, but not to as many other species and habitats as the priority threats. The Threats and Actions chapter focuses exclusively on the WAP priority threats.

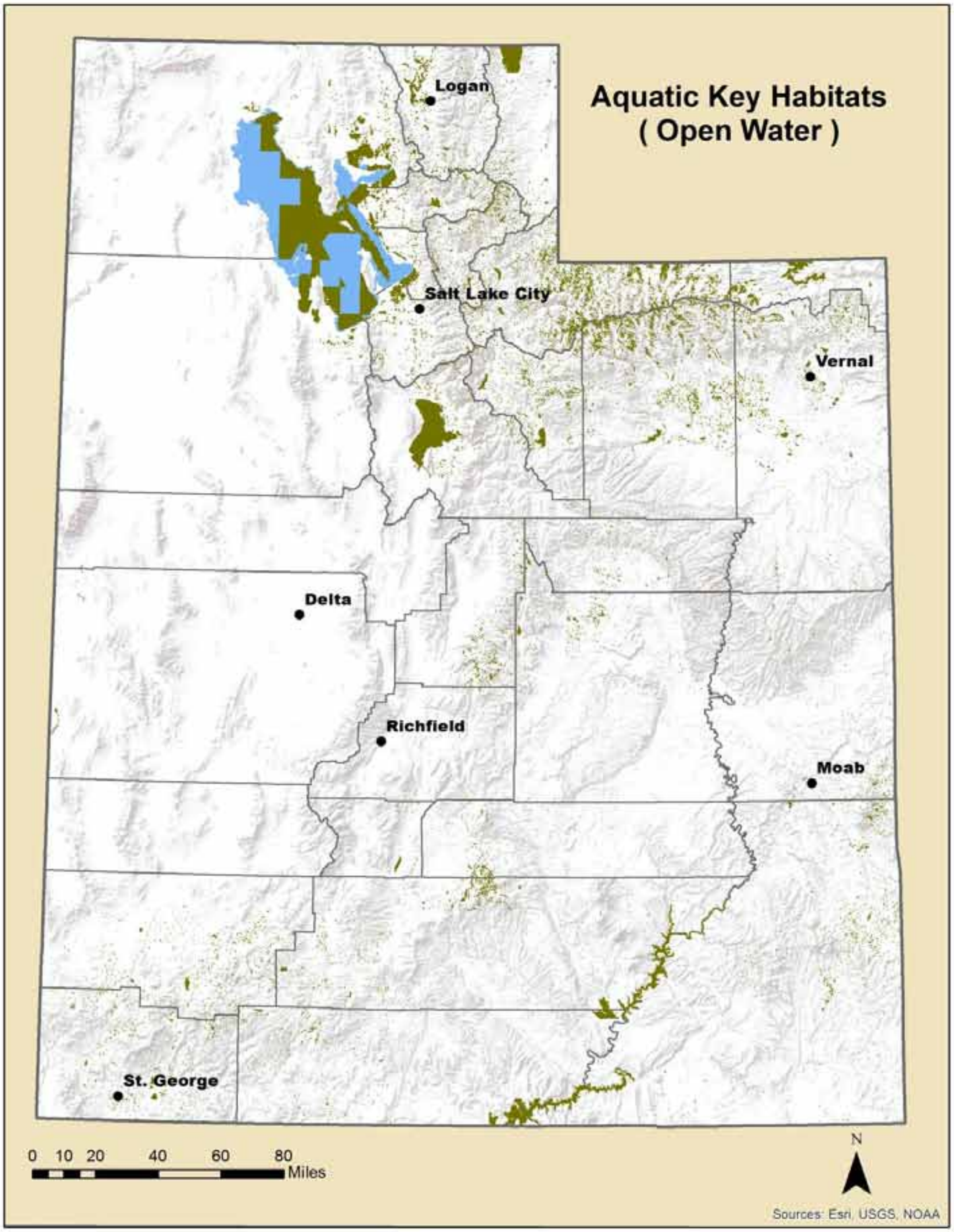
Threats to Open Water	**Threat Impact (Scope x Severity)**			
	Very High	**High**	**Medium**	**Grand Total**
Sediment Transport Imbalance			1	1
Roads – Transportation Network			1	1
Improper Grazing (current)			1	1
Presence of Diversions		1		1
Salinity Alteration (of water)			1	1
Droughts		1		1
Water Allocation Policies	1			1
Housing and Urban Areas			1	1
Agricultural / Municipal / Industrial Water Usage	1			1
Invasive Plant Species – Non-native			1	1
Grand Total	**2**	**2**	**6**	**10**

Improving Condition

A good strategy for management may include the following elements:

- Promoting policies that maintain or restore natural water and sediment flow regimes.
- Promoting policies that reduce inappropriate grazing by domestic livestock and wildlife.
- Promoting policies that reduce inappropriate siting of roads in riparian zones.
- Promoting policies that reduce inappropriate residential and commercial development in floodplains.
- Continuing the use of appropriate methods for reducing the spread and dominance of invasive weeds, including “early detection – rapid response” programs.

Figure KH-12. Extent of Open Water Aquatic Key Habitat in Utah.



Riverine

Extent and Brief Description

- Total current mapped area: 120,256 acres; 0.22% of state surface area (Figure 2-11).
- Distribution: mapped in 54 of 67 HUC8s that overlap Utah.
- Perennial streams, constrained to a channel (includes canals and ditches)

Threats

The following threats to Riverine were identified in a statewide assessment described in more detail in the Threats and Actions chapter. Yellow rows indicate WAP priority threats - those that negatively impact many species and habitats including Riverine. White rows indicate threats that are important to Riverine, but not to as many other species and habitats as the priority threats. The Threats and Actions chapter focuses exclusively on the WAP priority threats.

Threats to Riverine	Threat Impact (Scope x Severity)			
	Very High	High	Medium	Grand Total
Presence of Dams		1		1
Sediment Transport Imbalance			1	1
Roads – Transportation Network			1	1
Channel Downcutting (indirect, unintentional)		1		1
Improper Grazing (current)		1		1
Channelization / Bank Alteration (direct, intentional)		1		1
Presence of Diversions	1			1
Dam / Reservoir Operation			1	1
Inappropriate Fire Frequency and Intensity			1	
Brush Eradication / Vegetation Treatments			1	1
Salinity Alteration (of water)			1	1
Droughts		1		1
Water Allocation Policies	1			1
Housing and Urban Areas			1	1
Agricultural / Municipal / Industrial Water Usage	1			1
Invasive Plant Species – Non-native			1	1
Grand Total	**3**	**5**	**8**	**16**

Improving Condition

A good strategy for management may include the following elements:

- Promoting policies that maintain or restore natural water and sediment flow regimes.

- Promoting policies that reduce inappropriate grazing by domestic livestock and wildlife.
- Promoting policies that reduce inappropriate siting of roads in riparian zones.
- Promoting policies that reduce inappropriate residential and commercial development in floodplains.
- Continuing the use of appropriate methods for reducing the spread and dominance of invasive weeds, including “early detection – rapid response” programs.

Figure KH-13. Extent of Riverine Aquatic Key Habitat in Utah.

Chapter Introduction

It is a complex undertaking to create a comprehensive list of the threats to species and habitats, given Utah's diverse ecosystems and large area, and the complex nature of the threats themselves. Nationwide, many of the Wildlife Actions Plans from 2005 were inconsistent in the terminology used to describe threats and data gaps and essential conservation actions. This inconsistency impeded conservation across state borders, and challenged efforts toward collaboration, coordination, and joint fundraising within states.

Following the recommendation of the Association of Fish and Wildlife Agencies, Utah has adopted a standardized terminology[36] for threats to species and habitats, as well as for actions that can be taken to avoid, reduce, or mitigate threats. Using a standardized language to describe and refer to threats and actions during the planning process allows us to more easily identify which threats impact multiple species and habitats - collectively referred to as "conservation targets".

The Standardized Threats System

The standardized terminology now shared by many states and territories has two levels of threats. At the first level (Level 1), a small number of broad categories encompass all possible threats, based on where the threat is coming from (e.g. human disturbance, development, invasive species). These general Level 1 categories are then divided into more specific (Level 2) categories.

Using those pre-determined categories, any user of the system can define even more specific categories within this tiered system. In Utah, another level of standardized threats - Level 3 - was developed to ensure that important local information on threats was not lost in the more-general Level 2. For example, <u>Presence of Diversions</u> is a distinctly different threat (requiring different actions, and affecting different stakeholders) from <u>Dam / Reservoir Operation</u>. Both of these are Level-3 threats which (together with several others) are nested under the more general Level-2 threat <u>Dams and Water Management / Use</u>. In turn, that particular Level-2 threat is nested (together with several others) under the even more general Level-1 threat <u>Natural Systems Modification</u>.

Using this consistent terminology has greatly enhanced the ability to view threats and actions through a multi-conservation-target lens within Utah's state borders, and it will enable states to work together more readily.

While there is overlap among these categories, and many judgment calls were required, all of the specific threats and actions we identified could be fitted into this hierarchical system. The standardized

[36] Salafsky, N., Salzer, D., Stattersfield, A. J., Hilton-Taylor, C., Neugarten, R., Butchart, S. H. M., Collen, B., Cox, N., Master, L. L., O'Connor, S. and Wilkie, D. 2008. A Standard Lexicon for Biodiversity Conservation: Unified Classifications of Threats and Actions. Conservation Biology, 22: 897–911.

threat language does not address data gaps at all. To address this, the Utah plan treats data gaps as a new and separate Level-1 "threat", with a multitude of specific data gaps grouped into several new Level-2 "threats".

Each standardized threat, at every level, has an English label and also a numeric code. Elsewhere in this chapter, threat labels are used much more frequently than the numeric threat codes. Where codes appear, they are so formatted: #.#.#. The first (possibly only) digit refers to its Level-1 label, the second (if present) to Level 2, and the third (if present) to Level 3.

Statewide Threat Assessment

This threat assessment was undertaken strictly from the perspective of wildlife conservation. Some of the identified threats are also necessary and highly valued public services and land uses, for instance, water development, residential development, mining, and agriculture. They provide important values: legitimate, often vital public pursuits, from which all of society benefits. Nonetheless, activities such as removing water for municipal or agricultural uses are indisputably harmful to wildlife and their habitats, which are also legitimate public values and resources; therefore, these actions are still threats from the viewpoint of wildlife conservation. These threats need to be identified in order to determine which are most harmful, and where investments in remedial or preventive actions would be most effective and efficient.

A brief description of the threat-assessment process is provided below. More detail and background on the methods used to identify, measure, and prioritize threats and data gaps can be found in the Threats Methods appendix.

- Every SGCN and key habitat was evaluated, one at a time, for every threat. Species and habitat experts scored all the threats they thought were relevant to each target.
- Scoring consisted of assigning a value for the severity and for the scope of each threat-by-target instance. Using a numerical formula[37], severity and scope were integrated into a single measure: “threat impact.”
- When all threats to all targets had been evaluated, the data were reviewed to see 1) how many targets are impacted by each threat, and 2) the degree of impact (low, medium, high, very high). See Table T1 for results of this operation. There are 2,145 identified threat-by-target instances.

Table T1 provides complete results of the statewide assessment of threats to all WAP conservation targets. Threats are summarized at the most general level (Level 1).

[37] Borrowed directly from the NatureServe rank calculator, 2012 version.

Table T1. Complete Results of Threat Assessment

Level-1 Threats to SGCNs and Key Habitats	Threat Impact (Scope x Severity)						
	Very High	**High**	**Medium**	**Low**	**N.A.**	**Unk.**	**Total**
1. Residential and Commercial Development	6	18	25	75	3		127
2. Improper Agriculture and Aquaculture	2	25	19	92			138
3. Energy Production and Mining	5	26	19	129			179
4. Transportation and Service Corridors		15	23	142			180
5. Biological Resource Use		7	11	57			75
6. Human Intrusions and Disturbance		14	23	174			211
7. Natural System Modifications	48	110	97	162			417
8. Invasive and Other Problematic Species and Genes	42	71	84	80			277
9. Pollution		8	25	63		6	102
10. Geological Events		4		4			8
11. Climate Change and Severe Weather	35	35	56	14		11	151
12. Data Gaps					280		280
Total	**138**	**333**	**382**	**992**	**283**	**17**	**2145**

Ranking the Threats

The WAP Joint Team developed a threat ranking system and applied it to the full threats data set. The purpose is to provide efficiency and focus for WAP implementation. Threats which create larger problems, by virtue of severely impacting a large number of conservation targets across large areas, are ranked higher and are the focus of the WAP. Threats which impact many targets less severely or in more limited areas, or which affect relatively few targets (even if those few are severely or widely affected), are ranked lower and are left to be handled outside the scope of the WAP. This chapter presents summary information on the priority threats, plus all the identified data gaps facing species and habitats in Utah. A description of the threat-ranking process is provided below. More detail and background on the methods used to identify and measure threats and data gaps, as well as a table showing all the threats included in the full threats data set, can be found in the Threats Methods appendix.

- Beginning with the full threat-assessment data set (2,145 records), all Level 2 threats relevant[38] to Utah targets (42) had all the data relating to data gaps removed[39]. This eliminated seven Level-2 threats.
- Continuing with data (1,865 records) for the 35 remaining Level 2 threats, all instances of low impacts to targets (992 records) were removed. This eliminated four Level-2 threats.
- From the remaining data set (873 records, in 31 Level-2 threats) records indicating impacts that were either not-applicable (3 records) or of unknown level (17 records) were then censored out.
- For the remaining data set (853 records, in 31 Level-2 threats) a notation was made on how many targets each threat impacts (range 1 to 173), and the average (27.5)was calculated.
- All Level-2 threats impacting an above-average (>27.5) number of targets were selected, and labeled "priority Level-2 threats."
- The 11 priority Level-2 threats account for over 32% of the full data set (690 of 2,145 records).

Table T2 summarizes of the results of our Level-2 threat prioritization exercise. *Priority Level 2 threats are highlighted in orange.* Numerical threat codes are part of the hierarchy and standardization.

Table T2. Results of Threat Ranking - Level-2 Threats

	Threat Impact (Scope x Severity)			
Priority Level-2 Threats to SGCNs and Key Habitats	**Very High**	**High**	**Medium**	**Grand Total**
1. Residential and Commercial Development				
1.1 Housing and Urban Areas	1	10	23	34
2. Improper Agriculture and Aquaculture				
2.3 Improper Livestock Farming and Ranching	2	24	17	43
4. Transportation and Service Corridors				
4.1 Roads and Railroads		15	15	30
6. Human Intrusions and Disturbance				
6.1 Recreational Activities		13	23	36
7. Natural System Modifications				
7.1 Fire and Fire Suppression	14	20	15	49
7.2 Dams and Water Management / Use	34	77	62	173
7.3 Other Ecosystem Modifications		13	20	33
8. Invasive and Other Problematic Species and Genes				
8.1 Invasive Non-native Species	22	34	47	103
8.2 Problematic Native Species	20	37	36	93
11. Climate Change and Severe Weather				
11.1 Habitat Shifting and Alteration	4	5	20	29
11.2 Droughts	22	24	21	67
Grand Total	119	272	299	690

[38] "Volcanoes and Tsunamis" is one example of a Level 2 threat which was deemed not relevant to Utah.
[39] Data gaps were not subjected to the threat-ranking exercise - all have been retained. See the Data Gaps section of this chapter for more information.

At the end of the Level-2 threat prioritization exercise, nested within the 11 priority Level-2 threats there remained 54 Level-3 threats. Level 3 is the level towards which conservation actions can most readily be envisioned and directed. The Joint Team felt that 54 was an unwieldy number to address with actions and monitoring, and that further investigation was warranted.

- Beginning with the priority Level-2 threat data (690 records, in 54 Level-3 threats), the last few steps of the previous operation were executed.
- A notation was made on how many targets each threat impacts (range 1 to 67), and the average (12.8 targets impacted) was calculated.
- All Level-3 threats impacting an above-average (>12.8) number of targets were selected, and labeled "priority Level-3 threats."
- The 19 priority Level-3 threats account for 25.3% of the full data set (543 of 2,145 records).

Table T3 summarizes the results of the Level-3 threat prioritization exercise. *Priority Level-3 threats are highlighted in yellow*. Numerical threat codes are part of the hierarchy and standardization.

Table T3. Results of Threat Ranking - Level-3 Threats

Priority Level-3 Threats to SGCNs and Key Habitats	Threat Impact (Scope x Severity)			
	Very High	High	Medium	Grand Total
1.1 Housing and Urban Areas				
1.1.0 Housing and Urban Areas	1	10	21	32
2.3 Improper Farming and Ranching				
2.3.1 Improper Grazing (current)		17	13	30
4.1 Roads and Railroads				
4.1.1 Roads – Transportation Network		12	12	24
6.1 Recreational Activities				
6.1.1 OHV Motorized Recreation		6	10	16
7.1 Fire and Fire Suppression				
7.1.1 Inappropriate Fire Frequency and Intensity	14	20	10	44
7.2 Dams and Water Management / Use				
7.2.1 Presence of Dams		8	6	14
7.2.2 Presence of Diversions	6	12	4	22
7.2.3 Dam / Reservoir Operation	6	8	8	22
7.2.5 Channelization / Bank Alteration (direct, intentional)		14	9	23
7.2.8 Agricultural / Municipal / Industrial Water Usage	11	5	9	25
7.2.9 Water Allocation Policies	11	15	1	27
7.2.11 Sediment Transport Imbalance		4	12	16
7.3 Other Ecosystem Modifications		13	20	33
(no Level 3 threats individually rose to priority level)[40]				

[40] Note the Level-2 priority threat "7.3, Other Ecosystem Modifications" with no associated Level-3 threats. Threat 7.3 actually has five Level 3 threats nested within it, but none individually rose to Level-3 priority status. Accordingly, this threat is addressed at Level 2.

8.1 Invasive Non-native Species				
8.1.1 Invasive Wildlife Species - Non-native	13	12	11	36
8.1.2 Invasive Plant Species – Non-native	4	14	31	49
8.1.5 Disease – Alien Organisms	5	7	4	16
8.2 Problematic Native Species				
8.2.1 Problematic Animal Species – Native		7	11	18
8.2.7 Natural Rarity	18	19	8	45
11.1 Habitat Shifting and Alteration				
11.1.1 Increasing Stream Temperatures	4	3	10	17
11.2 Droughts				
11.2.0 Droughts	22	24	21	67
Grand Total	**135**	**225**	**223**	**543**

The intent of this ranking process was to identify the threats with the highest impact on the most species and habitats, so that conservation resources could be focused more efficiently. The Joint Team felt these results were satisfactory in this regard, winnowing out almost 75% of the original data set while, intuitively, retaining all of the most important statewide threats for further consideration.

Ideally, the wildlife conservation community needs to move toward steady management for the benefit of many species and habitats at once. The WAP attempts to enable this process; prioritizing threats to focus on the ones with the biggest statewide impact is an important mechanism to move it in this direction. This change in approach will be much more efficient and proactive in:

- Reducing the number of species warranting a listing under the Endangered Species Act.
- Reducing the number of divisive, expensive conflicts among stakeholders and authorities.
- Improving broad ecosystem health and function - cleaner air and water, more carbon in the soil, more water in the streams and lakes, less soil erosion, and more native wildlife.
- Increasing recreational and economic opportunities and intangible amenities for all Utahns.

Although lower-priority threats will not receive further attention in the WAP, they may still be highly detrimental to a small number of species or habitats. Lead poisoning is a prime example: although few species are affected by lead poisoning, for at least one (California condor) it is the biggest threat of all. Such threats do need to be addressed to ensure conservation of a species or habitat. But they are not a priority in the WAP, thus they will receive no further consideration here.

This chapter provides information on all the threats that remained after this prioritization exercise. These are the threats to wildlife and habitats that are most likely to result in significant problems for Utah if they are not managed. In the pages which follow, there is a brief narrative account for every priority threat in Table T3.

The Standardized Actions System

Like the standardized threats, the standardized actions are based on two levels (Level 1 and Level 2) from the published literature.

- The Level 1 actions are based on what general type of action (e.g. water protection, land protection, law and policy changes) could address a given threat.
- The Level 2 actions provide more specific and detailed instances, that each nest within the most relevant Level 1 category.

As with the standardized threats system, any user of the standardized actions system can define increasingly specific categories within this tiered system. In Utah, many Level 3 actions were developed in order to ensure that important local information was not washed out by the generality of the first and second levels.

Continuing the repeated pattern from the standardized threats, each standardized action at every level has an English label and also a numeric code. Elsewhere in this chapter, action labels and codes occur with equal frequency. Action codes are formatted just like threat codes: #.#.#. The first digit refers to its Level 1 label, the second to Level 2, and the third to Level 3.

Essential Conservation Actions

Conservation professionals need to understand both the biological systems and the human social systems in which they work. The core strategy of conservation is to influence these biological and social systems, for the good of wildlife and their habitats. Actions are essential to bring this strategy to life, to actually improve the conservation status of species and habitats. Actions are taken to do such things as:

- Restore and/or improve degraded wildlife populations and habitat conditions or functions.
- Respond to emergencies.
- Take advantage of valuable opportunities.

Appropriate actions will need to be chosen or developed in concert with the administrators and stakeholders of the activities - many being *legitimate economic, cultural, and/or recreational pursuits* - which have been identified as "priority threats".

<u>Identifying Realistic, Acceptable Actions Collaboratively</u>

A wise starting point for prescribing conservation actions is outlining where the various implementation challenges may lurk. Such a practice can help avoid some predictable conflicts in the future. Some threats can be addressed with actions that UDWR and/or partners have full authority to undertake. Other threats can often be easily addressed, with a little dialogue and compromise. UDWR and partners will continue to take these types of actions, individually and collectively.

Other types of threats are more challenging to address for a number of reasons: e.g., none of the current WAP partners have the legal authority to tackle them, there are demands on the resource that are in conflict with wildlife needs, or there are factors influencing the threat for which it is unclear what specific action to take. In order to address threats such as these, it will be necessary to work with their authorities and stakeholders to find areas of mutual interest, and make acceptable progress.

The actions included in this plan are presented as starting points in the discussion, not fixed requirements. Progress will be made by considering all ideas that can result in broadly-acceptable mechanisms to meet the needs of wildlife and Utahns, not just the actions already listed in the WAP. Inclusiveness is a requirement for determining what, how, where and when conservation will happen. Many vital stakeholders have not yet been included in determining the final, decided WAP actions.

Virtually all of the SGCNs and key habitats are affected by multiple threats. As such, UDWR understands the importance of communicating the need for collaboration with the authorities and stakeholder of threats for which it has no authority. In cases where targets are affected by multiple threats, actions will be strategically implemented to ensure a diversified and balanced approach to conservation, whereby funding and effort can be applied at an appropriate level to address each threat. These actions will be evaluated on an ongoing basis, to assess their contribution towards achieving the threat objectives and to ensure an equitable contribution towards target security.

This chapter presents a description and write-up for each priority threat. The central feature of each priority threat write-up is a set of ***Essential Conservation Actions*** that consist of four key points:

- Objective(s) for Each Priority Level 3 Threat.
- Potential Indicators of Success Reaching Each Objective.
- Potential Conservation Actions.
- Likely Authorities, Stakeholders, and/or Partners[41].

Some priority threats are significant, intimidating challenges that will require intensive stakeholder collaboration to correct. But there are successful precedents for situations like this. A number of case studies are included as examples, to provide inspiration to those who must meet these upcoming challenges. Some resources and suggestions for initiating and structuring crucial stakeholder conversations are provided in the Implementation Mechanisms and Key Partnerships chapter.

[41] UDWR considers itself a stakeholder, partner, and/or authority in all of these priority threats. To reduce the size of this document, UDWR is not included in these lists.

Residential and Commercial Development

Threats from human settlements or other non-agricultural land uses with a substantial footprint.

Within this broad category, one Level-2 threat was ranked as a priority: Housing and Urban Areas.

Housing and Urban Areas

Table T4 summarizes the numbers of species and habitats impacted by this priority Level-2 threat, by all nested priority Level-3 threats, and the level of impacts (Very High, High, or Medium).

This Level-2 threat is further subdivided into several Level-3 threats, two of which have impacts above the Low level. One of these Level-3 threats, the eponymous Housing and Urban Areas, was ranked as a priority.

Table T4. Results of Threat Assessment of Priority Level-2 Threat, Housing and Urban Areas

Level-3 Threat - Housing and Urban Areas	Threat Impact (Scope x Severity)			
	Very High	High	Medium	Grand Total
Amphibians			**2**	**2**
Columbia Spotted Frog			1	1
Great Plains Toad			1	1
Aquatic Habitats			**4**	**4**
Aquatic-Forested			1	1
Aquatic-Scrub/Shrub			1	1
Open Water			1	1
Riverine			1	1
Aquatic Inverts		**1**		**1**
Desert Springsnail		1		1
Birds			**5**	**5**
Greater Sage-grouse			1	1
Gunnison Sage-grouse			1	1
Sharp-tailed Grouse			1	1
Southwestern Willow Flycatcher			1	1
White-faced Ibis			1	1
Fishes		**4**	**2**	**6**
Desert Sucker		1		1
Northern Leatherside Chub			1	1
Southern Leatherside Chub			1	1
Virgin Chub		1		1
Virgin Spinedace		1		1
Woundfin		1		1
Mammals	**1**	**2**	**1**	**4**

[a Race of the] Chisel-toothed Kangaroo Rat			1	1
[a Race of the] Montane Vole	1			1
American Bison		1		1
Utah Prairie Dog		1		1
Reptiles		**3**	**3**	**6**
Gila Monster		1		1
Mohave Desert Tortoise		1		1
Smith's Black-headed Snake			1	1
Utah Banded Gecko			1	1
Utah Milksnake			1	1
Western Threadsnake		1		1
Terrestrial Habitats			**4**	**4**
Desert Grassland			1	1
Lowland Sagebrush			1	1
Mojave Desert Shrub			1	1
Mountain Sagebrush			1	1
Grand Total	**1**	**10**	**21**	**32**

Utah is one of the fastest growing states in the nation. From 1970 - 2013 the state's population nearly tripled from 1.1 million to 2.9 million and it is projected that there will be 1 to 2.5-million new Utahns by 2050. That growth will necessitate more places for people to live, work, shop, and play (often at the expense of wildlife and their habitats). For every new resident, open space is lost due to construction of housing, roads, schools, commercial buildings, and other infrastructure. Additionally, urban growth requires the development and use of limited water resources. Fortunately, much of Utah's population increase is expected to occur in existing urban centers such as the Wasatch Front, St. George, and Cedar City.

The impacts of urbanization on wildlife are greatest where growth overlaps with rare habitats and range-restricted species. Of 11 species with a threat score of high or very high for housing and urban development, 9 are restricted to Washington county and primarily impacted by the growth of St. George and surrounding suburbs. Those species can be broadly lumped into those dependent on the Virgin River and adjacent riparian areas and those reliant upon Mojave Desert habitats. The Utah prairie dog, a federally threatened species endemic to the Cedar City area of south-central Utah, is an example of a species with a High threat rating and contentious battles over urban development.

As nearly 80% of Utah is in public ownership, there is political opposition to reductions in the private lands base. Therefore, voluntary agreements and incentives to preserve land in open space are generally preferred actions. Land use planning decisions occur at a high level with wildlife concerns often taking a back seat to economic and other quality of life factors such as transportation, clean air, and education. Rather than driving the conversation, wildlife concerns need to be incorporated into planning efforts in order to achieve the greatest impact. Although the primary aim of the WAP is to propose actions that directly benefit species of greatest conservation need, the indirect benefits of preserving wildlife habitat in and around urban areas are many. Experiencing nature in an urban context can foster support for ecological preservation and has the potential to improve quality of life and health of urban and suburban residents.

Case Study: Managing Wildlife / Growth Conflicts With the Washington County Lands Bill

The St. George Metropolitan Area in Washington County has been one of the nation's fastest growing urban areas with an annual growth rate of 6.2% over the last two decades, and projected cumulative growth of 242% by 2050. It is home to the federally listed desert tortoise, southwestern willow flycatcher, woundfin, and Virgin River chub. ESA protection of those species has restricted private property rights, and public land ownership has slowed economic development, resulting in decades of bitter fighting over land use in Washington County.

Through the Washington County Growth and Conservation Act of 2009 (which was rolled into the Omnibus Public Land Management Act of 2009), a compromise was reached which sought to protect endangered species while giving cities space to grow. Through participation from all sides, the measure was supported by environmental activists, developers, recreationalists, miners, and local officials. This 2009 Act:

- *Designated 256,000 acres in Washington County as wilderness, including land within Zion National Park.*
- *Created the Red Cliffs and Beaver Dam Wash National Conservation Areas to protect the Mojave desert tortoise.*
- *Designated 166 miles of the Virgin River as a Wild and Scenic River, the first in Utah's history.*
- *Enhanced management of OHV use through a comprehensive travel management plan.*
- *Authorized the BLM to sell 5,000 acres of non-sensitive lands to developers, to help St. George continue to grow - with 95% of proceeds going to acquire high priority, biologically significant inholdings within Wilderness Areas and National Conservation Areas.*

Essential Conservation Actions to Address This Threat

Some threats to wildlife can be addressed with actions for which UDWR and/or partners have substantial authority, as well as stakeholder buy-in and broader social license. Other threats are more challenging to address, because they also constitute legitimate economic, cultural, and/or recreational pursuits. In order to address such threats, appropriate actions will need to be chosen or developed in concert with the administrators and stakeholders of those legitimate pursuits. The objectives and actions listed below are presented as starting points in an inclusive discussion, not requirements or decisions that have already been made. Any and all ideas that can result in broadly-acceptable actions to meet the needs of wildlife and Utahns are most welcome. Inclusiveness is a requirement for deciding what conservation actions will actually happen, on whose terms, and when. See the Partnerships and Implementation Mechanisms chapter for more resources.

Objective #1 for Housing and Urban Areas

Open lands that are crucial to wildlife do not have the potential to be developed for housing and urban growth.

Potential Indicators of Success Reaching This Objective

- Specific land tracts of sufficient acreage are in ownership, easement, or zoning status that precludes housing and urban development.

Potential Conservation Actions

Code	Action
1.2.1	Develop a list of priority locations for resource and habitat protection.
5.2.2	Complete a scaled-down version of the Crucial Habitat Assessment Tool (CHAT) to identify important wildlife lands.
5.2.3	Apply protective zoning designations to identified critical wildlife areas.
5.2.4	Enable the private sector to use Transfer of Development Rights (TDR) to encourage development away from sensitive areas.
6.1.3	Increase the profitability of land uses that maintain wildlife habitats.
6.1.4	Continue UDWR's Cooperative Wildlife Management Unit program.
6.3.5	Institute a process where actions that result in adverse impacts to wildlife or habitat can be offset by funding conservation and management on other lands through mechanisms such as "conservation banks".
6.3.6	Manage game species to support sustainable populations that contribute to economic activity and the maintenance of natural resources.
6.4.2	Continue UDWR's Walk-in Access program and expand it to non-consumptive uses.
6.5.3	Enroll private lands in temporary voluntary agreements (Safe Harbor Agreements, Candidate Conservation Agreements, etc.).
7.1.1	Engage with statewide and local efforts to ensure wildlife values are incorporated into visioning and planning efforts.
7.3.7	Establish entities that qualify for NRCS stewardship funds to administer easements.

Likely Authorities, Stakeholders, and/or Partners

- Utah Open Lands
- Envision Utah
- Utah School and Institutional Trust Lands Administration
- Virgin River Program
- County and City Planning and Zoning Commissions
- The Nature Conservancy
- US Fish and Wildlife Service
- Natural Resources Conservation Service
- Private landowners
- Private developers
- Your Utah Your Future

Objective #2 for Housing and Urban Areas

Future physical and environmental footprints of housing and urban development are reduced or managed so that wildlife resources are sustained.

Potential Indicators of Success Reaching This Objective

- Decrease in per capita water consumption.
- Future development follows smart growth principles to reduce urban sprawl.
- SGCN populations in and around existing urban areas expand or remain stable.

Potential Conservation Actions

Code	Action
2.1.1	Maintain the integrity of important habitat areas by providing spatial and noise buffers to adjacent housing/urban growth.
2.3.2	Identify and maintain wildlife migration corridors, and protected buffers around populations of SGCNs that may need to move up or down in elevation.
2.3.3	Develop wildlife crossing structures to provide safe passage of roads or other movement barriers.
3.1.3	Manage human-wildlife conflicts by means which minimize property and human safety risks while preserving intact wildlife populations.
4.3.5	Encourage landscaping with native plants to provide pollinator and wildlife habitat and water conservation.
4.3.6	Develop public information and educational programs aimed at encouraging attitudes and behaviors that are positive for wildlife conservation.
4.3.7	Conduct environmental education in urban parks and open spaces to foster appreciation for

conservation and connect our growing urban population with nature, potentially broadening support for natural resource conservation.

5.2.5 Support more xeriscaping.

5.2.6 Enable and promote redevelopment and compact development to minimize open-space conversion.

6.4.3 Provide rebates for activities that reduce residential water use.

6.5.2 Emphasize the importance of open spaces and outdoor recreation to enhance the lives and health of the public.

7.1.1 Engage with statewide and local efforts to ensure wildlife values are incorporated into visioning and planning efforts.

Likely Authorities, Stakeholders, and/or Partners

- Utah Division of Water Resources
- Utah Department of Transportation
- Slow the Flow
- Water Conservancy Districts
- Envision Utah
- County and City Planning and Zoning Commissions
- Natural Resources Conservation Service
- Private landowners
- Private developers

Improper Agriculture and Aquaculture

Threats from improper farming and ranching practices as a result of agricultural expansion and intensification, including silviculture, mariculture, and aquaculture.

Within this broad category, one Level-2 threat was ranked as a priority: Improper Livestock Farming and Ranching.

Improper Livestock Farming and Ranching

Table T5 summarizes the numbers of species and habitats impacted by this priority Level-2 threat, by all nested priority Level-3 threats, and the level of impacts (Very High, High, or Medium).

This Level-2 threat is further subdivided into several Level-3 threats, three of which have impacts above the Low level. One of these, Improper Grazing (current) was ranked as a priority. This threat occurs when a site does not have the capacity to accommodate the duration, intensity, and/or timing of grazing that occurs by livestock, wildlife, feral animals, or some combination thereof.

Table T5. Results of Threat Assessment of Priority Level-2 Threat, Improper Livestock Farming and Ranching

Level 3 Threat - Improper Grazing (current)	**Threat Impact (Scope x Severity**		
	High	**Medium**	**Grand Total**
Amphibians	**1**	**3**	**4**
Great Plains Toad		1	1
Mexican Spadefoot		1	1
Plains Spadefoot		1	1
Western Toad	1		1
Aquatic Habitats	**2**	**2**	**4**
Aquatic-Forested		1	1
Aquatic-Scrub/Shrub	1		1
Open Water		1	1
Riverine	1		1
Aquatic Inverts	**2**	**2**	**4**
Bear Lake Springsnail		1	1
Bifid Duct Pyrg	1		1
Southern Bonneville Springsnail		1	1
Western Pearlshell	1		1
Birds	**1**	**1**	**2**
Southwestern Willow Flycatcher		1	1
Yellow-billed Cuckoo	1		1
Fishes	**5**	**2**	**7**
Bonneville cutthroat trout	1		1
Colorado River cutthroat trout	1		1

Desert Sucker	1		1
Least Chub		1	1
Southern Leatherside Chub		1	1
Virgin Spinedace	1		1
Yellowstone cutthroat trout	1		1
Mammals	**1**		**1**
Pygmy Rabbit	1		1
Reptiles	**2**	**1**	**3**
Desert Night Lizard		1	1
Gila Monster	1		1
Many-lined Skink		1	1
Mohave Desert Tortoise	1		1
Western Threadsnake	1		1
Terrestrial Habitats	**2**	**1**	**3**
Aspen-conifer	1		1
Desert Grassland		1	1
Mountain Sagebrush	1		1
Grand Total	**17**	**13**	**30**

Threat – Improper Grazing (current): Grazing by domestic livestock on private and public lands is a large and very important part of rural Utah's economic viability and cultural heritage. Livestock grazing can be done sustainably or unsustainably. Livestock grazing can be ecologically beneficial where it mimics processes and conditions with which the land and vegetation evolved. In Utah, for example, one could anticipate the possibility of ecologically-beneficial effects in the Utah-Wyoming Mountain Ecoregion, which enters into Utah in Rich County and was historically grazed intermittently by herds of bison. In other areas, the potential negative impacts of livestock grazing can be minimized by thoughtfully managing the scope, intensity, duration, and species of livestock grazed. Improper grazing can result in degradation of the function and condition of soil and water, and may result in the introduction and spread of noxious, invasive, and/or undesirable plant species – all to the detriment of key habitats, several SGCNs, and the economic health of ranchers. These are the threats we seek to reduce.

Fortunately there are a number of economically- and ecologically-sustainable stewardship practices that are eligible for technical and/or financial assistance. Through these actions it is often possible to greatly reduce impacts to species and habitats, with little to no negative effect on ranching operations, and sometimes a significant benefit (e.g., cattle prefer clean trough water over muddy pond or creek water; they also gain more weight on clean water[42]).

[42] W.D.Willms et al. 2002. Effects of water quality on cattle performance. J. Range Mgt 55:452-460. Also see http://extension.oregonstate.edu/harney/sites/default/files/nce__pasture_distribution__and_water_quality.pdf accessed January 31, 2015.

Case Study: Envisioning Sustainable Grazing for Three National Forests in Southern Utah

In fall 2011, the Utah Department of Agriculture and Food and the Utah Department of Natural Resources jointly convened a collaborative group to discuss sustainable grazing on three National Forests in southern Utah: Dixie, Fishlake, and Manti-La Sal. A diverse array of stakeholders met to learn from one another, identify current issues, and develop agreement on how National Forest lands can be sustainably grazed. Representatives from the livestock industry, conservation interests, state and federal agencies, universities, sportsmen's interests, and local government attended ten meetings over the course of a year. The group worked to achieve consensus to ensure that all participants were comfortable with the documents produced by the collaborative.

The group was tasked with developing consensus agreement on grazing management principles and practices for National Forest lands in southern Utah that provide for ecological sustainability, are socially acceptable, and economically viable.

The group identified key indicators of ecological, social, and economic conditions related to grazing. Numerous potential ecological indicators were listed – 11 for upland range areas, and 15 for riparian areas. The group agreed on 12 social and economic indicators – things which, if measured in the areas where grazing occurs on National Forest land, could help everyone understand the effect that changes in grazing management might have on individual permittees and local ranching culture, as well as local economies and communities.

With the three types of indicators identified, the collaborative focused on grazing management principles and practices. Three fundamental principles of grazing management, used together, provide the foundation for improving the sustainability of grazing: (1) <u>Time</u>: duration/length of grazing use in an area; (2) <u>Timing</u>: when – what season – an area is grazed; and (3) <u>Intensity</u>: how much is eaten by livestock while they are in an area.

Using these three principles as a foundation, the group listed more than 20 specific grazing management practices which could improve the sustainability of grazing activities on National Forest lands. Such practices include changing the use of pastures at different times of the year, resting pastures from grazing, reducing pasture or allotment stocking rates, or other adjustments to grazing patterns that contribute to ecological, social, and economic sustainability.

Most of the group's recommendations involved communication and shared decision-making among permittees, the Forest Service, and potentially other interested parties. The collaborative also provided recommendations specific to the Forest Service, given that agency's role in administering and managing grazing on the National Forests. Further, a key focus of many discussions was how to provide appropriate incentives to livestock operators to embrace grazing management principles on the Forests, since their full participation is critical to successful, sustainable grazing.

The group recommended a continued collaborative effort by all parties involved in activities related to National Forest grazing. Improving communication, building trust, and working and learning together are critical to achieving the collaborative's primary goal. That goal is having a grazing system on the three National Forests of southern Utah that is ecologically sustainable, broadly socially acceptable, and economically viable for the ranchers and communities that depend upon it for their culture and livelihood.

Case Study: Simple Changes to Grazing Practices Can Make a Big Difference to SGCNs

Sometimes very modest changes in land stewardship practices can have big benefits to SGCNs. One example is changes in grazing that have been implemented in Sanpete County, Utah, to benefit Columbia spotted frogs.

Early spring grazing can be detrimental to Columbia spotted frogs in a couple of ways. The first is directly, through trampling of adults and their eggs. The second is indirectly, through increased water turbidity and siltation which can suffocate eggs and tadpoles. Biologists and private landowners have been able to fence sensitive areas and/or make minor changes to grazing timing, while providing off-site water, in order to offset the risk to amphibians with little to no impact upon ranching operations.

Essential Conservation Actions to Address This Threat

Some threats to wildlife can be addressed with actions for which UDWR and/or partners have substantial authority, as well as stakeholder buy-in and broader social license. Other threats are more challenging to address, because they also constitute legitimate economic, cultural, and/or recreational pursuits. In order to address such threats, appropriate actions will need to be chosen or developed in concert with the administrators and stakeholders of those legitimate pursuits. The objectives and actions listed below are presented as starting points in an inclusive discussion, not requirements or decisions that have already been made. Any and all ideas that can result in broadly-acceptable actions to meet the needs of wildlife and Utahns are most welcome. Inclusiveness is a requirement for deciding what conservation actions will actually happen, on whose terms, and when. See the Partnerships and Implementation Mechanisms chapter for more resources.

Objective #1 for Improper Grazing (current)

Grazing is managed such that ecological conditions in Key Habitats show improvement in various indicators of rangeland health.

Potential Indicators of Success Reaching This Objective

- At the site, allotment, and larger landscape scales, indicators of soil stability, ecological integrity, and hydrological integrity are at, or are moving toward levels that represent proper functioning for the various habitats in which grazing occurs.
- At a HUC-8 or comparable landscape scale, measurable vegetative characteristics (e.g., species composition and habitat structure) are comparable to, or are on a trend towards the reference condition for all key habitats' constituent biophysical settings (BpSs) as described in the LANDFIRE vegetation model for the corresponding map zone.

Potential Conservation Actions

Code	Action
2.1.2	Adjust grazing practices – per the grazing principles of timing, duration, and intensity – to improve conditions of habitat, water and wildlife.
5.4.8	On public lands, encourage collaborative problem-solving and monitoring among agency staff, permittees, and interested parties.
6.4.1	Utilize cost-share and technical assistance programs administered by NRCS, FSA, UDAF, University Extension, and other organizations to improve natural resource management.
6.5.4	Encourage landowner, permittee, and (on public lands) conservation NGO and citizen science involvement in monitoring efforts.
6.5.5	Develop locally and, on public lands, broadly-acceptable strategies for managing grazing in key areas.
6.5.6	Provide technical assistance to grazing permittees to increase buy-in for management changes.

Likely Authorities, Stakeholders, and/or Partners

- US Forest Service
- Bureau of Land Management
- Grazing permittees
- Utah School and Institutional Trust Lands Administration
- Utah Farm Bureau Federation
- Utah Cattlemen's Association
- Utah Woolgrowers' Association
- Utah Department of Agriculture and Food
- Conservation NGOs
- Academic specialists in rangeland science and related disciplines

Transportation and Service Corridors

Threats from long narrow transport corridors and the vehicles that use them, including associated wildlife mortality.

Within this broad category, one Level-2 threat was ranked as a priority: Roads and Railroads.

Roads and Railroads

Table T6 summarizes the numbers of species and habitats impacted by this priority Level-2 threat, by all nested priority Level-3 threats, and the level of impacts (Very High, High, or Medium).

This Level-2 threat is further subdivided into several Level-3 threats, two of which have impacts above the Low level. One of these, Roads – Transportation Network was ranked as a priority.

Table T6. Results of Threat Assessment of Priority Level-2 Threat, Roads and Railroads

Level 3 Threat - Roads - Transportation Network	Threat Impact (Scope x Severity)		
	High	Medium	Grand Total
Aquatic Habitats		**4**	**4**
Aquatic-Forested		1	1
Aquatic-Scrub/Shrub		1	1
Open Water		1	1
Riverine		1	1
Aquatic Inverts	**1**		**1**
Bifid Duct Pyrg	1		1
Birds		**2**	**2**
Bald Eagle		1	1
Southwestern Willow Flycatcher		1	1
Fishes	**7**	**2**	**9**
Bonneville cutthroat trout	1		1
Colorado River cutthroat trout	1		1
Desert Sucker	1		1
June Sucker		1	1
Southern Leatherside Chub		1	1
Virgin Chub	1		1
Virgin Spinedace	1		1
Woundfin	1		1
Yellowstone cutthroat trout	1		1
Mammals		**1**	**1**
Allen's big-eared bat		1	1
Reptiles	**4**	**2**	**6**
Black-necked Gartersnake		1	1

Gila Monster	1		1
Midget Faded Rattlesnake		1	1
Mohave Desert Tortoise	1		1
Utah Banded Gecko	1		1
Western Threadsnake	1		1
Terrestrial Habitats		**1**	**1**
Mountain Sagebrush		1	1
Grand Total	**12**	**12**	**24**

Threat – Roads – Transportation Network: The road and transportation system in Utah is vital to all aspects of life to residents of Utah. There are over 975 miles of U. S. Interstate and approximately 2,060 miles of U.S. Highways in Utah, along with 3,658 miles of Utah state highways. These major roadways are the principal means of transporting goods and people to, from, and around the state. There are also thousands of miles of lighter-duty roads in the state transportation network, ranging from paved 2-lane county roads, to dirt or gravel backways that are graded once a year.

Roads impact wildlife in numerous ways. In the WAP threat assessment, the largest negative effect of roads was identified as destruction and fragmentation of riverine and riparian habitat. Roads were historically built in areas that required the cheapest, simplest construction. Many of these areas were in canyon bottoms, along creeks and rivers where bridges and culverts were needed to cross water bodies, creating barriers to fish passage. Wandering waterways were stabilized to prevent lateral movement of the stream, preventing flood events from establishing and maintaining riparian vegetation that is needed to provide habitat for many aquatic and terrestrial wildlife species.

Utah's population is projected to grow substantially by 2050. This could lead to significant changes to existing roads, along with new roads being planned and built. As existing roads are altered, or new roads are planned and built, collaborative partnering could avoid, minimize or mitigate habitat fragmentation, and benefit wildlife as well as people.

Case Study: Partnering to Improve Stream Connectivity

In 2004, mine reclamation began for a defunct coal mine in the Scofield area. The mine operator had gone bankrupt, and the Utah Division of Oil, Gas and Mining (DOGM) had taken responsibility for the reclamation of the mine site with limited funds from bankruptcy proceedings. Most of the money was used to reclaim the mine location itself, as well as the long stretch of roadway providing access from Utah Highway 96 to the mine site.

The final part of the reclamation involved potentially removing a 400' culvert, parallel to the main highway, which directs Eccles Creek underneath the access road. This long culvert is a major fish barrier. Eccles Creek is a tributary to Mud Creek, which fills Scofield Reservoir, a popular recreational fishery for *the area. The culvert was found to lie along the Utah Department of Transportation (UDOT) right-of-way. Besides providing access from the highway to the mine, the culvert had enabled the construction of a large vehicle pull-out along the highway, within the state right-of-way.*

DOGM worked with UDWR, UDOT and the adjoining private landowner, to determine if the culvert could be removed or if there was a need to keep the highway pull-out for maintenance or safety reasons. It was determined that there was no compelling reason to keep the pull-out, and that it and the culvert should be removed to recover the lost fish habitat values.

DOGM applied for and received $51,000 in Civil Penalty funds from the US Office of Surface Mining to finish the removal of asphalt, fill, and culvert from Eccles Creek. DOGM and UDWR are now planning to remove the culvert in 2015, along with re-contouring the natural stream channel and restoring fish access to 1.5 miles of riverine habitat. Habitat restoration will include providing as much stream meander as possible, and creating complex fish habitat with a series of rock- and log-formed step pools.

Essential Conservation Actions to Address This Threat

Some threats to wildlife can be addressed with actions for which UDWR and/or partners have substantial authority, as well as stakeholder buy-in and broader social license. Other threats are more challenging to address, because they also constitute legitimate economic, cultural, and/or recreational pursuits. In order to address such threats, appropriate actions will need to be chosen or developed in concert with the administrators and stakeholders of those legitimate pursuits. The objectives and actions listed below are presented as starting points in an inclusive discussion, not requirements or decisions that have already been made. Any and all ideas that can result in broadly-acceptable actions to meet the needs of wildlife and Utahns are most welcome. Inclusiveness is a requirement for deciding what conservation actions will actually happen, on whose terms, and when. See the Partnerships and Implementation Mechanisms chapter for more resources.

<u>Objective #1 for Roads - Transportation Network</u>

New roads are planned and sited in areas where there are limited impacts to wildlife. When existing roads are maintained, barriers to wildlife movement are altered to allow for movement.

<u>Potential Indicators of Success Reaching This Objective</u>

- UDOT works with UDWR and other wildlife stakeholders to site and design new highways to avoid, minimize, and/or mitigate wildlife-vehicle conflicts.
- UDOT works with UDWR and other wildlife stakeholders to improve and maintain existing highways to avoid, minimize, and/or mitigate wildlife-vehicle conflicts.

<u>Potential Conservation Actions</u>

Code	Action
1.1.1	Develop a list of priority locations for site / area protective designation.
2.1.4	Design and locate recreational infrastructure/facilities in appropriate locations that avoid or minimize adverse impacts on SGCNs and key habitats.
2.3.1	Develop a list of priority locations for restoration of habitats and natural processes.
2.3.11	Create selective fish passage structures at priority barriers.
2.3.12	Remove undesired instream barriers or consolidate multiple barriers where feasible.
5.2.3	Apply protective zoning designations to identified critical wildlife areas.
5.4.3	Enforce existing regulations on stream alteration.

Likely Authorities, Stakeholders, and/or Partners

- Utah Department of Transportation
- US Forest Service
- Bureau of Land Management
- Utah School and Institutional Trust Lands Administration
- Conservation NGOs

Human Intrusions and Disturbances

Threats from human activities that alter, destroy, and disturb habitats and species associated with non-consumptive uses of biological resources.

Within this broad category, one Level-2 threat was ranked as a priority: Recreational Activities.

Recreational Activities

Table T7 summarizes the numbers of species and habitats impacted by this priority Level-2 threat, by all nested priority Level-3 threats, and the level of impacts (Very High, High, or Medium).

This Level-2 threat is further subdivided into numerous Level-3 threats, seven of which have impacts above the Low level. One of these, OHV Motorized Recreation, was ranked as a priority.

Table T7. Results of Threat Assessment of Priority Level-2 Threat, Human Intrusions and Disturbances

Level 3 Threat - OHV Motorized Recreation	**Threat Impact (Scope x Severity)**		
	High	**Medium**	**Grand Total**
Amphibians	**3**		**3**
Great Plains Toad	1		1
Mexican Spadefoot	1		1
Plains Spadefoot	1		1
Birds	**2**	**3**	**5**
Ferruginous Hawk		1	1
Golden Eagle		1	1
Mexican Spotted Owl	1		1
Southwestern Willow Flycatcher	1		1
Yellow-billed Cuckoo		1	1
Fishes		**4**	**4**
Desert Sucker		1	1
Virgin Chub		1	1
Virgin Spinedace		1	1
Woundfin		1	1
Mammals		**2**	**2**
Dark Kangaroo Mouse		1	1
Kit Fox		1	1
Reptiles	**1**		**1**
Many-lined Skink	1		1
Terrestrial Habitats		**1**	**1**
Desert Grassland		1	1
Grand Total	**6**	**10**	**16**

Threat: OHV Motorized Recreation: With its beautiful and diverse landscapes featuring dramatic alpine mountains, iconic red rock deserts, shimmering salt flats, and stunning rivers and lakes, Utah is a virtual mecca for outdoor recreation enthusiasts. In all its diversity, from birdwatching and nature photography to jet-skiing and snowmobiling, outdoor recreation contributes more than $5.8 billion to the state's economy, employs more than 65,000 people, and is the primary driver behind Utah's $7.4 billion tourism industry. In recognition of that importance, the Governor's Outdoor Recreation Office was created in 2013 with the vision to *Establish a nationwide recreation management standard, acknowledging that outdoor recreation is an essential component of Utah's culture, identity, diverse economy, and well-being, and ensuring that the State's natural assets can sustain economic growth and quality-of-life dividends for years to come.*

When enjoyed responsibly, OHV Motorized Recreation can have little impact on wildlife habitats and populations, and can provide wonderful opportunities for people to observe and appreciate wildlife. However, when enjoyed without adequate consideration for its negative potential, it can impact wildlife severely, resulting in changes in wildlife abundance and community composition, degraded habitats, and conflicts between wildlife stakeholders. Recreation impacts on wildlife can roughly be categorized as impacts to individuals and impacts to habitats.

Individual impacts include activities that may directly kill or displace an individual animal, such as striking them with a vehicle. They also include activities that unintentionally or intentionally harass individuals. Obvious behavioral responses to disturbance (such as a bird flushing from a nest) are often accompanied by invisible physiological responses (such as elevated levels of stress hormones). Whereas a single incident may not harm an individual, repeated disturbance can negatively impact survival or reproduction. The impact can be especially acute when critical life stage habitats such as dens, nests, maternity colonies and hibernacula are disturbed. Recreation impacts that directly impact individuals also include the problems of introduced and/or subsidized predators, and introduced pathogens.

Habitat impacts result in changes to habitat structure and function that in turn affect the behavior, survival, reproduction, and distribution of individuals. Common impacts are trampling plants, compacting soil, polluting water, and dispersing weeds. The impacts can be more significant in rare and vulnerable habitats important to wildlife such as riparian areas and alpine meadows.

For both forms of impact, the significance and magnitude of effect are related to the scope, intensity and timing of the recreational activity. Further complicating matters, even within the same species, the individual response may vary greatly due to factors such as habitat condition, habituation, and life stage.

In general, recreation was not ranked as a high-impact threat to many individual species or habitats. Recreational activities rose to a priority threat because they are pervasive on the landscape, impacting many species. In most instances, recreation alone is unlikely to drive a species to an ESA listing or extinction, but instead it acts cumulatively or as a multiplier with other threats to negatively impact populations. OHV Motorized Recreation commonly serves as a vector for other priority threats including invasive species and diseases, and is also a frequent source of fire ignitions. As recreation continues to increase with the growth in both population and tourism, finding ways to manage it while providing for the needs of wildlife will be a large and growing challenge for the foreseeable future.

Case Study: Managing OHV Use to Conserve the Coral Pink Sand Dunes Tiger Beetle

The Coral Pink Sand Dunes tiger beetle (CPSD tiger beetle) occurs only at the Coral Pink Sand Dunes, a 3,500 acre geologic feature named for the deep pink color of its sand dunes. The site is leased from BLM and managed by the Utah Division of State Parks and Recreation. The CPSD tiger beetle occurs sporadically throughout the dunes, but only consistently exists in two populations occupying a total area approximately 500 acres in size. OHV use significantly impacted the CPSD tiger beetle's habitat by damaging vegetation that supports prey items, directly killing prey items, and reducing soil moisture. It was also responsible for directly killing beetles. The impacts of OHVs and drought were cited in a 2012 proposal by the FWS to list the beetle as threatened under the ESA.

The economy of southern Utah depends heavily upon tourism, and limiting or closing the State Park to OHVs could have had a significant adverse effect on the economies of Kanab and Kane Counties. Therefore, following the listing proposal, a conservation committee met with the dual goals of protecting CPSD tiger beetle habitat and balancing the needs of this rare species with the interests of stakeholders. The committee evaluated current survey and distribution information for the CPSD tiger beetle and reassessed the conservation commitments of a 2009 Candidate Conservation Agreement. Based on that evaluation, a Conservation Agreement and Strategy was signed by the FWS, Bureau of Land Management, Utah Department of Natural Resources (Division of Parks and Recreation), and Kane County. Subsequently the FWS withdrew the listing proposal, as the conservation measures of the new Conservation Agreement and Strategy expanded the protected area, and comprehensively addressed all threats to the species to the point that the beetle no longer met the definition of a threatened or endangered species under the ESA.

Essential Conservation Actions to Address This Threat

Some threats to wildlife can be addressed with actions for which UDWR and/or partners have substantial authority, as well as stakeholder buy-in and broader social license. Other threats are more challenging to address, because they also constitute legitimate economic, cultural, and/or recreational pursuits. In order to address such threats, appropriate actions will need to be chosen or developed in concert with the administrators and stakeholders of those legitimate pursuits. The objectives and actions listed below are presented as starting points in an inclusive discussion, not requirements or decisions that have already been made. Any and all ideas that can result in broadly-acceptable actions to meet the needs of wildlife and Utahns are most welcome. Inclusiveness is a requirement for deciding what conservation actions will actually happen, on whose terms, and when. See the Partnerships and Implementation Mechanisms chapter for more resources.

Objective #1 for Recreational Activities

Recreational opportunities are designed and presented in ways that encourage and promote responsible participation, while also ensuring that wildlife and habitat impacts are kept at acceptably low levels.

Potential Indicators of Success Reaching This Objective

- New trails and recreation facilities are designed to minimize wildlife impacts.
- SGCN populations persist in areas of high recreation interest, despite growth in the recreation sector of Utah's economy.

Potential Conservation Actions

Code	Action
2.1.3	Install and/or maintain signage, fencing, or other aids to appropriate recreational use.
2.1.4	Design and locate recreational infrastructure/facilities in appropriate locations that avoid or minimize adverse impacts on SGCNs and key habitats.
2.1.5	Monitor and manage recreational activities to avoid or minimize adverse impacts on SGCNs and key habitats.
2.1.10	Close areas, roads, or trails during times of severe fire danger.
2.1.11	Close areas, roads, or trails following severe wildfire to allow for successful rehabilitation following re-seeding efforts.
2.3.3	Develop wildlife crossing structures to provide safe passage of roads or other movement barriers.
2.3.4	Rehabilitate undesignated roads and vehicle routes.
3.1.2	Determine wildlife response to disturbance.
5.2.7	Ensure wildlife review of special recreation permits.
5.2.8	Continue to require mufflers with approved spark arresters on all OHVs.
6.1.1	Promote Utah as an ecotourism/wildlife watching destination.
6.1.2	Emphasize the importance of outdoor recreation to Utah's economy.
6.5.2	Emphasize the importance of open spaces and outdoor recreation to enhance the lives and health of the public.

7.2.2 Maintain a voice on the Utah Outdoor Recreation Advisory Group.

7.2.4 Engage with statewide and local efforts to ensure wildlife values are incorporated into recreation planning efforts.

7.2.5 Support the establishment of multi-agency OHV travel plans developed on a County or planning unit level.

Likely Authorities, Stakeholders, and/or Partners

- National Park Service
- US Forest Service
- Bureau of Land Management
- Utah Division of State Parks and Recreation
- US Fish and Wildlife Service Refuges
- Utah School and Institutional Trust Lands Administration
- Utah Outdoor Industry Association
- Utah Outdoor Recreation Office
- Governor's Balanced Resource Council
- County and City Parks, Recreation, and Trails Committees
- Utah Outdoor Recreation Advisory Group
- OHV user groups

Objective #2 for Recreational Activities

Responsible recreation is promoted and encouraged via effective education and enforcement.

Potential Indicators of Success Reaching This Objective

- Decrease in the mileage of user-created trails.
- Decrease in law enforcement citations issued to outdoor recreationists.

Potential Conservation Actions

Code	Action
2.1.5	Monitor and manage recreational activities to avoid or minimize adverse impacts on SGCNs and key habitats.
4.2.4	Include materials covering responsible outdoor recreation and OHV use in shed antler and hunter education courses.

4.3.3 Develop and distribute brochures, web materials, and social media to positively encourage behavior.

4.3.6 Develop public information and educational programs aimed at encouraging attitudes and behaviors that are positive for wildlife conservation.

5.2.9 Continue to require youth to complete an education program including responsible and ethical riding to obtain an ATV permit.

5.4.5 Support ongoing efforts to reduce illegal OHV use to prevent resource damage and the spread of invasive/problematic plant species.

5.4.6 Provide officers to enforce existing hunting, fishing, and recreation laws and regulations.

5.4.9 Use citations and restitution charges to mitigate damage to public resources.

7.2.3 Explore a more robust state-federal partnership to provide adequate resources for recreation administration on federal lands.

7.2.6 Form public/private partnerships (with e.g., with OHV dealers, REI, Cabela's) to disseminate outdoor recreation information and education.

7.2.7 Use public/private partnerships to educate outdoor recreationists on the need and methods to decontaminate recreational gear (waders, boats, caving gear, OHVs) to prevent the spread of invasive/problematic species and/or pathogens.

Likely Authorities, Stakeholders, and/or Partners

- National Park Service
- US Forest Service
- Bureau of Land Management
- Utah Division of State Parks and Recreation
- US Fish and Wildlife Service Refuges
- Utah School and Institutional Trust Lands Administration
- Utah Outdoor Industry Association
- Utah Outdoor Recreation Office
- Outdoor businesses
- TREAD Lightly
- RIDE ON Utah
- Leave No Trace
- County and City Parks, Recreation, and Trails Committees
- OHV user groups
- Governor’s Balanced Resource Council
- Utah Outdoor Recreation Advisory Group

Natural System Modifications

Threats from actions that convert or degrade habitat in service of "managing" natural or semi-natural systems, often to improve human welfare.

Within this very broad category, three Level-2 threats were ranked as priorities: Fire and Fire Suppression, Dams and Water Management / Use, and Other Ecosystem Modifications. Each has been given its own table and associated threat/action descriptions.

Fire and Fire Suppression

Table T8 summarizes the numbers of species and habitats impacted by this priority Level-2 threat, by all nested priority Level-3 threats, and the level of impacts (Very High, High, or Medium).

This Level-2 threat is further subdivided into several Level-3 threats, two of which have impacts above the Low level. One of these, Inappropriate Fire Frequency and Severity, was ranked as a priority.

Table T8. Results of Threat Assessment of Priority Level-2 Threat, Fire and Fire Suppression

Level 3 Threat - Inappropriate Fire Frequency and Severity	Column Labels			
	Very High	High	Medium	Grand Total
Aquatic Inverts	**1**			**1**
Western Pearlshell	1			1
Birds	**3**	**3**	**6**	**12**
Boreal Owl			1	1
California Condor			1	1
Ferruginous Hawk			1	1
Golden Eagle			1	1
Greater Sage-grouse	1			1
Gunnison Sage-grouse	1			1
Lewis's Woodpecker		1		1
Mexican Spotted Owl	1			1
Olive-sided Flycatcher		1		1
Sharp-tailed Grouse		1		1
Southwestern Willow Flycatcher			1	1
Yellow-billed Cuckoo			1	1
Fishes	**3**	**11**	**1**	**15**
Bluehead Sucker		1		1
Bonneville Cutthroat Trout	1			1
Bonytail		1		1
Colorado Pikeminnow		1		1
Colorado River Cutthroat Trout	1			1
Desert Sucker		1		1
Flannelmouth Sucker		1		1

Humpback Chub		1		1
Razorback Sucker		1		1
Roundtail Chub		1		1
Southern Leatherside Chub			1	1
Virgin Chub		1		1
Virgin Spinedace		1		1
Woundfin		1		1
Yellowstone Cutthroat Trout	1			1
Mammals		**4**		**4**
[a Race of the] Chisel-toothed Kangaroo Rat		1		1
Dark Kangaroo Mouse		1		1
Kit Fox		1		1
Pygmy Rabbit		1		1
Reptiles	**4**		**2**	**6**
Desert Night Lizard			1	1
Gila Monster	1			1
Mohave Desert Tortoise	1			1
Smith's Black-headed Snake			1	1
Utah Banded Gecko	1			1
Western Threadsnake	1			1
Terrestrial Habitats	**3**	**2**	**1**	**6**
Aspen-conifer	1			1
Desert Grassland		1		1
Gambel Oak		1		1
Lowland Sagebrush	1			1
Mojave Desert Shrub	1			1
Mountain Sagebrush			1	1
Grand Total	**14**	**20**	**14**	**44**

Threat - Inappropriate Fire Frequency and Intensity: This includes all cases of fire regimes that have been disrupted from their long-term norm. Some habitats are now burning with greatly increased frequency. These tend to be lower-elevation deserts and shrublands, and the cause is most commonly the presence of a continuous bed of fine fuels, which readily accepts ignition and carries fire across vast distances. Continuous fine-fuel beds leave no unburned mosaics (as burned, native bunchgrasses would have) and allow fire to jump significant obstacles such as rivers and interstate highways. These unnatural fire patterns often burn with a sterilizing thermal intensity, generating heat sufficient to kill all native seed stored in the soil bed, and potentially impacting soil microbes and mychorrizae which are important for native soil and plant ecology.

These fine, continuous fuels are created by invasive non-native, frequently annual grasses such as cheatgrass and red brome. The most apparent landscape effects of increased lower-elevation fire frequency are a reduction in shrub and forb cover and an increase in the extent of areas dominated by annual grasses. These areas will remain at an ecological “dead end” until active restoration is conducted to restore habitat functions. Many wildlife species are negatively impacted by these landscape changes due to reductions in food and cover[43], while very few tolerate or benefit from the changes.

Other habitats are now burning with greatly decreased frequency. These tend to be mid- and high-elevation forests. The principal cause of less-frequent fire in upper elevation landscapes is suppression of almost every ignition, which is a policy requirement either created by, or imposed upon, local, state, and federal land- and fire-management agencies. This policy has been implemented nationally, through a highly effective, interagency wildfire response system. This system has tremendous logistical and tactical capacities, enabled by massive public expenditures. However, until recently there was no coherent, national strategy[44] for allowing some natural fire progression, and no recognition of the risk, unsustainability, and "unnaturalness" of the degree of fuel accumulation the wholesale use of this response and suppression system has caused.

A secondary cause of reduced fire frequency is land-cover fragmentation caused by human developments such as reservoirs, subdivisions, and highways. Fragmentation facilitates fire suppression by preventing fires from running as far as they once would have, and complicates and retards use of prescribed fire by introducing numerous risks and complications to fire management.

The most apparent vegetative effect of decreased middle- and upper-elevation fire frequency is a reduction in the area occupied by young stands of deciduous tree species and by shade-intolerant conifers, shrubs, and herbaceous plants. Concurrently, there has been an increase in the density and acreage of shade-tolerant and/or fire-intolerant conifer forests and an aging of deciduous forests. As with excess low-elevation fire, many wildlife species are negatively impacted by the extensive landscape changes resulting from excessively infrequent mid- and high-elevation fire.

Another negative consequence of less-frequent fire at higher, more productive elevations is excessive fuel buildup. When a fire ignites and suppression is not completely successful, the resulting fire can be catastrophically damaging to a variety of values and interests. Of particular concern are effects on aquatic ecosystems and developed water supplies, both of which can be destroyed by catastrophic floods and debris flows unleashed by heavy rains following severe fire events[45].

Fire suppression is necessary in some circumstances to protect property and human life. The unmet need is to operationalize, at a multi-decadal and continental scale, a recognition that not every fire needs to be suppressed. Excessive fuel buildup prohibits simple reversion to a “let-it-burn” policy. The growing problem of catastrophic mega-fires can be solved by a systematic campaign of active

---

[43] "Food and cover" encompasses things such as physical structure of the vegetation, stem spacing, microclimate moderation, etc., which may ultimately translate into a change in food availability, thermal buffering, foraging efficiency, et cetera. These attributes influence how local concerns might be articulated, and threats addressed.

[44] http://www.forestsandrangelands.gov/strategy/thestrategy.shtml

[45] A series of before and after photos can be seen at http://azgeology.azgs.az.gov/sites/azgeo.azgs.az.gov/files/article_files/Beatty%27sGuestRanch8%2611July2011V2.pdf, accessed 3/15/2015.
A video can be seen at http://gallery.usgs.gov/videos/437#.VVTUoJPrvW4, accessed 3/15/2015.

restoration via mechanical fuel-reduction treatments and prescribed fire to safely return wildfire as a viable, natural, cost-effective means of maintaining necessary patterns of ecological succession across the landscape. The fire- and land-management policy environment will require significant change to enable this solution to occur, however[46].

Case Study: Prioritizing Fuels Treatments with Landscape Conservation Forecasting

In conjunction with federal-agency partners and the national LANDFIRE program, The Nature Conservancy recently developed a planning tool known as Landscape Conservation Forecasting (LCF). The purpose of LCF is to improve the ecological health of very large landscapes for affordable prices. This is done by working with managers of large agency administrative units, such as whole National Forests, National Parks or BLM Field Offices, to identify specific land-management projects that have high returns on investment.

The foundation of LCF is a set of maps that show: (1) the distribution of ecological systems – dominant vegetation types one would expect to find based on the physical environment; and (2) the current classes of vegetation in each ecological system, based on succession, structure, and whether they are natural or are "uncharacteristic" of reference (pre-settlement) conditions.

The integrity (health) of ecological systems is assessed by one or more metrics. The primary metric is known as Ecological Departure, which measures the dissimilarity between: (1) the amounts of vegetation classes expected under reference conditions, and (2) the amounts of vegetation classes that are currently present on the landscape.

The functioning of ecological systems is represented in computerized state-and-transition ecological models. For each system the model shows "how it works," both naturally and in response to human management actions. The models contain pathways that predict how amounts of vegetation classes will change over time as a result of applying management actions, each of which has a known cost.

Once the maps, metrics and models are in place, Conservancy staff work jointly with agency staff members and stakeholders, using the ecological models to predict, or forecast, outcomes of applying sets of management actions, each with its known cost, over a medium- to long-range time period (usually 20 or 50 years). Specifically, the group focuses on actions that are designed to reduce the amount of vegetation classes with "too many" current acres, such as old or uncharacteristic classes, and (ideally) convert those acres into classes with "too few" current acres, such as young or native classes.

Model-run outputs are expressed in terms of predicted Ecological Departure values in the future. These can be compared with Ecological Departure values that models predict would result over the same time period if no active management were done. Such comparison shows the magnitude of improvement in

[46] Williams, J. 2013. Exploring the onset of high-impact mega-fires through a forest land management prism. Forest Ecology and Management 294(2013):4-10.

ecological integrity that would result from doing active management vs. doing just custodial or "minimum" management.

The predicted "magnitude of improvement in ecological integrity" from using active management is a benefit to the agency (and society) in terms of healthier vegetation conditions. This benefit also has a cost associated with it – the cost of implementing the management actions over the 20- or 50-year time period. The ratio of benefit to cost for each set of management actions may be expressed as a single value that represents its "Return on Investment" (ROI). Different sets of management actions may be compared with each other using their ROI values, which are a common currency. Agency managers may thus be guided to select and implement the set of management actions for each ecological system that has the highest ROI value, though other factors such as reducing hazardous fuels to maintain public safety may cause them to implement different actions in specific locations.

About 20 large-scale applications of LCF have been completed or are now in progress, mainly in Nevada and western Utah. Each LCF project is similar to those that preceded it in this region. As more LCF projects are completed – none identical, but all with common underpinnings – a combined product will begin to emerge with size and scale sufficient to plan for and achieve improved ecological health through much of the Intermountain West.

Essential Conservation Actions to Address This Threat

Some threats to wildlife can be addressed with actions for which UDWR and/or partners have substantial authority, as well as stakeholder buy-in and broader social license. Other threats are more challenging to address, because they also constitute legitimate economic, cultural, and/or recreational pursuits. In order to address such threats, appropriate actions will need to be chosen or developed in concert with the administrators and stakeholders of those legitimate pursuits. The objectives and actions listed below are presented as starting points in an inclusive discussion, not requirements or decisions that have already been made. Any and all ideas that can result in broadly-acceptable actions to meet the needs of wildlife and Utahns are most welcome. Inclusiveness is a requirement for deciding what conservation actions will actually happen, on whose terms, and when. See the Partnerships and Implementation Mechanisms chapter for more resources.

Objective #1 for Inappropriate Fire Frequency and Intensity

Fire is excluded from habitats in which potential burns now would be frequent, large, and destructive to soils and native vegetation; the habitats are being actively managed (treated) to reduce components or factors that promote risk of catastrophic fire, such as cheatgrass, excessive conifer encroachment, or unnaturally large stands of mature Gambel oak.

Potential Indicators of Success Reaching this Objective

- Many land- and resource-management agencies are conducting long-range planning to identify where and when to implement fuel-reduction treatments aimed at invasive annual grasses, pervasive conifer encroachment, etc.
- The distribution of vegetation classes in susceptible habitats is becoming more similar to (less departed from) their natural reference distribution – especially due to reduction of uncharacteristic annual-grass-dominated classes.
- Annual acreage treated for fuels reduction is adequate and appropriate.
- Treatment unit sizes are appropriate for the habitat type and its natural disturbance regime.

Potential Conservation Actions

Code	Action
2.1.8	Address fire ignition points to minimize the risk of unintended fire starts.
2.1.9	Establish or enhance fuel breaks in locations that are susceptible to large or intense fires.
2.1.10	Close areas, roads, or trails during times of severe fire danger.
2.2.5	Conduct mechanical control of invasive/problematic species.
2.2.6	Conduct biological control of invasive/problematic species.
2.2.7	Conduct chemical control of invasive/problematic species.
2.3.9	Increase cover and extent of native riparian vegetation[47] by restoring beavers on the landscape, where social and environmental factors permit (per Beaver Restoration Assessment Tool).
2.3.14	Conduct upland vegetation treatments to restore characteristic upland vegetation, and reduce uncharacteristic fuel types and loadings.
2.3.15	Conduct riparian vegetation treatments to restore characteristic riparian vegetation, and reduce uncharacteristic fuel types and loadings.
2.3.18	Conduct better fire suppression in habitats/locations that are susceptible to damage from fire that now would be too frequent or intense.
2.3.19	Conduct fuels reduction through targeted grazing.
2.3.20	Conduct post-fire rehabilitation.
2.3.22	Increase the volume and diversity of native seed and plant stock available for rehabilitation or restoration.
4.1.3	Include fire ecology in grade-school and university curricula.
4.2.2	Provide training opportunities to professional staff and partners/stakeholders.

[47] Due to their elevated water tables and frequent surface water, riparian areas generally exhibit lower air temperature, higher relative humidity, and higher fuel moisture content than surrounding uplands. Reduced intensity, severity, and/or frequency of fire in riparian areas can be expected as a result. Native riparian grasslands and shrublands have longer fire-return intervals and lower burn severities than surrounding uplands. Native riparian forests tend to have infrequent, higher-severity fire due to high fuel loads, but they tend to recover quickly, particularly if herbivory is not excessive.

4.3.2 Develop and implement mass-media communication plans.

5.2.8 Continue to require mufflers with approved spark arresters on all OHVs.

6.3.3 Use grass banking to promote forage supply reliability[48] in anticipation of more vegetation treatments and wildfire.

7.2.1 Support Utah's Watershed Restoration Initiative.

Likely Authorities, Stakeholders, and/or Partners

- US Forest Service
- Bureau of Land Management
- National Park Service
- Utah Division of Forestry Fire and State Lands
- Utah Watershed Restoration Initiative
- Utah Division of Water Resources
- The Nature Conservancy
- Other conservation NGOs

Objective #2 for Inappropriate Fire Frequency and Intensity

Fire is returned to habitats from which it had been unnaturally excluded; the fire regime (frequency and intensity) in these habitats generally approximates a natural, pre-settlement regime.

Potential Indicators of Success Reaching this Objective

- Policies mandating immediate suppression of all natural ignitions are modified to enable and promote managed wildland fire where it would be beneficial to habitats.
- Public attitudes toward the use of managed and prescribed fire are shifting from concern and opposition, toward tolerance and acceptance.
- Many land- and resource-management agencies are conducting long-range planning to identify where and when to implement fire and fire-surrogate[49] treatments.
- The distribution of age and structure classes in affected habitats is becoming more similar to (less departed from) their natural reference distribution – generally, acres of older and/or

[48] It is common practice to remove livestock from areas that have burned or received a vegetation treatment. Grazing permittees need a substitute location to feed their animals during this disruption, which often lasts 2 years and sometimes is longer. Grass banking is one way to provide this alternative forage during the disruption.
[49] Fire surrogate treatments are mechanical or chemical interventions intended to yield similar outcomes as actual fire, in terms of fuel loadings, compositions, and arrangements. Sometimes they are used instead of, and sometimes in concert with, prescribed fire. The purpose is to reduce damage caused by wildfires, often with ultimate goal of resuming a more natural fire regime in systems from which fire has long been suppressed.

denser classes are being converted back to more open younger classes, or assisted in succession to more open older classes.

- Annual acreage treated for fuels reduction is adequate and appropriate.
- Treatment unit sizes are appropriate for the habitat type and its natural disturbance regime.

Potential Conservation Actions

Code	Action
2.3.14	Conduct upland vegetation treatments to restore characteristic upland vegetation, and reduce uncharacteristic fuel types and loadings.
2.3.15	Conduct riparian vegetation treatments to restore characteristic riparian vegetation, and reduce uncharacteristic fuel types and loadings.
2.3.17	Apply or allow more fire in habitats/locations where fire was historically more frequent or intense.
4.1.3	Include fire ecology in grade-school and university curricula.
4.2.2	Provide training opportunities to professional staff and partners/stakeholders.
4.3.2	Develop and implement mass-media communication plans.
6.3.3	Use grass banking to promote forage supply reliability in anticipation of more vegetation treatments and wildfire.
7.3.4	Increase the use of stewardship contracting on BLM and National Forest lands.

Likely Authorities, Stakeholders, and/or Partners

- US Forest Service
- Bureau of Land Management
- National Park Service
- Utah Division of Forestry Fire and State Lands
- Utah Watershed Restoration Initiative
- Utah Division of Water Resources
- The Nature Conservancy
- Other conservation NGOs

Dams and Water Management / Use

Table T9 summarizes the numbers of species and habitats impacted by this priority Level-2 threat, by all nested priority Level-3 threats, and the level of impacts (Very High, High, or Medium).

This Level-2 threat is further subdivided into numerous Level-3 threats, 11 of which have impacts above the Low level. Seven of these were ranked as priorities: Water Allocation Policies, Agricultural/Municipal/Industrial Water Usage, Channelization/Bank Alteration (direct, intentional), Presence of Diversions, Dam/Reservoir Operation, Sediment Transport Imbalance, and Presence of Dams.

Table T9. Results of Threat Assessment of Priority Level-2 Threat, Dams and Water Management / Use

Level 3 Threats - Water Allocation Policies, Agricultural/Municipal/Industrial Water Usage, Channelization/Bank Alteration (direct, intentional), Presence of Diversions, Dam/Reservoir Operation, Sediment Transport Imbalance, Presence of Dams	Threat Impact (Scope x Severity)			
	Very High	High	Medium	Grand Total
Amphibians		**2**	**5**	**7**
Arizona Toad		1		1
Great Plains Toad			2	2
Northern Leopard Frog			3	3
Relict Leopard Frog		1		1
Aquatic Habitats	**11**	**7**	**9**	**27**
Aquatic-Forested	3	2	2	7
Aquatic-Scrub/Shrub	3	1	2	6
Emergent		1	2	3
Open Water	2	1	1	4
Riverine	3	2	2	7
Aquatic Inverts		**2**	**6**	**8**
Bifid Duct Pyrg			1	1
California Floater		1	2	3
Desert Springsnail		1	1	2
Pilose Crayfish			1	1
Western Pearlshell			1	1
Birds		**2**	**3**	**5**
Mexican Spotted Owl		1		1
Southwestern Willow Flycatcher			2	2
Yellow-billed Cuckoo		1	1	2
Fishes	**23**	**53**	**26**	**102**
Bear Lake Sculpin	2			2
Bear Lake Whitefish	2			2
Bluehead Sucker	3	3	1	7
Bonneville Cisco	2			2
Bonneville Cutthroat Trout		5	1	6

Bonneville Whitefish	2			2
Bonytail		2	4	6
Colorado Pikeminnow		3	4	7
Colorado River Cutthroat Trout		3		3
Desert Sucker	1	3	2	6
Flannelmouth Sucker	3	3	1	7
Humpback Chub		2	3	5
June Sucker		3	1	4
Northern Leatherside Chub		2	1	3
Razorback Sucker		3	4	7
Roundtail Chub	3	3	1	7
Southern Leatherside Chub		5		5
Virgin Chub	2	4		6
Virgin Spinedace	1	3	2	6
Woundfin	2	4		6
Yellowstone Cutthroat Trout		2	1	3
Grand Total	**34**	**66**	**49**	**149**

The threat of dams and water management/use includes diversions and withdrawal of both surface and ground water from natural systems. This is a broad scale threat which encompasses multiple methods of water use and means of extraction. Utah receives an average of 13 inches of rain a year, making it the second driest state in the nation[50]. Statewide, residential water use averages approximately 180 gallons of water, per person, per day. This is the third-highest rate of residential water use in the nation.

To provide sufficient water supply to Utah's human population, a complex network of dams, diversions, canals, wells, and pipelines has been built to store and supply water to meet agricultural, municipal, and industrial needs. As Utah's population grows, conservation of water will become increasingly important to ensure sufficient water for human use, as well as for healthy wildlife and habitats.

UDWR's stake in water conservation is that water is essential for all wildlife. This is most obviously a need for fish and rivers, but all wildlife and all habitats rely on water. UDWR has worked with many partners on water related issues. This has been accomplished through endangered species recovery programs, conservation agreements, water rights regulations, stream alteration permits, water acquisition, and many other processes.

Many of the priority WAP threats are not clearly bounded, simple, or linear with respect to cause and effect. They would be much easier to describe and manage if they were. The threat of dams and water management/use exemplifies this challenge. To present and address the water-related problems facing species and habitats as cleanly and simply as possible, actions have been organized in the following way:

[50] http://le.utah.gov/interim/2012/pdf/00002706.pdf accessed February 22, 2015.

- Actions related to dams and diversions will focus on correcting barriers to fish movement and other mechanisms of habitat and population fragmentation.
- Actions related to water use will focus on retaining or acquiring water to sustain the habitat at critical times.
- Actions related to dam/reservoir operation and sediment transport imbalance will focus on maintaining or restoring appropriate temperature and sediment regimes, and timing of flows.

To minimize repeating the same objectives and actions multiple times, actions are for the most part listed under just one threat (though it would not be incorrect to list them under multiple threat categories). For example, the action of removing a diversion (listed under Presence of Diversions), would affect fish movement, but it could also affect the amount, and thus temperature, of water in the system (thus it could also qualify as an action under Dam/Reservoir Operation). Affecting the amount of water in a stream affects a stream's capacity to transport sediment (thus removing a diversion could also qualify as an action under Dam/Reservoir Operation).

Managers who are planning projects in streams or rivers to address one specific threat, should examine the actions under *all* Dams and Water Management/Use Level-3 threat categories to determine if actions identified under other threats could help address their threat and improve their project.

The case studies and objectives for the more specific Level 3 threats, which are discussed below, provide examples of cases where UDWR and partners have worked together to address specific threats. Together, we are starting to develop much more comprehensive approaches than were formerly routine to identify and prioritize threats and actions on a broader scale. Comprehensive, watershed-scale management and restoration plans have been developed for the Weber River and San Rafael River, and community watershed groups are established in many other locations. The Weber and San Rafael are examples of two very different rivers and watersheds (with different outlets, level of development, degree and kind of fishing interest and pressure, native species communities, etc.). But these two plans have both been developed in close consultation with local stakeholders to identify native species needs and broadly-acceptable, yet still specific, goals and objectives. These plans discuss all of the Level-3 threats discussed below, as well as additional watershed-specific threats that aren't statewide priorities, but which locally are very important. They also pull together information known about the watershed and species needs, fishing pressure, agricultural and municipal water needs, and other information specific to the watershed. With this information and buy-in from the local stakeholders, the working groups are able to prioritize efficient work areas where threats can be addressed most effectively. These watershed-scale plans are the model that we will build upon and continue to utilize in the future.

Threat - Water Allocation Policies: In Utah, the right to use water is based on the prior appropriations doctrine, which originated in the 1870's. A core principle of this doctrine is that rights are conditional on beneficial use (agricultural, industrial, or urban). For over a century, maintaining ecosystem services or values was not considered a beneficial use of water, and attempts to do so could result in loss of water rights.

In 1986, the Utah Legislature passed a bill enabling UDWR and the Utah Division of State Parks and Recreation to acquire and hold instream flow rights under certain circumstances. While the statutory definition of "beneficial use" remained unchanged, as a practical matter state agencies began recognizing the beneficial use of instream flows for specific environmental or recreational purposes.

The 1986 law was amended in 2008 and 2013 to allow private, non-profit fishing groups to lease water to protect or restore stream flows for three native trout taxa. This is an area where there are still great needs, but some progress has been made by working with owners of water rights, and state and federal regulations, to find mutually-beneficial solutions.

Many SGCNs and key habitats are impacted by water allocation policies. However, by far the worst-affected are the fishes, with 74% of all the medium, high, or very high impacts.

Case Study: Acquiring Instream Flow to Sustain the Habitat of Multiple SGCNs

Until August 2014, the least chub, a fish whose entire range lies within Utah, had been a Candidate for federal listing under the ESA. Many actions implemented under a Candidate Conservation Agreement supported the FWS decision to remove the species from candidate status. These actions included the acquisition of an instream flow for the largest existing population of the species, at the Bishop Springs Wetland Complex in western Utah's Snake Valley.

A small spring-fed reservoir is the primary water supply for Bishop Springs Wetland Complex, which also supports populations of Columbia spotted frog, northern leopard frog, and Utah physa, all SGCNs in Utah. A single property owner had water rights associated with this reservoir for agricultural purposes. When the landowner exercised these water rights, up to two thirds of the wetland complex was dewatered, resulting in the mortality of thousands of least chub as well as impacts to Columbia spotted frog. Through closely working with the landowner and FWS, a Candidate Conservation Agreement with Assurances was entered into which allowed for UDWR to purchase and install supplies to convert his inefficient flood irrigation operation into a more efficient pressurized irrigation system in return for the landowner agreeing to supply the water saved for least chub. Through this agreement the landowner also received assurances from FWS that if least chub were federally listed in the future, he would not be required to take additional conservation measures on this property. In October 2008, the State Engineer approved an exchange application and granted an instream flow to the Division of Wildlife Resources for the Bishop Springs Wetland Complex.

Essential Conservation Actions to Address This Threat

Some threats to wildlife can be addressed with actions for which UDWR and/or partners have substantial authority, as well as stakeholder buy-in and broader social license. Other threats are more challenging to address, because they also constitute legitimate economic, cultural, and/or recreational pursuits. In order to address such threats, appropriate actions will need to be chosen or developed in concert with the administrators and stakeholders of those legitimate pursuits. The objectives and actions listed below are presented as starting points in an inclusive discussion, not requirements or decisions that have already been made. Any and all ideas that can result in broadly-acceptable actions to meet the needs of wildlife and Utahns are most welcome. Inclusiveness is a requirement for deciding what conservation actions will actually happen, on whose terms, and when. See the Partnerships and Implementation Mechanisms chapter for more resources.

Objective #1 for Water Allocation Policies

Enabling conditions (laws and policies) exist for a broader array of agencies or conservation organizations to hold in-stream water rights for the benefit of aquatic habitats and SGCNs.

Potential Indicators of Success Reaching this Objective

- Conservation agencies and NGOs have active and regular engagement with state water authorities to discuss options for achieving species and habitat conservation objectives.
- Agencies and NGOs are aware of and using all instream flow authorities for which they are already eligible.
- Agencies and NGOs inventory and communicate any necessary instream flow authorities for which they are not yet eligible.

Potential Conservation Actions

Code	Action
5.1.4	Engage with water management authorities and water user groups to find flexibility within existing water laws and policies for meeting wildlife conservation objectives.

Likely Authorities, Stakeholders, and/or Partners

- Utah Division of Water Rights
- Utah Division of Water Resources
- Trout Unlimited
- Water rights owners
- Water conservation groups
- Water user groups

Objective #2 for Water Allocation Policies

Aquatic key habitats (especially those with occurrences of SGCNs) contain sufficient water to maintain a functioning aquatic ecosystem that supports the conservation target(s).

Potential Indicators of Success Reaching this Objective

- Quantity and timing of flows are appropriate for the aquatic system.
- All age classes of the native fish community are represented.
- Reproduction and recruitment of native species community is occurring.

Potential Conservation Actions

Code	Action
1.2.3	Establish Candidate Conservation Agreements (CCAAs) or similar tools for mutually beneficial solutions.
1.2.5	Determine minimum instream flow requirements for relevant SGCNs and aquatic habitats.
1.2.6	Develop a list of priority areas that pose high risk to SGCNs or aquatic habitats from surface or groundwater development, where maintaining/enhancing flows or groundwater levels is needed.
1.2.7	Acquire water rights from willing sellers to hold instream flow.
1.2.8	Develop water leasing program to hold instream flow.
2.1.7	Establish monitoring systems for stream flow, stream temperature, and/or groundwater level (as appropriate) in key areas.

Likely Authorities, Stakeholders, and/or Partners

- Utah Division of Water Rights
- Trout Unlimited
- Water conservation groups
- Water user groups

Threat - Agricultural/Municipal/Industrial Water Use: This is the main driver for all of the Dams and Water Management/Use threats. All people need water and our society has created a legal framework and a physical delivery system that prioritize getting water to people. The end result is surface water ecosystems that no longer function naturally in terms water and sediment transport regimes, or as fish and wildlife habitat. In addition, groundwater-dependent aquatic ecosystems often no longer provide the conditions necessary for the species that historically occurred there, due to reductions in spring discharge and stream baseflows as a result of groundwater pumping.

This threat is also directly tied to the threat of water allocation policies, which was seen in the WAP threat assessment as an enabling factor affecting numerous SGCNs and key habitats, in all areas of the state. The threat assessment implicates water policy and the heavy use it permits, in complete dewatering of some stream systems, a pervasive state of diminished flows and levels, and consequent widespread habitat loss and fragmentation.

While comprising only 17% of the total species and habitats considered, fishes are more heavily impacted by water use related threats than any other taxonomic group. Sixty-eight percent of the medium, high, or very high threats from water development are associated with fishes.

Case Study: Coordinating Water Deliveries to Achieve Fish Passage and Maintain Fish Habitat

On the lower Duchesne River, the Central Utah Water Conservancy District, UDWR, irrigators and water user groups coordinate to ensure the delivery of instream flows targeted to achieve fish passage requirements and maintain habitat. This same collection of partners also completed a CCAA/SHA to provide regulatory assurances to landowners and water users, prior to the recent restoration of fish passage around the Myton Diversion which allows fish access to an additional 20 miles of riverine habitat.

Essential Conservation Actions to Address This Threat

Objective #1 for Agricultural / Municipal / Industrial Water Use

Aquatic key habitats (especially at those locations important for SGCNs) contain sufficient water to maintain a functioning aquatic ecosystem that supports the conservation target(s).

Potential Indicators of Success Reaching this Objective

- Water flows that mimic natural conditions.
- Water quality sufficient to maintain ecosystem health.
- Positive biological response (invertebrates, native fish, etc.).
- Quantity and timing of flows/groundwater inputs/surface water levels are appropriate for the aquatic system.
- Adult individuals of native species community are present.
- Reproduction and recruitment of native species community is occurring.

Potential Conservation Actions

Code	Action
1.2.3	Establish Candidate Conservation Agreements (CCAAs) or similar tools for mutually beneficial solutions.
1.2.5	Determine minimum instream flow requirements for relevant SGCNs and aquatic habitats.

1.2.6 Develop a list of priority areas that pose high risk to SGCNs or aquatic habitats from surface or groundwater development, where maintaining/enhancing flows or groundwater levels is needed.

1.2.7 Acquire water rights from willing sellers to hold instream flow.

1.2.8 Develop water leasing program to hold instream flow.

2.1.7 Establish monitoring systems for stream flow, stream temperature, and/or groundwater level (as appropriate) in key areas.

4.3.6 Develop public information and educational programs aimed at encouraging attitudes and behaviors that are positive for wildlife conservation.

5.1.4 Engage with water management authorities and water user groups to find flexibility within existing water laws and policies for meeting wildlife conservation objectives.

Likely Authorities, Stakeholders, and/or Partners

- Utah Division of Water Rights
- Water Conservancy Districts
- Local water users
- Water conservation groups
- US Bureau of Reclamation
- US Department of Interior
- US Fish and Wildlife Service
- Trout Unlimited

Threat - Channelization/Bank Alteration (direct, intentional): This threat is one of the greatest in terms of the number of taxa and habitats impacted, but typically has a lower threat impact than other water use threats; no taxa or habitats have a “very high” impact rating associated with this threat. Fish are more impacted by this threat than any other taxonomic group, with 68% of all the medium, high, and very high threats affecting them. Many fish rely on complex habitats - oxbows, pools, and backwaters - for various life-stage requirements (e.g., temperature, food, cover, water quality conditions). Channelization and bank alteration projects are frequently done for flood control, to facilitate water deliveries or to protect homes, roads, land, or other resources. This can reduce required habitat complexity, making it more difficult for many species to forage for food, hide from predators, take refuge from high/fast flows, and survive into adulthood. Terrestrial SGCNs are also impacted by this threat, which degrades or eliminates the riparian areas on which 82% of bird species in Utah have partial or complete dependence. Riparian areas also provide roosting and foraging habitat for bats.

Stream alteration permits are required for these projects to be completed today, but many systems are already subject to this degraded condition due to past activities. Stream alteration permits can be denied, or projects can be changed, due to projected impacts to sensitive species. However, species managers are not always consulted on these projects, and the agency issuing the permits is not always aware of species concerns when issuing the permits.

While flood control and resource protection are necessary, in order to have healthy wildlife and habitats, and prevent additional ESA listings in the future, these projects need to be undertaken in a more holistic manner, and with better coordination among permitting agencies and wildlife managers.

Case Study: Restoring the Channelized Provo River

In the 1950s and 60s, the middle Provo River in Wasatch County, Utah was dammed and then channelized, straightened, and diked to facilitate water deliveries for municipal, industrial and agricultural uses. Many of the river's abundant resources were lost, such as riparian forest, emergent wetland, backwater and deep fishing holes - prime fish and wildlife habitat. In 1999, the Utah Reclamation Mitigation and Conservation Commission began the Provo River Restoration Project (PRRP) between Jordanelle Dam and Deer Creek Reservoir as partial mitigation for a diversity of impacts associated with federal water development begun in the 1950s, including the Central Utah Project.

River reconstruction was completed in 2008. This entailed moving the straightened river channel into excavated meanders mimicking historic conditions, reconnecting the river to existing remnants of historic secondary channels, and building small side channels and ponds to recreate aquatic features and provide wetland and wildlife habitat. Existing levees were set back to create a near-natural flood plain, allowing the river to change course more naturally. The project also entailed acquiring an 800- to 2,200-foot-wide continuous corridor running the length of the middle Provo River, protected in perpetuity for public access and wildlife habitat. Planting and fostering streamside vegetation needed for a healthy fishery has been ongoing since the project began.

The Columbia spotted frog population responded positively to the habitat creation and restoration actions associated with this project and their numbers increased dramatically in the middle Provo River. The strength of this population in response to restoration efforts was specifically identified in the US Fish and Wildlife Service's finding[51] that listing under ESA was not warranted.

Monitoring of this habitat, as well as other physical features and sensitive species also continues. Specific studies include: monitoring native and sport fish populations; monitoring macroinvertebrate (stoneflies, mayflies, midges, etc.) populations; conducting bird and bird-habitat studies and surveys; surveying for Columbia spotted frogs, assessing native riparian and wetland areas, and monitoring revegetated areas; and, monitoring hydrological conditions and conducting flow and river mechanics studies.

[51] https://www.federalregister.gov/articles/2002/08/30#fish-and-wildlife-service accessed February 3, 2015.

Essential Conservation Actions to Address This Threat

Objective #1 for Channelization / Bank Alteration (direct, intentional)

Complex habitats and floodplain connections are restored or maintained in selected rivers/streams.

Potential Indicators of Success Reaching this Objective

- Reduction in artificially-channelized or -straightened stream miles.
- When making decisions on stream alteration permits, Utah Division of Water Rights solicits, and when feasible incorporates, suggestions from UDWR and other agencies or organizations with natural resource management or wildlife-conservation interests.
- When planning Emergency Watershed Protection projects, the Natural Resources Conservation Service coordinates with UDWR to ensure those projects are not being planned with objectives in conflict with the purposes of a restoration project carried out in the same location.

Potential Conservation Actions

Code	Action
1.2.1	Develop a list of priority locations for resource and habitat protection.
1.2.3	Establish Candidate Conservation Agreements (CCAAs) or similar tools for mutually beneficial solutions.
2.3.1	Develop a list of priority locations for restoration of habitats and natural processes.
2.3.6	Restore aquatic habitat complexity.
2.3.7	Pursue mitigation measures for stream alteration projects.
2.3.8	Restore floodplain connectivity.
2.3.9	Increase cover and extent of native riparian vegetation by restoring beavers on the landscape, where social and environmental factors permit (per Beaver Restoration Assessment Tool).

Likely Authorities, Stakeholders, and/or Partners

- Utah Division of Water Rights
- Natural Resources Conservation Service
- US Forest Service
- Bureau of Land Management
- National Park Service
- Trout Unlimited
- The Nature Conservancy
- Developers
- Landowners

- City and county stakeholders

Threat - Presence of Diversions: Water diversions are a broad category of structures which can remove water from the stream and/or create a physical impediment to the movement and passage (upstream or downstream) of fish, sediment, and coarse woody debris. Even small water diversions can completely fragment a previously-intact natural system which depends on migratory movement of fishes. Some diversions also have design features which may entrain or entrap fish in canals, or otherwise remove them from the natural channel, so that a potentially significant portion of the breeding population is lost through annual water management actions. Many diversions have been abandoned[52] and are falling into disrepair. While they are no longer actively used to remove water, they often still present a bidirectional impediment to fish passage, and may also restrict the downstream movement of sediment or coarse woody debris, both of which are fundamentally important in aquatic ecology.

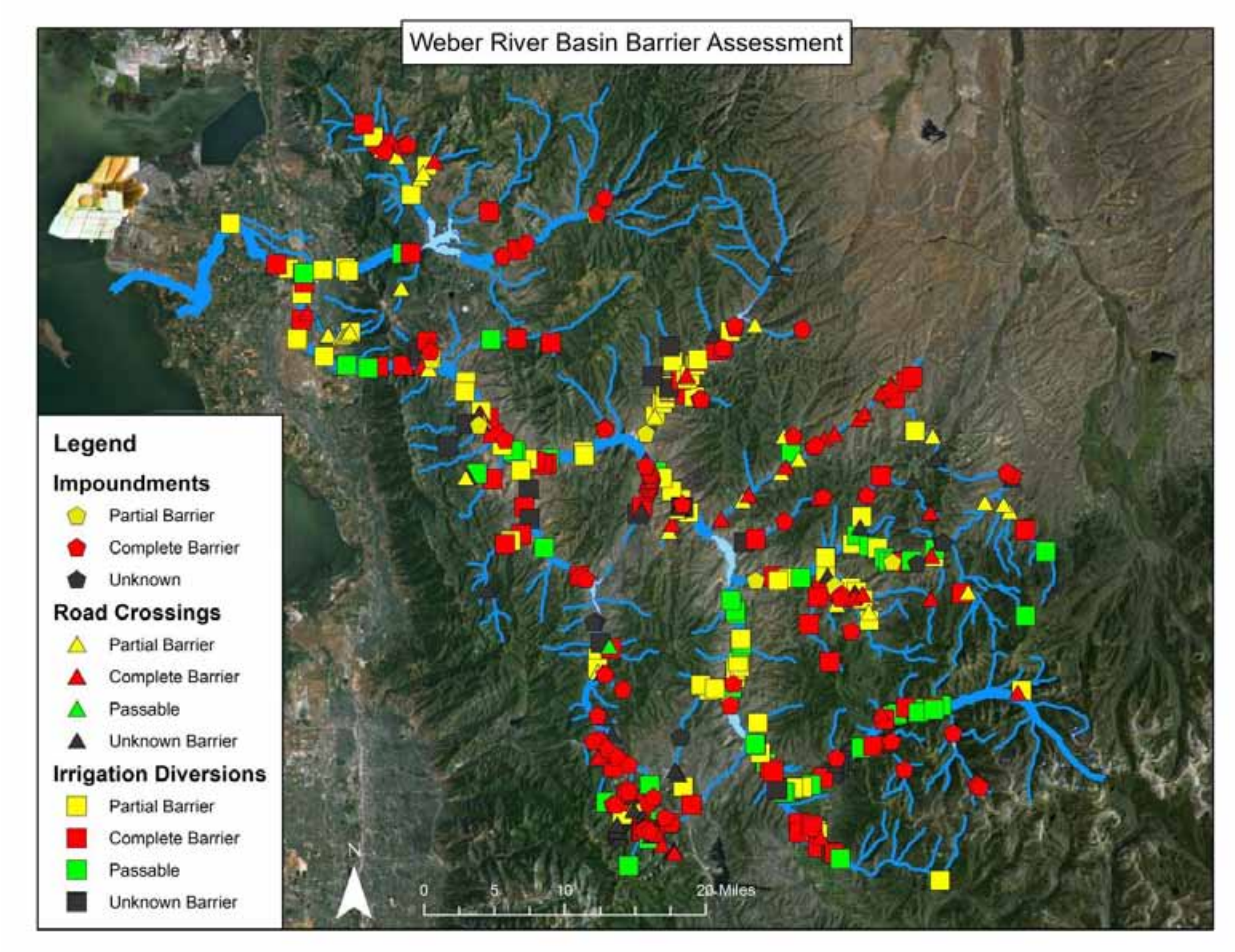
This threat, like all the other ones nested within Dams and Water Management/Use, disproportionately impacts fish and their habitats. Fish represent 71% of the targets (and 15 of the 17 fish SGCNs) with medium, high, or very high impacts from this threat.

Water diversion structures are much smaller than dams and are typically more widely distributed throughout a watershed. While one dam may have a greater negative impact to wildlife than one diversion, the vastly more numerous and widely distributed diversions have the potential to cause a greater scope of impact for many species. Diversions are generally less permanent structures than dams, and across the landscape there are frequent opportunities to influence how and when they are built, removed, or renovated.

While both dams and diversions are recorded by the Utah Division of Water Rights, they have not been fully mapped in relation to their impact on fish passage. WAP partners are beginning to do this in some watersheds. For example, diversions and other fish barriers have been mapped in the Weber River watershed (Figure T1[53]).

Figure T1. Presence of Diversions and Other Barriers to Fish Passage, Weber River Basin, Utah.

[52] At present, no reclamation or surety bond is required to receive public grants or loans to build or maintain private water diversions. Therefore there is no public recourse to financing the removal or repair of abandoned private diversions, besides another public grant or loan.
[53] Paul Burnett, Trout Unlimited, unpublished data.



This map highlights the diversity, abundance, and extent of diversions in this watershed and was created for prioritizing which diversions most urgently need to be altered to permit fish passage. This type of mapping still needs to occur for many other Utah watersheds. All new diversions on fish bearing streams should be made passable to the desirable aquatic species which are present, or planned for reintroduction. However, water diversion structures are already abundant on the landscape, and retrofitting them for fish passage is very costly[54]. Therefore, assessment and prioritization of existing diversions for fish-passage retrofitting - whether they are abandoned or still in operation - needs to occur.

Case Study: Restoring Fish Passage Through a Major Weber River Diversion

The Weber River is home to a unique native fish community including Bonneville cutthroat trout and a unique population of bluehead sucker. The watershed also provides agricultural and municipal water to much of the Ogden, Utah area through a series of dams and smaller diversions. The major diversion at

[54] A recent estimate is approximately $10,000 per foot of height of the diversion.

the mouth of Weber Canyon presented a complete barrier to all upstream fish movement since its construction, which is believed to have occurred in the 1930s.

UDWR worked with a broad partnership that included TU, BOR, WRI, Blue Ribbon Council, Habitat Council, USFWS, Weber Basin Water Conservancy District, South Weber Irrigation Company and Uintah Central Irrigation Company to develop a comprehensive project that not only upgraded the irrigation diversion facility, but also incorporated upstream fish passage, and prevented entrainment of fish by screening at the irrigation intakes on both sides of the diversion. The screens were installed in 2010 – 2011 and a fish-passage channel was constructed in 2011.

Fish passage through the constructed fish-passage channel (or fishway) was monitored during 2011-2013, but most extensively in 2013, when a trap was operated in place from mid-March through mid-November. During that time 1,216 fish moved through the fishway. Monitoring of movement documented all native fish moving upstream through the fishway, including juvenile bluehead sucker which are rarely documented in the system.

While there are multiple additional dams and diversions on the Weber River, this single structure now connects approximately 11 miles of mainstem river habitat. A process for identifying and prioritizing habitat reconnection at additional upstream sites has been developed in the Weber River Restoration Plan.

Essential Conservation Actions to Address This Threat

<u>Objective #1 for Presence of Diversions</u>

Native fishes are able to move past water-diversion barriers where necessary or desired.

<u>Potential Indicators of Success Reaching this Objective</u>

- Number of diversions removed or made passable for fish.
- Increased miles of connected/accessible habitat.
- Number of diversion intakes having screens or other technology to prevent or reduce fish entrainment.

<u>Potential Conservation Actions</u>

Code	Action
2.3.10	Prioritize fish passage and/or screening at existing diversions, in coordination with priorities of water users and other partners.
2.3.11	Create selective fish passage structures at priority barriers.
2.3.12	Remove undesired instream barriers or consolidate multiple barriers where feasible.

Likely Authorities, Stakeholders, and/or Partners

- Utah Division of Water Rights
- Utah Division of Water Resources
- Natural Resources Conservation Service
- Trout Unlimited
- The Nature Conservancy
- Developers
- Landowners
- Water Conservancy Districts
- Local water users
- City and county stakeholders

Threat - Dam/Reservoir Operation: One of the greatest continual impacts of dams is the alteration of the timing and magnitude of the natural hydrograph. Many fish life-history patterns are based on the natural hydrograph. The rising limb of the hydrograph from snowmelt runoff often cues spawning movements and also results in seasonal flooding of floodplains and backwaters, which constitute good rearing habitats for young fish of many species.

Changes in water temperature and sedimentation are also some of the major impacts of dam operation. Altered thermal and sediment-transport regimes downstream are also major impacts associated with dam operations. Dams also trap 90% or more of the sediment in a stream resulting in degradation, or downcutting, of the stream channel downstream[55]. This effectively damages or destroys even more habitat than the upstream impoundment. These impacts can greatly impact native species' ability to grow and survive in these altered conditions, and can also favor the establishment of nonnative coldwater predatory fish species below dams, which can drive recruitment of native juveniles to near zero.

Water storage for agriculture and culinary use is a critical need for the communities and people who rely on these uses. In some cases, UDWR and partners have been able to work with water users and dam managers to purchase water and find flexibility in timing of water releases to allow for a more natural hydrograph while still meeting the underlying societal needs for water.

Case Study: Operating a Dam / Reservoir System to Provide Spawning and Nursery Flows

The June sucker was federally listed as an endangered species in April 1986. The lower 4.9 miles of the Provo River were designated as critical habitat because this was the only known spawning location for the species. The Provo River also serves as a major water supply for agricultural and municipal /

[55] See the threat description for Sediment Transport Imbalance, page 173, for more detail.

industrial uses along the heavily populated and growing Wasatch Front. June sucker, as the name implies, typically spawn in June, just after the peak of spring run-off. At the time of federal listing, upstream reservoirs captured the majority of spring runoff, altering the natural hydrograph which resulted in June sucker adults becoming stranded in isolated pools and the desiccation of eggs and larvae from dewatered spawning beds.

A group of state, federal and local stakeholders formed the June Sucker Recovery Implementation Program (Recovery Program) to recover the June sucker while balancing water needs for the human population along the Wasatch Front. Water has been acquired for June sucker recovery efforts in accordance with State of Utah water law through direct purchase, long-term leases, conservation (e.g. conversion of flood irrigation to pressurized sprinkler systems, piping inefficient open canal systems), and environmental commitments associated with new water development projects.

Each spring the Provo River Flow Workgroup, including community representatives, water managers, and UDWR biologists, meet to examine water supply conditions within the drainage. Through operational flexibility, and using water acquired specifically for June sucker, flows are provided to the Lower Provo River that mimic the natural hydrograph to the extent possible.

Effectiveness of this approach to addressing the threat associated with water development and operations is demonstrated by increasing numbers of adults successfully spawning in the lower Provo River.

Essential Conservation Actions to Address This Threat

Objective #1 for Dam/Reservoir Operation

Natural hydrographs (timing, duration, temperature, etc) are restored or mimicked in priority stream reaches below dams and reservoirs.

Potential Indicators of Success Reaching this Objective

- Water temperatures are appropriate.
- Sediment transport regime is sufficient to maintain essential downstream habitats.
- The downstream hydrograph is sufficient to promote suitable habitat conditions and characteristics that allow for the complete life cycle of the target SGCN(s).
- Demographically adequate fish reproduction and recruitment are occurring.
- Decreased frequency of dewatered system or water occurring only in small isolated pools.

Potential Conservation Actions

Code	Action

2.3.5 Mimic or restore natural hydrograph, to promote natural channel/aquatic characteristics and site-appropriate riparian vegetation.

2.3.13 Modify dam operations where feasible to mimic or restore processes and conditions favorable to relevant SGCNs and aquatic habitats.

Likely Authorities, Stakeholders, and/or Partners

- Utah Division of Water Resources
- Utah Division of Water Rights
- Utah Division of Water Quality
- Utah Geological Survey
- Utah Department of Natural Resources
- Utah Reclamation Mitigation and Conservation Commission
- Water Conservancy Districts
- US Bureau of Reclamation
- Natural Resources Conservation Service
- US Forest Service
- Bureau of Land Management
- National Park Service
- US Fish and Wildlife Service
- Universities
- Trout Unlimited
- The Nature Conservancy
- Utah Rivers Council
- Other water / river NGOs
- Native American tribes
- Water-user groups
- Fishing groups

Threat - Sediment Transport Imbalance: Two basic materials flow, or are transported, down all rivers. The first material, water, is the first thing people think of when they imagine a river. The second material, sediment, may not be so obvious, but its importance to natural habitats and human interests cannot be overstated. Sediment transport is the movement of solid particles[56], typically due to a combination of gravity acting on sediment and/or the movement of water in which the sediment is entrained. A river system is said to be in equilibrium when there is a balance between 1) the amount of

[56] These particles can range in size from microscopic (clays and clay minerals) to gigantic (house-sized boulders). Most sediment particles lie on the channel bottom, and roll, slide, or bounce downstream when the force of water and other sediment particles pushing on them, gets strong enough to move them.

sediment load being supplied to the river system and 2) the capacity of the river system to transport that sediment load.

- If the capacity to move is greater than the load being moved, erosion would be expected. This is due to the river having the excess energy needed to transport more sediment than is currently being transported.
- If the capacity to move is less than the load available to be moved, deposition would be expected. The amount of excess energy needed to move the extra sediment is not available in the system, so the sediment is deposited in the channel.

Aggradation means "to fill up with sediment", and within a river channel, it is a raising of local streambed elevation due to net sediment deposition. Degradation is the opposite: a lowering of local streambed elevation due to net sediment erosion, leading to channel incision (down cutting).

The presence of dams and diversions within a watershed disrupts a river's natural sediment and water transport by altering both capacity and load, on both sides of the dam or diversion. These structures capture and retain both water and sediment. Large reservoirs release clear, nearly sediment-free water to the downstream river system. Water releases from dams and diversions are often intentionally different from rates of flow into the upstream reservoir: sometimes they are higher, and often they are lower. Downstream channel changes result from this imbalance between the river's sediment-transport capacity and the sediment load supplied to the channel.

All reservoirs are constantly aggrading with sediment, which is a major concern of water-supply managers, who would prefer their reservoir storage volume be occupied by water, not rocks and mud. Downstream of a dam or diversion, things are less certain - either aggradation or degradation may occur. Factors that result in degradation below dams include reduced sediment supply and increased sediment transport capacity from elevated baseflows (when dam outflows stay constant year round). The main factor that results in aggradation below a dam or diversion is reduced sediment transport capacity from a reduction in both floods and baseflows.

These physical changes to the river channel also alter habitat for native fish that evolved in dynamic river systems. For example, deposition of fine material can fill the spaces between important spawning gravels. Also, incision of its channel, coupled with reduced stream flows, can leave a river below its floodplain. This reduces fish access to what should be seasonally-flooded off-channel habitat. Even if adults spawn successfully and their eggs hatch, very young fish require access to these slow-velocity backwaters to survive and grow during this vulnerable life stage.

Another potential impact of sediment transport imbalance is that clear water in some cases favors non-native fish, which both compete for limited resources and prey on native fish. Many non-native predatory fish are visual foragers. Therefore, reducing the turbidity of the water below dams potentially increases predation of native fish by these non-native fish species.

Case Study: Operating a Dam to Reduce Sediment Transport Imbalance.

The suggested results of this example are hypothetical projections, as this project is currently under development. However, the protocols for this project were designed to solve multiple issues created by sediment transport imbalance, including loss of reservoir storage and downstream impacts to native fish. Millsite Reservoir is owned and operated by the Ferron Canal and Reservoir Company and nominally provides 18,000 acre feet of storage for agricultural and municipal water use, recreation, and electrical generation. Sediment deposition rates of ~73 acre feet per year have reduced the storage capacity of the reservoir. One solution identified by the water users was to raise the height of the dam several feet to increase storage capacity. One ecological consequence of raising the dam is the reservoir would spill less often and at a lower magnitude, creating problems for native fish that have been described in previous threats.

Currently, the irrigation company has purchased a dredge and plans to pump sediment out of the reservoir to perpetually maintain the remaining storage capacity. Supplying excess sediment to the creek below that dam would create a sediment imbalance and potentially result in damage to property and ecological function. The solution is to install sediment and flow gauges at two key points - at the reservoir inflow, and also below the dam, so discharge rates can be matched to the amount of sediment input. Dredging will continue only while the reservoir is spilling and discharge rate does not exceed allowable limits of dissolved oxygen and Nephelometric Turbidity Units specified by the Utah Department of Environmental Quality and UDWR. A monitoring station will be established in the stream below the reservoir. Data will be transmitted to a satellite and then posted to the internet.

With a portable device, the dredge operator will be able to see stream flow levels below the dam, and increase or decrease discharge as needed to maximize sediment removal and still stay below defined limits. This will establish a real-time control of dredging operations, which maximizes the amount of sediment removed from the reservoir while at the same time protecting the stream ecosystem below the dam. It has also been decided that the dredge will not spend all its time near the dam pumping fine sediment, rather the operator will circle around the reservoir so that a mix of particle sizes including gravels will be discharged.

While dredging has not yet started, a collaborative effort is underway to collect baseline, pre-project data with activities including the establishment of physical cross sections, analysis of aquatic macroinvertebrate samples, and monitoring of fish populations. It is hoped that the project will result in no negative impacts to downstream habitat, and future monitoring may in fact find that biological conditions may be improved by this attempt to restore sediment balance and maintain the water supply, recreation, and electrical generation functions of this reservoir for the local community.

Essential Conservation Actions to Address This Threat

Objective #1 for Sediment Transport Imbalance

Opportunities are found and taken, to modify or remove reservoir infrastructure, or modify outflow management, to simulate or return natural sediment transport.

Potential Indicators of Success Reaching this Objective

- Working to restore a more natural hydrograph (spring peak) is part of reaching sediment balance.
- Sediment transport supports natural ecology or sufficiently promotes native species reproduction.

Potential Conservation Actions

Code	Action
2.1.12	Build new or retrofit old dams with proven features designed to pass sediment.
2.1.13	Work with water users/reservoir operators to identify reservoirs where loss of storage due to sediment input is a concern.

Likely Authorities, Stakeholders, and/or Partners

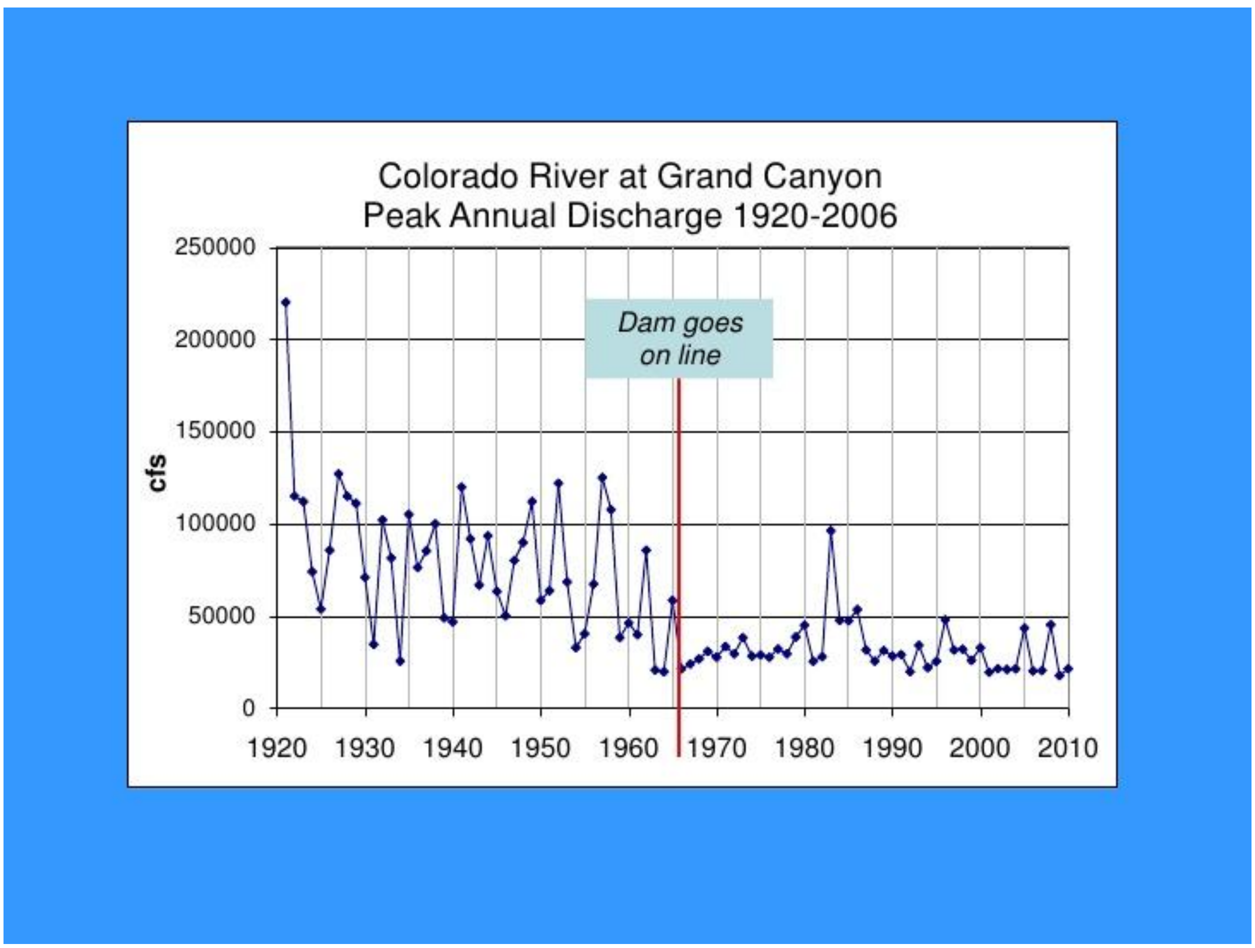
- Utah Division of Water Resources
- Utah Division of Water Rights
- Utah Division of Water Quality
- Utah Department of Natural Resources
- US Army Corps of Engineers
- Water Conservancy Districts
- US Bureau of Reclamation
- Natural Resources Conservation Service
- US Forest Service
- Bureau of Land Management
- National Park Service
- US Fish and Wildlife Service
- Universities
- Irrigation Companies

Threat - Presence of Dams: The previous threat description discussed how the presence of dams and diversions disrupts rivers' sediment and water transport capacity, and water and sediment load, on both sides of the channel obstruction. This threat description will focus and elaborate on other related aspects of dam presence that threaten wildlife and habitat viability.

The purpose of dams is to capture water within reservoirs and then release it in a fashion that is beneficial to people. Waters flowing into reservoirs are often laden with sediment, relatively well-oxygenated and relatively warm. Dams typically release cold, oxygen-depleted, nearly sediment-free water from deep in their reservoir. Large dams often have hydroelectric generation as part of their mandate, and thus strive to maintain relatively high and constant releases throughout the summer period of high electrical rates and demand. In order to have enough water to release all summer, large dams often seek to capture much of each spring's peak runoff within their reservoir.

Downstream of a large dam, the wildlife and habitat changes result from creating this unnatural leveling of a river's annual hydrograph and turbidity are numerous, diverse, and pervasive. Fish species native to large rivers often require access to a wide variety of habitats and flow conditions to complete their life cycle. Dams greatly reduce the variety of downstream habitats and flow conditions, by eliminating extremes of high and low water as show in Figure T2, depicting annual high-water events on the Colorado River, just below the Utah-Arizona border:[57]

Figure T2. Reduction in Spring Floods on the Colorado River due to Glen Canyon Dam, Grand Canyon, Arizona.



[57] http://www.slideshare.net/sercuser/examples-of-discharge-analysis, accessed February 24, 2015.

This homogenization eliminates many reproductive requirements of native fishes, and has led to numerous ESA listings in the southwestern USA and elsewhere. This homogenization has also benefitted many invasive or deleterious non-native fish species, which are another top-priority threat to SGCNs. Some of these are also prized sportfish. This establishes divisions within, and conflicts among, wildlife authorities and stakeholders.

Upstream of reservoirs, there are also numerous, diverse, and pervasive threats to wildlife and habitat viability. Relatively fast, cool, turbid waters slow above a reservoir, dropping their sediment and warming. Besides the physiological disadvantages this poses to native fishes, the changes favor the establishment and dominance of invasive or deleterious non-native fish species. Just as below dams, this establishes divisions and conflicts among people, as well as wildlife.

Major dams are considered to be permanent structures which are part of the current condition. Few new dams are now being built, and the likelihood of removing any functioning dams in the next 10 years is judged to be small, so both the threat and the ability to undertake remedial action are considered less significant, statewide, for dams than for diversions. While both dams and diversions are recorded by the Utah Division of Water Rights, they have not been fully mapped in relation to their impact on fish passage. UDWR and partners are beginning to do this is some watersheds.

Essential Conservation Actions to Address This Threat

<u>Objective #1 for Presence of Dams</u>

Opportunities are found and taken, to modify or remove reservoir infrastructure, or modify outflow management, to simulate or return natural sediment transport.

<u>Objective #2 for Presence of Dams</u>

Opportunities are found and taken, to reduce conflicts between and among wildlife stakeholders and authorities, to simulate or return native fish reproduction and recruitment.

<u>Objective #3 for Presence of Dams</u>

Quagga mussels are restricted in distribution to the locations they occupy in 2015.

<u>Potential Indicators of Success Reaching these Objectives</u>

- Working to restore a more natural hydrograph (spring peak) is part of reaching sediment balance.
- Sediment transport supports natural ecology or sufficiently promotes native species reproduction.

Potential Conservation Actions

Code	Action
2.1.12	Build new or retrofit old dams with proven features designed to pass sediment.
2.2.8	Avoid unintentional promotion or spread of existing invasive/problematic species through unrelated actions
2.2.9	Avoid establishment of new invasive/problematic species through education, planning, management, and/or regulation
2.2.10	Avoid spread of existing diseases/pathogens, or establishment of new diseases/pathogens, through education, planning, management, and/or regulation
2.3.11	Create selective fish passage structures at priority barriers
3.1.4	Conduct targeted predator management
3.4.2	Establish nurseries, refuge populations, hatcheries, etc, to support management
5.4.7	Allocate more enforcement resources to illegal species introductions

Likely Authorities, Stakeholders, and/or Partners

- Utah Division of Water Resources
- Utah Division of Water Rights
- Utah Division of Water Quality
- Utah Department of Natural Resources
- US Army Corps of Engineers
- Water Conservancy Districts
- US Bureau of Reclamation
- Natural Resources Conservation Service
- US Forest Service
- Bureau of Land Management
- National Park Service
- US Fish and Wildlife Service
- Universities
- Irrigation Companies

Other Ecosystem Modifications

Table T10 summarizes the numbers of species and habitats impacted by this priority Level-2 threat, by all nested priority Level-3 threats, and the level of impacts (Very High, High, or Medium).

This Level-2 threat is further subdivided into several Level-3 threats, five of which have impacts above the Low level. None of these was ranked as a Level-3 priority. This threat is therefore presented at the second level, with more detailed discussion to follow. Action against this Level-2 threat is warranted.

Table T10. Results of Threat Assessment of Priority Level-2 Threat, Other Ecosystem Modifications

Level 2 Threat - Other Ecosystem Modifications	Threat Impact (Scope x Severity)		
	High	Medium	Grand Total
Amphibians		**1**	**1**
Northern Leopard Frog		1	1
Aquatic Habitats	**3**	**3**	**6**
Aquatic-Forested	1		1
Aquatic-Scrub/Shrub	1	1	2
Emergent		1	1
Riverine	1	1	2
Aquatic Inverts		**2**	**2**
California Floater		1	1
Western Pearlshell		1	1
Birds	**5**	**5**	**10**
Greater Sage-grouse	1	2	3
Gunnison Sage-grouse	1	2	3
Sharp-tailed Grouse	1		1
Southwestern Willow Flycatcher		1	1
Yellow-billed Cuckoo	2		2
Fishes	**2**	**1**	**3**
Bonneville Cutthroat Trout	1		1
Colorado River Cutthroat Trout	1		1
Southern Leatherside Chub		1	1
Mammals	**1**	**4**	**5**
Allen's Big-eared Bat		1	1
Fringed Myotis		1	1
Pygmy Rabbit	1		1
Townsend's Big-eared Bat		1	1
Western Red Bat		1	1
Terrestrial Habitats	**2**	**4**	**6**
Aspen-conifer	1		1
Lowland Sagebrush	1	1	2
Mountain Sagebrush		2	2

Mountain Shrub		1	1
Grand Total	**13**	**20**	**33**

The first one of these non-priority Level 3 threats, Channel Downcutting, is unintentional and delivers no benefits to anyone. It occurs when flowing water lowers, through erosion, the elevation of the channel[58] in which it flows. Virtually all channels besides those in bedrock are susceptible, in widely varying degrees, to this threat. The flow regime of susceptible channels can be year-round, seasonal, or ephemeral. This threat is defined to include both channel downcutting in existing streams and channels; and also accelerated erosion that leads to gully formation.

Channel downcutting is somewhat unpredictable, and is difficult to prevent without a diagnosis of site vulnerability and subsequent adjustments in land management of the surrounding watershed. Channel downcutting is typically set in motion by extreme runoff or precipitation events, and the immediate cause can be a rapid springtime thaw, rain falling on snow, or an intense summer thunderstorm.

Gully formation is frequently an unintended consequence of long-term land use practices that reduce vegetation and/or litter cover, increase soil compaction, and reduce infiltration of water into the soil. Sometimes gullies form after a high-intensity fire consumes a site's vegetation and soil organic matter and creates a hydrophobic layer in the soil, preventing infiltration across extensive areas and thereby concentrating surface flow in ephemeral and seasonal channels. Sometimes downcutting of perennially-flowing channels is caused by the catastrophic failure of beaver dams or man-made impoundments during floods. Regardless of the cause, once it has begun on a site, channel downcutting can be very difficult to stop or reverse.

The habitat and wildlife effects of channel downcutting include severing floodplains from the water table, draining adjacent meadows or wetlands, reducing the area of riparian vegetation, reducing or eliminating complex aquatic habitat, and altering water flow and sediment transport regimes. Finally, all the sediment that was transported out of the down-cut channel ends up somewhere, often aggrading downstream channels and causing further impacts to wildlife species, their habitats, and also to human interests such as water supply infrastructure.

The other four Level 3 threats are planned and implemented with the intent to deliver some benefit to individuals or society. Therefore, they are easier to modify beforehand (e.g., in location, timing, or design) in order to reduce their impacts to wildlife. Of the four, the two smallest ones (Mine Shaft and Adit Closures on abandoned mines, and Rotenone Treatments for Fish Control) are readily addressed in environmental review of project proposals, and do not bear further discussion here.

The last two Level 3 threats, Brush Eradication/Vegetation Treatments and Seeding Non-native Plants, frequently are lingering elements of range improvement projects completed decades ago on behalf of

[58] Also see the threat description for Sediment Transport Imbalance, and look for the terms "degradation" and "equilibrium". The same hydrological principles and mechanisms apply here. The difference here is, there is no dam.

livestock operations. In such cases, the main problem today is the presence of aggressive non-native perennial grasses, often in the moister, higher-elevation terrestrial key habitats. The dominance of these grasses impedes the natural recovery of desirable native vegetation, which can have nutritional, reproductive, and behavioral effects on wildlife.

Contemporary projects sometimes bring these two threats together at the same time as elements of a single project with legitimate objectives such as public hazard reduction, forage improvement, or wildfire mitigation. As such, these threats may need to be looked at in a broader temporal and spatial context, in which case they may no longer appear as absolute threats, but as largely desirable interventions to conserve or restore landscape-scale wildlife habitat. Contemporary projects can often be easily modified in design (e.g., their seed mix) or implementation (e.g., the configuration of their treatment units) in order to reduce their impacts to wildlife.

Essential Conservation Actions to Address This Threat

Some threats to wildlife can be addressed with actions for which UDWR and/or partners have substantial authority, as well as stakeholder buy-in and broader social license. Other threats are more challenging to address, because they also constitute legitimate economic, cultural, and/or recreational pursuits. In order to address such threats, appropriate actions will need to be chosen or developed in concert with the administrators and stakeholders of those legitimate pursuits. The objectives and actions listed below are presented as starting points in an inclusive discussion, not requirements or decisions that have already been made. Any and all ideas that can result in broadly-acceptable actions to meet the needs of wildlife and Utahns are most welcome. Inclusiveness is a requirement for deciding what conservation actions will actually happen, on whose terms, and when. See the Partnerships and Implementation Mechanisms chapter for more resources.

Objective #1 for Other Ecosystem Modifications

Scope and severity of channel downcutting are declining for impacted species and habitats.

Objective #2 for Other Ecosystem Modifications

Land management agencies and agents develop vegetation management projects that avoid, minimize, or mitigate impacts to species and habitats identified as vulnerable to these threats.

Potential Indicators of Success Reaching these Objectives

- Priority areas for preventing or reversing this threat have been identified and mapped.
- Projects to address this threat are being proposed and funded.
- Projects have been evaluated and determined to be successful.

- Land management agencies and agents use best-available distribution maps or models for species and habitats identified as impacted by these threats.
- Land management agencies and agents develop and utilize best practices to avoid or reduce the creation of these threats to impacted species and habitats.
- Scope and severity scores of these threats have been reduced by at least one level, for all species and habitats impacted by these threats.

Potential Conservation Actions

Code	Action
1.2.1	Develop a list of priority locations for resource and habitat protection.
2.1.2	Adjust grazing practices – per the grazing principles of timing, duration, and intensity – to improve conditions of habitat, water and wildlife.
2.3.1	Develop a list of priority locations for restoration of habitats and natural processes.
2.3.6	Restore aquatic habitat complexity.
2.3.8	Restore floodplain connectivity.
2.3.9	Increase cover and extent of native riparian vegetation by restoring beavers on the landscape, where social and environmental factors permit (per Beaver Restoration Assessment Tool).
2.3.15	Conduct riparian vegetation treatments to restore characteristic riparian vegetation, and reduce uncharacteristic fuel types and loadings.
2.3.14	Conduct upland vegetation treatments to restore characteristic upland vegetation, and reduce uncharacteristic fuel types and loadings.
2.3.16	Have wildlife biologists review all WRI proposals to identify potential impacts to wildlife and provide recommendations accordingly.
2.3.21	Maintain the trend of decreased use of aggressive non-native perennial seed.
2.3.22	Increase the volume and diversity of native seed and plant stock available for rehabilitation or restoration.
4.2.2	Provide training opportunities to professional staff and partners/stakeholders.

Likely Authorities, Stakeholders, and/or Partners

- Utah Division of Forestry Fire and State Lands
- Utah Division of Water Rights
- Utah Division of Water Resources
- US Forest Service

- Bureau of Land Management
- The Nature Conservancy
- Other water / rivers NGOs
- Utah Department of Agriculture and Food
- Natural Resources Conservation Service
- Utah Watershed Restoration Initiative

Invasive and Other Problematic Species and Genes

Threats from non-native and native plants, animals, pathogens/microbes, or genetic materials that have or are predicted to have harmful effects on biodiversity following their introduction, spread and/or increase in abundance.

Within this broad category, two Level-2 threats were ranked as priorities: Invasive Non-native Species, and Problematic Native Species. Each has been given its own table.

Invasive Non-native Species

Table T11 summarizes the numbers of species and habitats impacted by this priority Level-2 threat, by all nested priority Level-3 threats, and the level of impacts (Very High, High, or Medium).

This Level-2 threat is further subdivided into numerous Level 3 threats, five of which have impacts above the Low level. Three of these were ranked as priorities: Invasive Wildlife Species - Non-native, Invasive Plant Species – Non-native, Disease – Alien Organisms

Table T11. Results of Threat Assessment of Priority Level-2 Threat, Invasive Non-native Species

Level 3 Threats - Invasive Wildlife Species - Non-native, Invasive Plant Species – Non-native, Disease – Alien Organisms	Threat Impact (Severity x Scope)			
	Very High	High	Medium	Grand Total
Amphibians		**6**	**3**	**9**
Arizona Toad		2		1
Columbia Spotted Frog			1	1
Northern Leopard Frog		1	2	3
Relict Leopard Frog		2		2
Western Toad		1		1
Aquatic Habitats			**5**	**5**
Aquatic-Forested			1	1
Aquatic-Scrub/Shrub			1	1
Emergent			1	1
Open Water			1	1
Riverine			1	1
Aquatic Inverts		**4**	**5**	**9**
California Floater			1	1
Carinate Glenwood Pyrg			1	1
Desert Springsnail			1	1
Fat-whorled Pondsnail		1		1
Otter Creek Pyrg		1		1
Pilose Crayfish		1		1
Sub-globose Snake Pyrg		1	1	2
Utah Physa			1	1

Birds		**4**	**9**	**13**
American Bittern			1	1
Burrowing Owl			1	1
Ferruginous Hawk			1	1
Golden Eagle			1	1
Greater Sage-grouse		1		1
Gunnison Sage-grouse		1		1
Mexican Spotted Owl			1	1
Peregrine Falcon			1	1
Sharp-tailed Grouse		1		1
Snowy Plover			1	1
Southwestern Willow Flycatcher		1		1
White-face Ibis			2	2
Fishes	**12**	**11**	**12**	**35**
Bear Lake Sculpin			1	1
Bear Lake Whitefish			1	1
Bluehead Sucker	1		1	2
Bonneville Cisco			1	1
Bonneville Cutthroat Trout		2		2
Bonneville Whitefish			1	1
Bonytail	1		1	2
Colorado Pikeminnow	1		1	2
Colorado River Cutthroat Trout		2		2
Desert Sucker	1	1		2
Flannelmouth Sucker	1		1	2
Humpback Chub	1			1
June Sucker		1		1
Least Chub	1		1	2
Razorback Sucker	1		1	2
Roundtail Chub	1		1	2
Southern Leatherside Chub		1	1	2
Virgin Chub	1	1		2
Virgin Spinedace	1	1		2
Woundfin	1	1		2
Yellowstone Cutthroat Trout		1		1
Mammals	**5**	**6**	**8**	**19**
[a Race of the] Chisel-toothed Kangaroo Rat			1	1
[a Race of the] Montane Vole			1	1
[a Race of] Botta's Pocket Gopher			1	1
Allen's Big-eared Bat			1	1
Big Free-tailed Bat		1	1	2

Bighorn Sheep	1			1
Black-footed Ferret	1			1
Dark Kangaroo Mouse		1		1
Fringed Myotis	1			1
Gunnison's Prairie Dog		1		1
Kit Fox		1		1
Little Brown Myotis	1			1
Pygmy Rabbit		1		1
Spotted Bat		1	1	2
Utah Prairie Dog	1		1	2
White-tailed Prairie Dog			1	1
Reptiles	**3**	**1**	**1**	**5**
Black-necked Gartersnake			1	1
Gila Monster	1			1
Mohave Desert Tortoise	1	1		2
Western Threadsnake	1			1
Terrestrial Habitats	**2**	**1**	**3**	**6**
Desert Grassland		1		1
Gambel Oak			1	1
Lowland Sagebrush	1			1
Mojave Desert Shrub	1			1
Mountain Sagebrush			1	1
Mountain Shrub			1	1
Grand Total	**22**	**33**	**46**	**101**

Threat - Invasive Wildlife Species - Non-native: Invasive non-native animals are recognized as a critical threat in many of Utah's ecosystems. While these species do impact some terrestrial ecosystems in Utah, they are a far more pervasive problem for our aquatic ecosystems. Of the 44 species and habitats for which invasive wildlife species were identified as a threat, 37 (84%) are aquatic.

Not all non-native ("introduced") species are considered invasive. Intentionally and legally introduced species are used to create important hunting and sport fishing opportunities, which can be properly managed and controlled to avoid or minimize impacts on native species and habitats. An introduced species is considered invasive if it becomes dominant over one or more desirable species or over some important aspect of the environment such as water flow or disease transmission. Besides their frequent economic and occasional human health impacts, invasive species cause ecological impacts by diverse mechanisms including direct predation and competition for resources. While the specific mechanisms vary, our objectives and the actions that can be taken will be similar regardless of the mechanism.

The overall management strategy for an invasive species - prevention, eradication, or suppression - will vary depending on the status of the introduction. There are many possible methods of introducing an invasive species. Some are intentional legal introductions with unintended consequences, others are intentional illegal introductions (frequently involving unsanctioned transfer of live sport fish from one water body to another), and many are unintentional (frequently involving "passive hitchhiking" as in the case of Quagga mussel). In some cases the mode of introduction is unknown.

Knowing the source of introduction is crucial for identifying how and where to manage invasive species. Once the invasive species is present though, removal and control methods will depend on the type of water body and its connections to other waters, the presence of native species, and other factors affecting our ability to effectively suppress or eradicate the species.

Case Study: Eradicating Invasive Fishes from the Virgin River

From 2003 to 2014, UDWR biologists in cooperation with Virgin River Recovery Program partners, successfully eradicated red shiner from approximately 40 miles of the Virgin River in Utah, and numerous associated off-channel marshes, ponds, and ditches. Near the end of that term, UDWR also worked with Arizona Game and Fish to successfully treat and remove red shiner from the Virgin River Gorge in Arizona. A fish barrier was also constructed across the river, near the state line. Before these eradication efforts, red shiners were present throughout the lower Virgin River and had completely displaced native fish.

It was believed that these efforts would, for a time, prevent red shiner from moving back upstream into Utah waters during flood events. Unfortunately, in September 2014, massive flooding in the Virgin River basin enabled red shiners to return upstream past the (breached) state line fish barrier, and re-invade Utah. These experiences exemplify what is possible, both good and bad, in efforts to manage established populations of non-native fishes. Prevention, when possible, is often cheaper and more effective than either eradication or suppression.

Essential Conservation Actions to Address This Threat

Objective 1 for Invasive Wildlife Species - Non-native

Additional invasive wildlife species are not established.

Objective 2 for Invasive Wildlife Species - Non-native

Invasive non-native wildlife species are removed or controlled, or their adverse impacts are reduced, in priority habitats or locations.

Potential Indicators of Success Reaching these Objectives

- Public messages and policies are in place to aggressively manage the risk of introductions.

- Native species are occurring, reproducing, and recruiting.

Potential Conservation Actions

Code	Action
2.2.1	Establish team to prioritize management of invasive/problematic species.
2.2.4	Contain established populations of invasive/problematic species.
2.2.5	Conduct mechanical control of invasive/problematic species.
2.2.7	Conduct chemical control of invasive/problematic species.
2.2.8	Avoid unintentional promotion or spread of existing invasive/problematic species through unrelated actions.
2.2.9	Avoid establishment of new invasive/problematic species through education, planning, management, and/or regulation.
4.3.6	Develop public information and educational programs aimed at encouraging attitudes and behaviors that are positive for wildlife conservation.
6.2.3	Maintain the trend of increased use of sterile non-native sportfish.

Likely Authorities, Stakeholders, and/or Partners

- Utah Division of Forestry Fire and State Lands
- Utah Division of Water Rights
- Utah Division of Water Resources
- US Forest Service
- Bureau of Land Management
- The Nature Conservancy
- Other conservation NGOs

Threat - Invasive Plant Species – Non-native: Introduced non-native plants that dominate vegetation communities can alter the natural or desired composition, structure and functioning of habitats. More specifically, non-native plant dominance can severely degrade native biological diversity, soil stability, and hydrologic function of habitats. Further, abundant non-native plants can drastically alter fundamental ecological processes such as fire or flood regime, and can exacerbate declines or cause the extirpation of SGCNs. Finally, invasive plants are a huge economic burden, increasing crop production costs, reducing crop quality, consuming water and fertilizer, increasing fire danger, and more.

Some well-known, highly damaging invasive plants include cheatgrass and tamarisk. There are many more, and it is a constant struggle to keep the list from growing. A number of local, state, and federal agencies maintain lists of invasive plants, and often provide information on their identification and control. In some cases invasive plants are regulated as "noxious weeds".

Case Study: Managing Tamarisk to Improve Hydrological Function and Habitat Complexity

The San Rafael River is a tributary of the Green River in southeastern Utah. In some stretches it still supports a number of SGCNs and key habitats, but viewed as a whole, it is a severely degraded river system. There are multiple factors which have led to the current state, including dams and diversions, water withdrawals, altered flow regime, and invasions by non-native plant and animal species. The San Rafael has for much of its length come to resemble a ditch, with little connection between the river and the floodplain and little resemblance to the dynamic, perennial desert river it once was.

The BLM and UDWR, working with Utah State University, have developed a restoration plan for the San Rafael River which addresses many of these issues at the watershed scale (Laub et al. 2013). Initial phases of implementation have focused on tamarisk removal on UDWR property.

Tamarisk dominance on the San Rafael has created a vicious cycle by trapping sediment along the river's banks, causing them to rise. This leads to channel incision and narrowing, which leads to further entrapment of the river within its banks, and disconnection from its floodplain. The goals of tamarisk removal on the San Rafael were to increase channel movement laterally, increase instream habitat complexity, recover native vegetation, and increase hydrologic connectivity of the river to its floodplain.

UDWR began whole-tree and root-wad removal on the San Rafael in 2009. Tamarisk was piled and left for future burning. In 2011, a very high snowpack led to a sustained springtime flood, where the river connected with the floodplain. Tamarisk piles were mobilized by the river, off the floodplain and back into the channel, enhancing lateral scour and creating habitat complexity. Pools and backwaters were formed and the channel was able to erode some of its levee-like banks (Keller et. al. 2014[59]). By 2012, significant natural recruitment of native vegetation was also occurring.

This fortunate timing of a natural flood following our mechanical vegetation removal allowed us to learn which methods were most effective for achieving our goals, and also provided insights into how man-made floods might be employed to accelerate habitat restoration. All this knowledge will be applied to future phases of this project, increasing the efficiency and effectiveness of the San Rafael River Restoration Plan as it is implemented up- and downstream of UDWR-administered reaches.

[59] Keller, D.L., et al. 2014. Effects of flooding and tamarisk removal on habitat for sensitive fish species in the San Rafael River, Utah: implications for fish habitat enhancement and future restoration efforts. Environmental Management 54(3):465-78.

Essential Conservation Actions to Address This Threat

Some threats to wildlife can be addressed with actions for which UDWR and/or partners have substantial authority, as well as stakeholder buy-in and broader social license. Other threats are more challenging to address, because they also constitute legitimate economic, cultural, and/or recreational pursuits. In order to address such threats, appropriate actions will need to be chosen or developed in concert with the administrators and stakeholders of those legitimate pursuits. The objectives and actions listed below are presented as starting points in an inclusive discussion, not requirements or decisions that have already been made. Any and all ideas that can result in broadly-acceptable actions to meet the needs of wildlife and Utahns are most welcome. Inclusiveness is a requirement for deciding what conservation actions will actually happen, on whose terms, and when. See the Partnerships and Implementation Mechanisms chapter for more resources.

Objective #1 for Invasive Plant Species – Non-native

Locations/habitats that currently do not have non-native plant problems remain free from the introduction and spread of invasive non-native plants.

Potential Indicators of Success Reaching this Objective

- Sufficient acres of habitats susceptible to invasion are monitored, and if necessary, treated annually.
- Size and arrangement of fuel breaks are adequate to deter the spread of unwanted fires.
- Acreage of weed-dominated, Uncharacteristic vegetation classes in habitats remains stable, or declines.

Potential Conservation Actions

Code	Action
2.1.8	Address fire ignition points to minimize the risk of unintended fire starts.
2.1.9	Establish or enhance fuel breaks in locations that are susceptible to large or intense fires.
2.1.10	Close areas, roads, or trails during times of severe fire danger.
2.2.2	Survey and inventory established and new populations of invasive/problematic species.
2.2.3	Eradicate established populations of invasive/problematic species.
2.2.4	Contain established populations of invasive/problematic species.
2.2.9	Avoid establishment of new invasive/problematic species through education, planning, management, and/or regulation.

2.3.5 Mimic or restore natural hydrograph, to promote natural channel/aquatic characteristics and site-appropriate riparian vegetation.

2.3.8 Restore floodplain connectivity.

2.3.9 Increase cover and extent of native riparian vegetation by restoring beavers on the landscape, where social and environmental factors permit (per Beaver Restoration Assessment Tool).

2.3.18 Conduct better fire suppression in habitats/locations that are susceptible to damage from fire that now would be too frequent or intense.

2.3.21 Maintain the trend of decreased use of aggressive non-native perennial seed.

4.3.6 Develop public information and educational programs aimed at encouraging attitudes and behaviors that are positive for wildlife conservation.

5.2.8 Continue to require mufflers with approved spark arresters on all OHVs.

5.2.10 Apply weed-free regulations to commercial and recreational transport of plant materials where applicable.

5.4.5 Support ongoing efforts to reduce illegal OHV use to prevent resource damage and the spread of invasive/problematic plant species.

7.2.7 Use public/private partnerships to educate outdoor recreationists on the need and methods to decontaminate recreational gear (waders, boats, caving gear, OHVs) to prevent the spread of invasive/problematic species and/or pathogens.

Likely Authorities, Stakeholders, and/or Partners

- US Forest Service
- Bureau of Land Management
- National Park Service
- Utah Division of Forestry Fire and State Lands
- Utah Division of State Parks and Recreation
- Utah Watershed Restoration Initiative
- Natural Resources Conservation Service
- Utah Division of Agriculture and Food
- Cooperative Weed Management Areas
- Local governments

Objective #2 for Invasive Plant Species – Non-native

Invasive plant dominance/presence is reduced or eliminated in locations or habitats where such an outcome is realistic (ecologically and economically).

Potential Indicators of Success Reaching this Objective

- Many land- and resource-management agencies are conducting long-range planning to identify where and when to implement treatment projects aimed at reducing invasive plant species.
- The distribution of vegetation classes in susceptible habitats is becoming more similar to (less departed from) their natural reference distribution – specifically due to reduction of uncharacteristic invasive-plant-dominated classes.
- Annual acreage treated by chemical, biological or mechanical means is adequate and appropriate.
- Treatment patch size is appropriate.

Potential Conservation Actions

Code	Action
2.2.2	Survey and inventory established and new populations of invasive/problematic species.
2.2.3	Eradicate established populations of invasive/problematic species.
2.2.5	Conduct mechanical control of invasive/problematic species.
2.2.6	Conduct biological control of invasive/problematic species.
2.2.7	Conduct chemical control of invasive/problematic species.
2.3.14	Conduct upland vegetation treatments to restore characteristic upland vegetation, and reduce uncharacteristic fuel types and loadings.
2.3.15	Conduct riparian vegetation treatments to restore characteristic riparian vegetation, and reduce uncharacteristic fuel types and loadings.
2.3.20	Conduct post-fire rehabilitation.
6.3.3	Use grass banking to promote forage supply reliability in anticipation of more vegetation treatments and wildfire.
7.2.1	Support Utah's Watershed Restoration Initiative.

Likely Authorities, Stakeholders, and/or Partners

- US Forest Service
- Bureau of Land Management
- National Park Service
- Utah Division of Forestry Fire and State Lands

- Utah Watershed Restoration Initiative
- Natural Resources Conservation Service
- Utah Department of Agriculture and Food
- The Nature Conservancy

Threat - Disease - Alien Organisms: Disease is a natural part of wildlife populations. Wildlife and plants have co-evolved with disease-causing organisms such as viruses, bacteria, parasites, and fungi. Under normal circumstances those native pathogens do not threaten the persistence of entire wildlife populations. However, where ecosystems are stressed or where populations are already reduced to small numbers or isolated ranges, these naturally occurring diseases can be problematic.

Yet, by far, the greatest identified disease impacts to Utah's wildlife come from introduced or alien pathogens. With the speed and frequency of international travel and the resulting transportation of pathogens, people, animals, plants, soils, and water, native wildlife species are exposed to pathogens to which they have never been exposed and to which they have no natural immunity. Introduced disease can also devastate native plant species, often changing the structure and function of habitats on which wildlife depend. For all species where disease was ranked as a high or very high threat, an alien disease-causing organism is the agent.

The cited diseases (or pathogens that cause them) include:

Chytridiomycosis: *Batrachochytrium dendrobatidis* (or "chytrid fungus" for short), is a fungus that grows in the cells of the epidermis of amphibians, causing thickening of the skin and impeding with the exchange of water, electrolytes and respiratory gases through the skin. It has spread across the globe, infecting and decimating frog and toad populations. Of Utah SGCNs, chytrid has been documented in Arizona toads, Columbia spotted frogs, northern leopard frogs, and western toads. Presently, approximately 70% of western toad populations have been infected and all could be impacted within the next 10 years. Where chytrid fungus is present in a population, die-offs have been documented and some populations have been reduced to very low numbers.

White-nose syndrome (WNS): is a disease affecting bats caused by the fungus *Pseudogymnoascus destructans.* The fungus invades the skin of the muzzle, ears, and wings of hibernating bats, causing disruption of the physiological functions of the skin. Further, infected bats exhibit higher levels of activity during hibernation, such as frequent arousal from torpor. The higher activity leads to premature expenditure of winter fat reserves and subsequent starvation. WNS was first documented in New York in the winter of 2006-2007. By 2014, it had been confirmed in 25 states and 5 Canadian provinces, where it has killed an estimated 5.5 million bats. In some species, 90 - 100% of individuals in hibernacula have died. Given current rates of spread, it is anticipated that WNS will reach Utah before the expiration of the 2015 WAP. The little brown myotis was included as an SGCN primarily due to the threat of WNS. Other SCGNs for which WNS was considered a threat include: Allen's big eared bat, fringed myotis, Townsend's big-eared bat, spotted bat, and big free-tailed bat. All hibernating bat species in Utah could potentially be affected by this disease.

Whirling disease: caused by the myxosporean parasite *Myxobolus cerebralis*, affects some trout species, salmon, and whitefish. The parasite attacks the cartilage tissue of a fish's head and spine. If sufficiently infected, young fish may develop symptoms such as whirling behavior, a black tail or even death. If they survive, fish may develop head deformities or twisted spines. Scientists believe there are other harmful effects such as making fish more susceptible to predation, less able to feed or survive environmental disturbances, or to reproduce. Infected trout develop very persistent spores, which can survive in moist environments for years. When an infected fish dies and decomposes, the spores are released into the environment and can survive transit through a predator's digestive tract or could be transferred on muddy boots or other equipment. Whirling disease was first documented in North America in Pennsylvania in 1956 via trout imported from Europe, and first found in Utah in 1991. Among SGCNs, whirling disease currently impacts Bonneville cutthroat trout and Colorado River cutthroat trout, and is expected to spread to Yellowstone cutthroat trout populations.

Upper respiratory tract disease (URTD), as caused by the bacteria *Mycoplasma agassizii* and *M. testudineum*, is probably the most important infectious disease affecting the Mojave desert tortoise. Infections in naïve populations can cause initial high mortality, followed by periods of low mortality and high morbidity. Environmental stress, fluctuations in availability of forage and water, human impacts, and exposure to toxicants may exacerbate the effects of the disease in populations. The bacteria are transmitted by direct contact. URTD spread is further accelerated when infected, but not always symptomatic, captive tortoises are released illegally back into the wild. Additionally, chronically-infected tortoises are more likely to emigrate than healthy ones, thus spreading the disease.

Sylvatic plague: is a rodent borne disease caused by the bacterium *Yersinia pestis* that was first recorded in native North American mammals in California in 1908. Plague is highly infectious for prairie dogs and recognized as a limiting factor in Utah, Gunnison’s, and white-tailed prairie dog populations. The disease is transmitted through flea bites, infected droplets, or direct contact. During epizootic events localized extirpations can occur within one active season. Black-footed ferrets are especially impacted, as they are susceptible to infection by this disease, and also are dependent upon healthy prairie dogs populations for prey.

West Nile Virus (WNV): is a Flavivirus, and *Culex* spp. mosquitoes are the main transmission vectors in the western hemisphere. WNV has received great attention as it causes illness in humans. It was first discovered in New York in 1999 and has since spread throughout the United States. Birds are the natural maintenance hosts of WNV, but the effect of viral infection varies by species. For example, Passeriformes[60] and Charadriiformes[61] species rarely experience mortalities despite developing high viral

[60] A high-level taxonomic grouping (Order) of birds which includes gulls, terns, and plover. Commonly referred to as "perching birds", which is fairly accurately descriptive, but not fully representative of the diversity of the Order

titers upon infection, whereas WNV causes high mortality in species such as corvids, thrushes, common grackles, house finches, house sparrows, ring-billed gulls and loggerhead shrikes. Of our SGCNs, WNV has been found in many of the raptors (bald eagle, peregrine falcon, California condor, ferruginous hawk) and all of the grouse species (Greater sage-grouse, Gunnison sage-grouse, sharp-tailed grouse). From December 2013 - February 2014, WNV was implicated in the death of over 20,000 eared grebes on the Great Salt Lake. The virus was then spread to bald eagles who scavenged on the grebes. There were 86 reported deaths among the eagles.

Respiratory disease: is one of the most important factors limiting the recovery of bighorn sheep in North America. No single pathogen has been identified as the cause of pneumonia, and various bacteria and viruses as well as lungworms have been isolated from pneumonic bighorn sheep. The bacterium *Mycoplasma ovipneumoniae* very consistently is detected in pneumonia outbreaks, and it is thought that this bacterium predisposes the animals for fatal pneumonia when infected with other bacteria such as leukotoxin-producing *Pasteurellaceae* such as *Mannheimia hemolytica* and *Bibersteinia trehalosi*. Respiratory pathogens detrimental to bighorn sheep are frequently carried in the respiratory tract by healthy domestic sheep, and contact with domestic sheep and goats is considered the primary risk factor for introduction of respiratory disease into a bighorn sheep populations. Outbreaks of pneumonia are characterized by high initial morbidity and mortality in all ages of bighorn sheep, followed by long periods of high lamb mortality and poor population performance as some bighorn sheep can become chronic shedders. Once introduced into a bighorn sheep population, there is a continuous risk of spread to neighboring bighorn sheep populations through animal movement. Therefore 1) proximity of bighorn sheep to domestic sheep grazing areas, and 2) the connectivity of habitats between other bighorn sheep herds and their seasonal ranges, together play a critical role in management of sheep pneumonia. In Utah, pneumonia with high lamb mortalities and poor population performance is observed in several California, Rocky Mountain, and desert[62] bighorn sheep populations across the state.

Given the widely differing nature and status of the pathogens and biology of the species affected, taking action on the threat of disease will necessarily require species-specific responses. Those specific actions can be found in species- and disease-management plans where they exist. Where still possible, actions should focus on disease prevention rather than control. Once the opportunity for prevention is lost, the remaining disease-management options can be few, expensive, controversial, and often without any assurance of success. New diseases will likely emerge over the term of this WAP. For example, WNS wasn't known in 2005, when Utah's first WAP was written. Therefore we must be able to respond effectively to new challenges as they arise.

---

which contains over 50% of all bird species. Also referred to as "songbirds", which is less accurate and less descriptive than "perching birds".

[61] A high-level taxonomic grouping (Order) of birds which includes gulls, terns, and plover. Commonly referred to as "shorebirds", which is fairly accurately descriptive, but not fully representative of the diversity of the Order.

[62] In the WAP, bighorn sheep are considered at the species level. These three sub-specific distinctions are important to game managers and stakeholders.

Essential Conservation Actions to Address This Threat

Objective #1 for Disease - Alien Organisms

The introduction and/or spread of existing and emerging diseases is prevented.

Potential Indicators of Success Reaching this Objective

- No new disease introductions occur in Utah's free-ranging wildlife.
- Existing alien diseases in Utah are not permitted to expand their distribution.

Potential Conservation Actions

Code	Action
2.2.10	Avoid spread of existing diseases/pathogens, or establishment of new diseases/pathogens, through education, planning, management, and/or regulation.
5.4.7	Allocate more enforcement resources to illegal species introductions.
6.2.2	Maintain the trend away from felt-soled wading boots.
7.2.7	Use public / private partnerships to educate outdoor recreationists on the need and methods to decontaminate recreational gear (waders, boats, caving gear, OHVs) to prevent the spread of invasive/problematic species and/or pathogens.

Likely Authorities, Stakeholders, and/or Partners

- Utah Department of Agriculture and Food
- USDA Animal and Plant Health Inspection Service
- National Park Service
- US Forest Service
- Bureau of Land Management
- Utah Division of State Parks and Recreation
- US Fish and Wildlife Service Refuges

Objective #2 for Disease - Alien Organisms

Known occurrences of these diseases are managed successfully.

Potential Indicators of Success Reaching This Objective

- Populations of impacted species are stable to increasing.
- Attain sufficient control of the disease in affected areas so that genetic and regional diversity and the potential for recovery to pre-disease abundance is maintained.

Potential Conservation Actions

Code	Action
2.2.3	Eradicate established populations of invasive/problematic species.
2.2.4	Contain established populations of invasive/problematic species.
2.2.10	Avoid spread of existing diseases/pathogens, or establishment of new diseases/pathogens, through education, planning, management, and/or regulation.
3.2.1	Conduct disease / parasite management.
3.3.1	Develop list of priority reintroduction species and locations.
3.4.2	Establish nurseries, refuge populations, hatcheries, etc, to support management.

Likely Authorities, Stakeholders, and/or Partners

- Utah Department of Agriculture and Food
- USDA Animal and Plant Health Inspection Service
- National Park Service
- US Forest Service
- Bureau of Land Management
- Utah Division of State Parks and Recreation
- US Fish and Wildlife Service Refuges

Problematic Native Species

Figure T12 summarizes the numbers of species and habitats impacted by this priority Level-2 threat, by all nested priority Level-3 threats, and the level of impacts (Very High, High, or Medium).

This Level 2 threat is further subdivided into numerous Level 3 threats, nine of which have impacts above the Low level. Two of these were ranked as priorities: Natural Rarity and Problematic Animal Species – Native.

Table T12. Results of Threat Assessment of Priority Level-2 Threat, Problematic Native Species

Level 3 Threats - Natural Rarity, Problematic Animal Species – Native	Threat Impact (Severity x Scope)			
	Very High	High	Medium	Grand Total
Amphibians	**1**			**1**
Relict Leopard Frog	1			1
Aquatic Inverts	**8**	**14**	**3**	**25**
Bear Lake Springsnail		1		1
Bifid Duct Pyrg			1	1
Black Canyon Pyrg	1			1
California Floater			1	1
Carinate Glenwood Pyrg		2		2
Cloaked Physa	1			1
Desert Springsnail		1		1
Fat-whorled Pondsnail		1		1
Hamlin Valley Pyrg	1			1
Kanab Ambersnail		1		1
Lamb Rams-horn	1			1
Longitudinal Gland Pyrg		1		1
Ninemile Pyrg		1		1
Northwest Bonneville Pyrg		1		1
Otter Creek Pyrg		1		1
Rocky Mountain Duskysnail			1	1
Sierra Ambersnail	1			1
Smooth Glenwood Pyrg	1			1
Southern Bonneville Springsnail		1		1
Sub-globose Snake Pyrg	1			1
Utah Amphipod	1			1
Utah Physa		1		1
Western Pearlshell		1		1
Wet-rock Physa		1		1
Birds	**2**	**2**	**7**	**11**
American White Pelican		1		1

California Condor		1		1
Caspian Tern	1			1
Greater Sage-grouse			1	1
Gunnison Sage-grouse			1	1
Mexican Spotted Owl			1	1
Sharp-tailed Grouse			1	1
Snowy Plover			1	1
Southwestern Willow Flycatcher	1		1	2
White-faced Ibis			1	1
Fishes		**6**	**6**	**12**
Bonytail		1	1	2
Desert Sucker			1	1
Humpback Chub		1	1	2
June Sucker		1		1
Razorback Sucker			2	2
Roundtail Chub		1		1
Virgin Chub		1		1
Virgin Spinedace			1	1
Woundfin		1		1
Mammals		**3**	**2**	**5**
Bighorn Sheep			1	1
Dark Kangaroo Mouse			1	1
Idaho Pocket Gopher		1		1
Kit Fox		1		1
Wolverine		1		1
Reptiles	**1**	**1**		**2**
Spotted Leaf-nosed Snake	1			1
Western Threadsnake		1		1
Terrestrial Habitats			**1**	**1**
Aspen-conifer			1	1
Terrestrial Inverts	**6**			**6**
Brian Head Mountainsnail	1			1
Eureka Mountainsnail	1			1
Mill Creek Mountainsnail	1			1
Montane Snaggletooth	1			1
Sluice Snaggletooth	1			1
Southern Tightcoil	1			1
Grand Total	**18**	**26**	**18**	**62**

Threat - Natural Rarity: Natural rarity is not a threat per se; rather it is more of a limiting factor. Nevertheless, it is so often a contributing factor to species imperilment and ESA listing that it demands management awareness, and sometimes, action in order to identify and manage threats before they get out of hand. Therefore we included it in the WAP threat assessment and ranking process, from which it emerged as a priority. It was identified as a threat for a number of species that are simply naturally rare in Utah.

There are several ways Natural Rarity can manifest. They are presented in order of increasing management priority, from a listing-prevention perspective:

- A small portion of Utah may be at the extreme end of a much larger range for a species. In these cases, there may (or may not) be a greater risk of losing the species in Utah even though as a whole the species is quite secure elsewhere in its extensive range. Great Plains toad is one example.
- In other cases, a species may be widespread within Utah, and often well beyond, and its natural condition is to occur at low densities. Spotted bat is one example.
- Finally, the species may occur in only one or very few locations in Utah, and nowhere else in the world. It may still occur at natural densities, or it may be depleted within its current distribution. This small range may have always been the case for this species, or this may be all that is left of a historically or prehistorically larger range. Least chub is one example.

Actions managers may choose to take to address this threat depend on which way it manifests, as well as any additional threats the species may face. Each species where this was identified as a threat should be evaluated on a case-by-case basis to determine what, if any, action can or should be taken to address the threat. As stated above, this threat - which is not actually a threat per se, rather a limiting factor - demands management awareness. However, management action is not universally warranted. Deciding to take no action can be technically justified yet still controversial among stakeholders, particularly if the reasoning has not been discussed and communicated.

Essential Conservation Actions to Address This Threat

<u>Objective # 1 for Natural Rarity</u>

Naturally-rare species remain extant in Utah through the ten-year life of this Wildlife Action Plan.

<u>Potential Indicators of Success Reaching this Objective</u>

- Numbers of populations, and/or abundance of individuals, and/or area of occupancy of naturally-rare species show an upward or static (not declining) trend.

<u>Potential Conservation Actions</u>

Code	Action
3.3.1	Develop list of priority reintroduction species and locations.
3.3.2	Develop broodstock and propagation program for species in need.
3.4.1	Establish team to prioritize species for *ex situ* conservation.
3.4.2	Establish nurseries, refuge populations, hatcheries, etc, to support management.
5.2.11	Apply the Mitigation Hierarchy to potential surface-disturbance activities within the distribution of naturally-rare species.

Likely Authorities, Stakeholders, and/or Partners

- Utah Division of Water Rights
- US Forest Service
- US Fish and Wildlife Service
- Bureau of Land Management
- The Nature Conservancy
- Other conservation NGOs, particularly those active in petitioning for ESA listing

Threat - Problematic Animal Species - Native: A native species is considered problematic if it becomes overwhelmingly dominant over other native species. Such unnatural dominance of one native species over others is often an outcome of human-caused changes in their distribution or environment.

Just as with invasive non-native species, problematic native species can affect other native species by various mechanisms, such as by predation, hybridization, subsidizing common predators or pathogens, or competition for resources. While the mechanisms vary, likely objectives and the actions that can be taken to achieve them will be similar regardless of the mechanism. This problem takes several forms:

- Among fishes and amphibians, hybridization among native taxa is a common problem when natural mechanisms that once kept populations separated are disrupted, allowing unnatural mixing of populations. Factors that contribute to this unnatural mixing include loss or disruption of natural disturbance regimes such as annual flooding, loss of habitats dependent on such disturbance, and restriction of remnant wildlife populations to shared fragments of habitat. Without reversing these factors or restoring the natural separation mechanisms, this is a very difficult threat to overcome.
- A few bird and mammal species are very tolerant of human activities and tend to persist, or even to increase in abundance with agriculture, urban development, and other land-use intensification. These species include ravens, brown-headed cowbirds, raccoons, skunks, and

coyotes. Sometimes these highly-tolerant species can exert a significant negative pressure on other wildlife, to the degree that human intervention becomes a management imperative.

- Native species whose populations have been greatly reduced, and/or for which new populations are being created, often have temporary need for relief from native predators, even ones that are present in characteristic or natural abundance. Once - or if - these small populations regain a certain threshold abundance or distribution, the need for this relief typically disappears at which point the suppression of native predators should be ended.

Finally, there are probably situations where the degree of threat is a matter of perspective and salience, or how prominently it figures in people's minds (regardless of its actual population-level effects on wildlife). It can be hard for people to accept that it is perfectly natural for one species to prey on another, or for people to share prey with other predators. Sometimes there are calls for predator control when, from the perspective of wildlife managers, there is no demographic need or scientific justification for such action.

Actions that can be taken to address this threat depend on these factors as well as what additional threats the species faces. Each species where this was identified as a threat should be evaluated on a case-by-case basis to determine what, if any, action can be taken to address the threat.

Essential Conservation Actions to Address This Threat

Objective # 1 for Problematic Animal Species - Native

Native fishes and amphibians at risk of hybridization and introgression have in situ refuge populations where problematic native species have been eradicated, and/or are excluded.

Objective # 2 for Problematic Animal Species - Native

Native fishes and amphibians at risk of hybridization and introgression are cultured in captivity.

Objective # 3 for Problematic Animal Species - Native

Highly human-tolerant problematic bird and mammal species are kept in check where their success has the potential to become problematic.

Objective # 4 for Problematic Animal Species - Native

Depleted native species whose populations require relief from native predators, receive assistance for as long as they need it, and no longer.

Potential Indicators of Success Reaching these Objectives

- Numbers of populations, and/or abundance of individuals, and/or area of occupancy of problematic native species show a downward or static (not rising) trend.

Potential Conservation Actions

Code	Action
3.3.1	Develop list of priority reintroduction species and locations.
3.3.2	Develop broodstock and propagation program for species in need.
3.4.1	Establish team to prioritize species for *ex situ* conservation.
3.4.2	Establish nurseries, refuge populations, hatcheries, etc, to support management.
5.2.12	Apply the Mitigation Hierarchy[63] to activities with the potential to accelerate the spread of problematic native species.

Likely Authorities, Stakeholders, and/or Partners

- Utah Department of Agriculture and Food
- USDA Wildlife Services
- Sportsmen's Groups
- US Forest Service
- US Fish and Wildlife Service
- Bureau of Land Management
- The Nature Conservancy
- Other conservation NGOs, particularly those active in litigating for animal welfare

[63] First, seek to avoid impacts altogether. Next, minimize impacts if full avoidance is impossible. Finally, offset impacts if avoidance and minimization are impossible or inadequate.

Climate Change and Severe Weather

Threats from long-term climatic change that may be linked to global climate change and other severe climatic or weather events outside the natural range of variation that could wipe out a vulnerable species or habitat.

Increased habitat shifting and extreme weather patterns associated with climate change exacerbate existing threats that are already challenging to address under current conditions. Coupled with projections of a near-doubling of the state population by 2050, prospects for SGCN conservation have likely never been more challenging. This population increase will, in all likelihood, impose additional demand on Utah's already-limited natural resources – limitations that under existing levels of use, have already impacted conservation targets resulting in their status as SGCNs. The list below contains some examples of existing threats being exacerbated by the results of climate change:

- The impacts associated with Improper Grazing, while they are a challenge to address today, are more severe under drought conditions.
- Drought increases the severity of impacts associated with Dams and Water Management/Use, while human population growth will increase the demand for limited water supplies.
- Drought and rising average temperatures increase the risk of Inappropriate Fire Frequency and Intensity, while an increased human population likely will elevate human-caused ignitions.
- Altered climate conditions may increase the vulnerability of SGCNs to threats posed by Invasive Non-native Species, and may provide conditions that promote invasion, establishment and competitive advantage of alien species to the detriment of SGCNs.
- SGCNs that fall into the realm of Natural Rarity are likely most vulnerable to impacts associated with climate change, and mechanisms to promote their survival (facilitated translocations to establish refuge populations) may run into political resistance (for example, the resistance to moving Utah prairie dogs across county borders).

Environmental change appears certain, but the specifics are still unclear. Existing laws, regulations, and policies present challenges or limitations that will need to be overcome in order to address threats (e.g., water management), for the benefit of conservation targets as well as human society. However, from a conservation planning perspective, abundant opportunities are available to address climate change-related impacts. Continued diligence in addressing existing threats will minimize the compounding effects associated with climate change.

Within this broad category, two Level 2 threats were deemed priorities: Habitat Shifting and Alteration and Droughts. Each has been given its own table.

Habitat Shifting and Alteration

Table T13 summarizes the numbers of species and habitats impacted by this priority Level-2 threat, by all nested priority Level-3 threats, and the level of impacts (Very High, High, or Medium).

This Level 2 threat is further subdivided into two Level-3 threats, both of which have impacts above the Low level. One of them, Increasing Stream Temperatures was ranked as a priority.

Table T13. Results of Threat Assessment of Priority Level-2 Threat, Habitat Shifting and Alteration

Level 3 Threat - Increasing Stream Temperatures	Threat Impact (Scope x Severity)			
	Very High	High	Medium	Grand Total
Amphibians			**1**	**1**
Relict Leopard Frog			1	1
Fishes	**4**	**3**	**9**	**16**
Bluehead Sucker			1	1
Bonneville Cutthroat Trout		1		1
Bonytail			1	1
Colorado Pikeminnow			1	1
Colorado River Cutthroat Trout		1		1
Desert Sucker	1			1
Flannelmouth Sucker			1	1
Humpback Chub			1	1
June Sucker			1	1
Razorback Sucker			1	1
Roundtail Chub			1	1
Southern Leatherside Chub			1	1
Virgin Chub	1			1
Virgin Spinedace	1			1
Woundfin	1			1
Yellowstone Cutthroat Trout		1		1
Grand Total	**4**	**3**	**10**	**17**

The title of this threat refers to major changes in habitat composition and location, possibly leading to an inability of species to shift their ranges in order to follow the changes of their needed habitat conditions. Impediments to species movement can happen for various underlying reasons.

Two possible response strategies to this scenario are to:

- Improve resilience - remove or reduce impediments to species movement as their habitats shift.
- Improve resistance - reduce the rate or severity of habitat shifting itself, so that species can remain in place longer if it is difficult or impossible for them to move.

Many of the coarse-scale terrestrial habitat management actions currently practiced in Utah serve to support resistance strategies. It is hoped that these actions continue, and are accelerated as a component of implementing the WAP. However, atmospheric CO_2 concentrations are still increasing rapidly, so resistance would be a risky stand-alone strategy for wildlife and habitat managers to adopt. Fortunately, resilience is also an option:

- Utah's wide range of elevational diversity[64] presents numerous opportunities for plant and animal species to shift their ranges upslope in response to warmer temperatures, specifically Increasing Stream Temperatures.
- Similarly, with 67% of the state's total acreage in public ownership, northward migrations of species and communities in response to climate change are a real possibility.
- Utah's public lands also establish boundaries for urban growth and development, while providing landscape-level opportunities to manage conservation targets and their opportunities for migration and range shifting.

Therefore, implementing a mixed strategy including an increasing proportion of actions to improve species' resilience - their ability to move as circumstances on the ground require it - is a real possibility.

Threat - Increasing Stream Temperatures: Many aquatic species have a narrow temperature range in which they can persist. Stream temperatures have been rising throughout the west as a result of drought, diversions, reduced snow pack, decreased spring runoff, and loss of riparian habitat that provide shade. As temperatures warm, many fish distributions retract from the warmer lowlands and are limited to cool-temperature refugia such as higher elevations or reaches with cold spring inflows, and thus available habitat and connectivity between drainages may be lost. This results in smaller, more fragmented populations which may not be able to recover naturally from catastrophic disturbances.

With continuing climate change, drought and water use are expected to increase and continue, temperatures will continue to warm and additional fish habitat will be lost. This will necessitate a major intensification of the management of SGCNs and key habitats, as well as of all the other threats that impinge upon them (e.g., Recreational Activities, Improper Grazing, Disease, Problematic Native Species, etc.).

Essential Conservation Actions to Address This Threat

Objective #1 for Increasing Stream Temperatures

Affected aquatic habitats are adaptively managed such that geo- and hydromorphic features and associated native plant communities are improved or maintained for SGCN resilience to increasing stream temperatures.

---

[64] This topographical diversity also provides numerous cold-temperature refugia, offering climate-resistance "hideouts" or climate-resilience "stepping stones" to various cool-adapted species.

Objective #2 for Increasing Stream Temperatures

Aquatic species' populations/community structure, composition, and genetic diversity are improved and maintained in order to establish the resiliency to persist on the landscape despite suitable habitat location/distribution shifts.

Potential Indicators of Success Reaching these Objectives

- Dissolved oxygen, pH, turbidity, conductivity, sediment, flow, and temperature levels are within a range that typically support native fish and aquatic species.
- Suitable habitat physical conditions (e.g., appropriate-sized substrates, essential channel features) exist for fish and aquatic species to occur.
- Associated surrounding riparian/wetland plant communities occur in aquatic habitat areas, mitigating increasing stream temperatures and abiotic fluctuations associated with shifting climatic conditions.
- Indicator wildlife species and/or SGCN reproduction and recruitment are occurring.
- Viable populations of riparian and aquatic indicator species occur.

Potential Conservation Actions

Code	Action
1.2.1	Develop a list of priority locations for resource and habitat protection.
2.3.1	Develop a list of priority locations for restoration of habitats and natural processes.
2.3.2	Identify and maintain wildlife migration corridors, and protected buffers around populations of SGCNs that may need to move up or down in elevation.
2.3.5	Mimic or restore natural hydrograph, to promote natural channel/aquatic characteristics and site-appropriate riparian vegetation.
2.3.6	Restore aquatic habitat complexity.
2.3.15	Conduct riparian vegetation treatments to restore characteristic riparian vegetation, and reduce uncharacteristic fuel types and loadings.
3.3.1	Develop list of priority reintroduction species and locations.
3.4.2	Establish nurseries, refuge populations, hatcheries, etc, to support management.
3.4.3	Assist wildlife or plant migration in anticipation of climate change.
7.1.1	Engage with statewide and local efforts to ensure wildlife values are incorporated into visioning and planning efforts.

Likely Authorities, Stakeholders, and/or Partners

- Utah Division of Water Rights
- Utah Division of Water Resources
- US Forest Service
- Bureau of Land Management
- The Nature Conservancy
- Other water / rivers NGOs

Droughts

Table T14 summarizes the numbers of species and habitats impacted by this priority Level-2 threat, by all nested priority Level-3 threats, and the level of impacts (Very High, High, or Medium).

This Level-2 threat is further subdivided into several Level-3 threats, four of which have impacts above the Low level. One of these Level-3 threats, the eponymous Droughts, was ranked as a priority.

Table T14. Results of Threat Assessment of Priority Level-2 Threat, Droughts

Level 3 Threat - Droughts	Threat Impact (Scope x Severity)			
	Very High	High	Medium	Grand Total
Amphibians	**4**	**2**	**2**	**8**
Arizona Toad	1			1
Columbia Spotted Frog	1			1
Great Plains Toad		1		1
Mexican Spadefoot			1	1
Northern Leopard Frog		1		1
Plains Spadefoot			1	1
Relict Leopard Frog	1			1
Western Toad	1			1
Aquatic Habitats		**5**		**5**
Aquatic-Forested		1		1
Aquatic-Scrub/Shrub		1		1
Emergent		1		1
Open Water		1		1
Riverine		1		1
Aquatic Inverts		**4**		**4**
Bifid Duct Pyrg		1		1
Longitudinal Gland Pyrg		1		1
Pilose Crayfish		1		1
Utah Amphipod		1		1
Birds		**3**	**8**	**11**
Black Rosy-finch			1	1
Black Swift			1	1
California Condor			1	1
Ferruginous Hawk		1		1
Greater Sage-grouse			1	1
Gunnison Sage-grouse			1	1
Olive-sided Flycatcher			1	1
Sharp-tailed Grouse			1	1
Southwestern Willow Flycatcher		1		1

White-faced Ibis		1		1
Yellow-billed Cuckoo			1	1
Fishes	**13**	**4**	**1**	**18**
Bluehead Sucker	1			1
Bonneville Cutthroat Trout		1		1
Bonytail	1			1
Colorado Pikeminnow	1			1
Colorado River Cutthroat Trout		1		1
Desert Sucker	1			1
Flannelmouth Sucker	1			1
Humpback Chub	1			1
June Sucker		1		1
Least Chub	1			1
Northern Leatherside Chub	1			1
Razorback Sucker	1			1
Roundtail Chub	1			1
Southern Leatherside Chub			1	1
Virgin Chub	1			1
Virgin Spinedace	1			1
Woundfin	1			1
Yellowstone Cutthroat Trout		1		1
Mammals		**3**	**7**	**10**
Big Free-tailed Bat		1		1
Dwarf Shrew			1	1
Gunnison's Prairie Dog			1	1
Idaho Pocket Gopher			1	1
Kit Fox			1	1
Preble's Shrew		1		1
Spotted Bat			1	1
Utah Prairie Dog		1		1
Western Red Bat			1	1
White-tailed Prairie Dog			1	1
Reptiles	**5**	**1**	**2**	**8**
Desert Night Lizard	1			1
Gila Monster	1			1
Many-lined Skink		1		1
Mohave Desert Tortoise	1			1
Smith's Black-headed Snake			1	1
Spotted Leaf-nosed Snake	1			1
Utah Banded Gecko	1			1
Western Threadsnake			1	1

Terrestrial Habitats		**2**	**1**	**3**
Aspen-conifer			1	1
Lowland Sagebrush		1		1
Mountain Sagebrush		1		1
Grand Total	**22**	**24**	**21**	**67**

Traditionally, fish and wildlife have been managed in place, based on average climate conditions within a normal range of variation. However, credible future climate scenarios for Utah project a trend away from historical averages, with greater extremes in variation as well. Conserving fish and wildlife into the future will require a paradigm shift that emphasizes population and habitat resiliency in light of the uncertainty associated with future conditions. This paradigm shift must be fulfilled by directed conservation actions to maintain, conserve, connect, restore, and enhance species' habitats, and thus their abilities to persist within or shift their own distributions, under these rapidly changing conditions.

Threat - Droughts: Addressing the influence and threat of increasing drought occurrence in what is now the second driest state in the nation may prove more than challenging for aquatic species and habitats, especially in disconnected or terminal drainages. Drought in conjunction with climate change and existing anthropogenic disturbances (water depletion, inappropriate grazing, etc.) may create synergistic impacts on aquatic and riparian wildlife, and the habitats on which they depend.

Essential Conservation Actions to Address This Threat

Some threats to wildlife can be addressed with actions for which UDWR and/or partners have substantial authority, as well as stakeholder buy-in and broader social license. Other threats are more challenging to address, because they also constitute legitimate economic, cultural, and/or recreational pursuits. In order to address such threats, appropriate actions will need to be chosen or developed in concert with the administrators and stakeholders of those legitimate pursuits. The objectives and actions listed below are presented as starting points in an inclusive discussion, not requirements or decisions that have already been made. Any and all ideas that can result in broadly-acceptable actions to meet the needs of wildlife and Utahns are most welcome. Inclusiveness is a requirement for deciding what conservation actions will actually happen, on whose terms, and when. See the Partnerships and Implementation Mechanisms chapter for more resources.

<u>Objective #1 for Droughts</u>

Terrestrial SGCNs and key habitats persist on the landscape, despite increasing drought conditions.

<u>Objective #2 for Droughts</u>

Aquatic SGCNs and key habitats persist on the landscape, despite increasing drought conditions.

Potential Indicators of Success Reaching these Objectives

- Dissolved oxygen, pH, turbidity, conductivity, sediment, flow, and temperature levels persist within a range that typically support native fish and aquatic species.
- Suitable physical habitat conditions (e.g., appropriate-sized substrates, essential channel features) exist for fish and aquatic species to occur.
- Suitable physical habitat conditions (e.g., appropriate vegetation structures and compositions, essential water sources) exist for terrestrial species to occur.
- Surrounding riparian/wetland plant communities occur with historic aquatic habitat areas.
- Viable indicator riparian, aquatic, and upland wildlife populations occur.

Potential Conservation Actions

Code	Action
1.2.1	Develop a list of priority locations for resource and habitat protection.
2.3.2	Identify and maintain wildlife migration corridors, and protected buffers around populations of SGCNs that may need to move up or down in elevation.
2.3.6	Restore aquatic habitat complexity.
2.3.9	Increase cover and extent of native riparian vegetation by restoring beavers on the landscape, where social and environmental factors permit (per Beaver Restoration Assessment Tool).
2.3.14	Conduct upland vegetation treatments to restore characteristic upland vegetation, and reduce uncharacteristic fuel types and loadings.
2.3.15	Conduct riparian vegetation treatments to restore characteristic riparian vegetation, and reduce uncharacteristic fuel types and loadings.
3.3.1	Develop list of priority reintroduction species and locations.
6.3.4	Use water banking to sustain instream flows, restore depleted aquifers, and promote water supply reliability.

Likely Authorities, Stakeholders, and/or Partners

- Utah Division of Water Rights
- Utah Division of Water Resources
- US Forest Service
- Bureau of Land Management
- The Nature Conservancy

Crucial Data Gaps

Gaps in our knowledge or understanding that severely impede our ability to detect, diagnose, and abate threats to species and habitats.

Data gaps are not included in the standardized lexicon of threats available for national use. Terms for data gaps were developed and standardized, and the same 3-level hierarchical organization was applied.

Data gaps were not subjected to the same prioritization process as the other threats, but rather inherit their priority from the degree to which they affect management of SGCNs and key habitats. All identified data gaps are included here.

First, the state of knowledge for SGCNs was summarized. Then, eight parallel areas of knowledge for species and habitats that were considered essential to effective, efficient conservation were highlighted. These are shown in Table DG1. This summarization provides a means to assess current conditions, to establish goals, and measure progress of the WAP to achieve benchmarks.

Table DG1. Essential Areas of Knowledge for SGCNs and Key Habitats.

Category	**Species Conservation Information Description**
Taxon identifiable	The systematic status of a taxon is sufficiently well understood and agreed upon to determine the conservation status of the taxon.
Conservation status defined	Formalized current conservation status (i.e., S-rank) is defined, where “current” means short-term trend (10 years or 3 generations, whichever is longer) has been established and evaluated within the past 5 years.
Distribution map or model exists	The taxon's distribution in Utah is sufficiently known to accurately predict (either from direct knowledge or modeled on known habitat associations) where it occurs.
Population trend	We know the trend in population size, area occupied, or defined metric used to describe or index the population status of the taxon in Utah.
Threats identified	If the taxon is known or thought to be naturally rare or declining, we have identified the current or potential threats affecting it.
Actions identified	If the taxon is naturally rare, or if its population is declining, we know why and know what is needed to develop management recommendations to secure or improve its conservation status.
Biology understood	We know enough about the biology of the taxon to establish meaningful and measurable distribution, population, or other defined management objectives (e.g., goals defined in terms of rarity, trend, and threats).
Management objectives and monitoring	Meaningful distribution, population, or other defined management objectives and indicators are established, and monitoring programs are in place documenting our progress toward their achievement.
Category	**Habitat Conservation Information Description**
Habitat identifiable	We are able to map (either from direct knowledge or from modeled data) where it occurs, with sufficiently high accuracy and resolution.

Current conservation status defined	Ecological Departure, or other measure of conservation status, has been defined and (re)evaluated from recent data (5 years).
Habitat quality estimate exists	We are able to describe (either from direct knowledge or from modeled data) and map the habitat condition, with sufficiently high accuracy and resolution.
Habitat trend exists	We know the spatial trend (extent and condition) of the habitat in Utah.
Threats identified	If the habitat is known to be small or thought to be declining in condition or area, we have identified and mapped the scope of the threats affecting it.
Actions identified	If the habitat area is small or declining in condition and we know why, we know what is needed to develop management recommendations to improve its conservation status.
Ecology understood	We know enough about the ecology of the habitat to establish meaningful, measurable habitat objectives or other defined management objectives (e.g., goals defined in terms of habitat extent and indicators of condition such as the threat's scope).

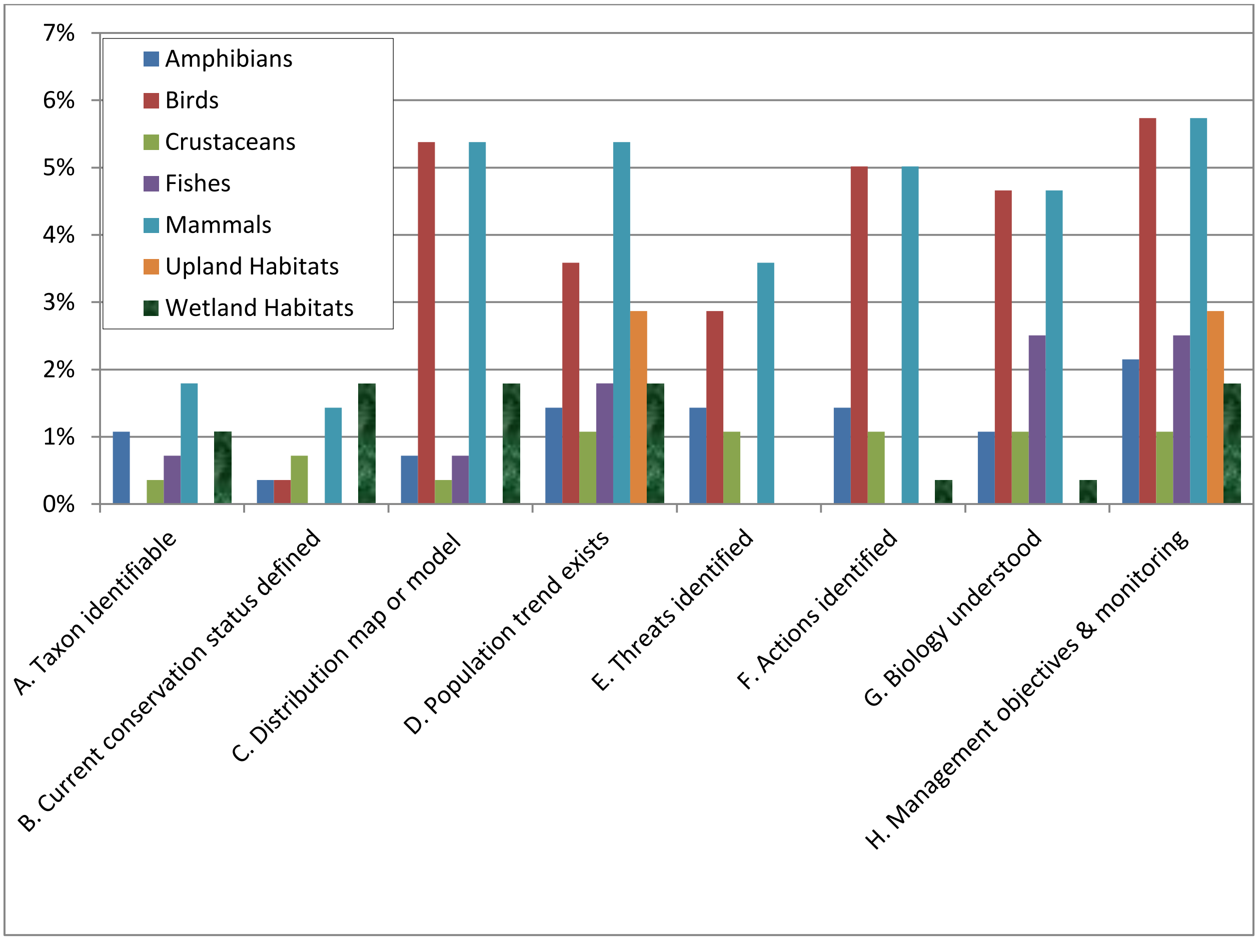
At the broadest conceptual level there is still a lot to learn about most conservation targets, but not all of the data gaps prevent action: not all data gaps are *crucial*. This is an important distinction between this comprehensive state-of-knowledge summary, and the particular "crucial data gaps" identified as impediments to conservation. Although there is inadequate insight, it is necessary to take action in a climate of uncertainty otherwise negative trends will continue. This initial summary provides both the "big picture" within which data gaps are nested, as well as a means of capturing and measuring progress over the next decade.

The overall state of knowledge varies considerably, by taxon and habitat grouping, into two broad patterns. Some taxonomic groupings, like amphibians, crustaceans, and fishes, have a diverse array of information needs with some species flagged in every category. In contrast, birds and mammals are both proportionally and numerically dominated by information needs in the areas of species distributions, population trends, identified actions, and understanding of their biology. Virtually none of the SGCN birds and mammals have established management objectives or species-level monitoring plans. (The Monitoring chapter describes our programmatic monitoring approaches for species and habitats.)

Similar to birds and mammals, terrestrial habitats are dominated by just a few categories (lacking both trend information and management objectives or monitoring plans). Aquatic habitats are similar to aquatic species, needing a more diverse set of information to be effectively and efficiently conserved.

A handful of conservation targets (>1%) were identified as being sufficiently well-understood to have management objectives established and monitoring plans in place, which are programmatic goals of SGCN managers. These species are not fully conserved, but actions have been implemented; therefore, they do not appear in this summary.

Figure DG1. Summarized state of conservation knowledge. Plotted values are the relative amount (%) of "no" answers to the eight essential knowledge questions. The numbers of conservation targets in each target category (amphibians, birds, etc.) considered deficient in one or more essential knowledge areas are shown, standardized to the total of all conservation targets. For example, there are 3 SGCN amphibians for which taxonomic uncertainty impedes conservation progress, which represents roughly 1% of the total information needs for all SGCNs and key habitats.



There are institutional deficiencies to be recognized and potential efficiencies of scale to be had where large numbers of conservation targets with similar needs cluster. Examples include:

- useful distribution models for many birds
- basic range maps for many cryptic small mammals
- better statewide maps and condition assessments for aquatic habitats

Efficiencies in meeting these needs may be gained by considering the data gaps comprehensively by the cooperating WAP implementation partners. For example, data gaps may be grouped, ordered, and prioritized by:

- the likely-affected landowners, land managers, or other stakeholders
- the expected duration or complexity of operations
- the necessary timing or order of operations

These concepts may be best addressed by an implementation team (also see the Partnerships and Implementation Mechanisms chapter) with the means and motivation to address data gaps, but this knowledge summary establishes a baseline.

In any prioritization scheme for filling data gaps, there is an implicit "order of operations" for many steps in the information needed to effectively conserve WAP targets. Yet some information needs can be met concurrently with the abatement of known threats. The work to resolve data gaps will need to be staged over time to make the most efficient use of resources, or pulsed to make use of sporadic or otherwise unpredictable funding sources. Identifying and prioritizing data gaps will allow for productive and strategically beneficial use of opportunistic funding or other resources.

Table DG2 provides a summary of the numbers of conservation targets impacted by data gaps. Each of these has been broken out in turn, into the numbers of conservation targets (birds, fishes, habitats, etc) for which each Level 2 Data Gap was identified. These can then be cross-referenced to the individual species and habitat accounts which list the specific data gaps affecting them. Of the 280 currently identified data gaps, over 30% relate to our ability to sufficiently describe our SGCN distributions in Utah. This gap is not solely limited to rare and elusive animals – 3 out of 5 Aquatic Habitats are considered to be so poorly mapped as to impede effective conservation[65].

Table DG2. Full List of Crucial Data Gaps

Level 2 and Level 3 Data Gaps	Threat Impact (Scope x Severity)	
	NA[66]	Grand Total
12.1 Inadequate Understanding of Ecology and Life History	**69**	**69**
Inadequate Understanding of Ecology and Life History	39	39
Unknown Population Status	8	8
Relative Impacts of Fragmentation	7	7
Cheatgrass Impacts	5	5
Vulnerability to Chytrid	4	4
Wind Power Impacts	2	2
Impacts on Migrating Birds	1	1
Persistent Declines in Prey Species	1	1
Importance and Contribution of Fluvial Populations	1	1
Interaction with Non-native Species Unknown	1	1

[65] This is changing rapidly however, with the development of new data sets and methodologies, and also technological changes (computing power, imagery, software for classification, etc) which are driving costs down. See the Aquatic Habitats section of the Key Habitats chapter, and the Periodic Status Assessments of Key Habitats section of the Monitoring chapter for more details.

[66] Threat Impact is included in the formatting of these Data Gaps summary tables, to demonstrate that 1) data gaps were considered at the same time and in a similar fashion as threats, but 2) they were not prioritized.

12.2 Inadequate Understanding of Distribution or Range	**85**	**85**
Inadequate Understanding of Distribution or Range	85	85
12.3 Inadequate Inventory and Assessment Methods	**73**	**73**
No Morphological Key or Other Means to Identify	45	45
Inventory Techniques Poorly Developed	17	17
No Standardized Condition Assessment Method	11	11
12.4 Taxonomic Debate	**25**	**25**
Taxonomic Debate	23	23
Uncertain Management / Conservation Unit	2	2
12.5 Abiotic Conditions and Processes	**10**	**10**
Relationship Between Groundwater and Surface Water	5	5
Atmospheric Deposition / Snowmelt Chemistry	4	4
Abiotic Conditions and Processes	1	1
12.6 Climate Change	**11**	**11**
Future Effects of Greater Temperature Variability under Climate Change	9	9
Climate Change	1	1
Future Effects of Greater Precipitation Variability under Climate Change	1	1
12.7 Inadequate Restoration Tools or Methods	**7**	**7**
Plant Material Development	4	4
Inadequate Restoration Tools or Methods	3	3
Grand Total	**280**	**280**

Inadequate Understanding of Ecology and Life History

Table DG5 summarizes the numbers of species and habitats impacted by this Level-2 data gap and by all nested Level-3 data gaps. Data gaps were identified during the threat assessment process, but were not evaluated for scope and severity, and ranked by impact, in the same way as the other threats.

This Level-2 data gap is further subdivided into ten Level-3 data gaps: Cheatgrass Impacts, Importance and Contribution of Fluvial Populations, Interaction with Non-native Species Unknown, Vulnerability to Chytrid, Relative Impacts of Fragmentation, Persistent Declines in Prey Species, Impacts on Migrating Birds, Unknown Population Status, Wind Power Impacts, and the eponymous and general Inadequate Understanding of Ecology and Life History.

Table DG5. Results of Threat Assessment of Priority Level-2 Data Gap, Inadequate Understanding of Ecology and Life History

Level 3 Data Gaps - Cheatgrass Impacts, Importance and Contribution of Fluvial Populations, Interaction with Non-native Species Unknown, Vulnerability to Chytrid, Relative Impacts of Fragmentation, Persistent Declines in Prey Species, Impacts on Migrating Birds, Unknown Population Status, Wind Power Impacts, Inadequate Understanding of Ecology and Life History	**Threat Impact (Scope x Severity)**	
	NA	**Grand Total**
Amphibians	**4**	**4**
Mexican Spadefoot	1	1
Northern Leopard Frog	1	1
Plains Spadefoot	1	1
Western Toad	1	1
Aquatic Inverts	**15**	**15**
[a Species of] Fossaria	1	1
Cloaked Physa	1	1
Coarse Rams-horn	1	1
Desert Tryonia	1	1
Green River Pebblesnail	1	1
Lamb Rams-horn	1	1
Mountain Marshsnail	1	1
Pilose Crayfish	2	2
Rustic Ambersnail	1	1
Sierra Ambersnail	1	1
Top-heavy Column	1	1
Utah Amphipod	2	2
Widelip Pondsnail	1	1
Birds	**10**	**10**
Band-tailed Pigeon	1	1
Black Rosy-finch	1	1
Flammulated Owl	1	1

Golden Eagle	2	2
Greater Sage-grouse	1	1
Gunnison Sage-grouse	1	1
Mexican Spotted Owl	1	1
Snowy Plover	1	1
Yellow-billed Cuckoo	1	1
Fishes	**13**	**13**
Bluehead Sucker	1	1
Bonneville Cutthroat Trout	1	1
Bonytail	2	2
Colorado Pikeminnow	1	1
Flannelmouth Sucker	1	1
Humpback Chub	1	1
Northern Leatherside Chub	2	2
Razorback Sucker	3	3
Roundtail Chub	1	1
Mammals	**7**	**7**
[a Race of the] Chisel-toothed Kangaroo Rat	1	1
[a Race of] Botta's Pocket Gopher	1	1
Idaho Pocket Gopher	1	1
Little Brown Myotis	1	1
Preble's Shrew	1	1
Townsend's Big-eared Bat	2	2
Reptiles	**6**	**6**
Black-necked Gartersnake	2	2
Many-lined Skink	1	1
Midget Faded Rattlesnake	3	3
Terrestrial Inverts	**13**	**13**
[a Race of the] Yavapai Mountainsnail	1	1
Cross Snaggletooth	1	1
Deseret Mountainsnail	1	1
Eureka Mountainsnail	1	1
Lyrate Mountainsnail	1	1
Mill Creek Mountainsnail	1	1
Mitered Vertigo	1	1
Montane Snaggletooth	1	1
Ribbed Dagger	1	1
Sluice Snaggletooth	1	1
Southern Tightcoil	1	1
Striate Gem	1	1
Thin-lip Vallonia	1	1
Grand Total	**68**	**68**

Data Gap – Inadequate Understanding of Ecology and Life History: This data gap includes a large number and wide variety of bird, mammal, and aquatic SGCN targets for which managers lack the ecological context in which to:

- assess the relative impacts of individual threats or stressors, or
- adequately describe habitat associations, given the current lack of understanding of their range (data gap #12.1), or the inability to inventory them or assess their status (data gap #12.2).

This Level-2 category steps into the specifics of SGCN/threat interactions: it is the “so what” of knowing distributions well enough to identify potential threats, but not knowing enough about the species ecology (or even life history) to describe the relative importance of particular habitat conditions, the impact of a given threat within that distribution, or a beneficial course of abatement action. This fundamental lack of understanding of many SGCNs' basic ecology – their relationships to space within their range, and to the other species – often paralyzes management action. For example, 39 SGCNs were flagged as having too little information on their basic ecology to even identify, much less take action to address, the threats facing them.

Five other Level 3 data gaps identified the unknown importance of specific threats to 20 SGCN species (e.g., impacts of wind power, cheatgrass, or chytrid fungus), presumably because their distribution is well enough described to identify potential threats specific to those landscapes. The population abundances of 10 more SGCNs are largely unknown, making it difficult to assess the importance of particular sub-populations (e.g., fluvial populations) or even the status of the species in the state. Two more SGCNs in this Level 2 category were flagged for data gaps relating to inter-specific relationships with non-native species, and prey species upon which SGCNs rely.

Many of these Level 3 data gaps may be directly addressed by targeted research, once the means to assess their species distribution and habitat associations have been determined and applied.

Case Study: Full Life-cycle Conservation of Flammulated Owls

The Flammulated Owl is an insectivorous owl of western montane forests, breeding in coniferous forest habitat from British Columbia south to Oaxaca in southern Mexico. It is believed that all owls breeding in the U.S. and Canada winter in western Mexico south to Central America, but linkages between specific breeding areas and wintering areas are lacking. It has a low reproductive rate, and may be declining due to the loss or alteration of mature pine forest habitat. It receives high vulnerability scores from Partners In Flight (PIF) due to its very small population size and restricted non-breeding distribution which make it vulnerable to chance events. It is also a Bird of Conservation Concern to the FWS (FWS 2008) and a SGCN in the majority of state WAPs for western states.

The Flammulated Owl was further identified a high priority species for monitoring, specifically recommending nocturnal surveys in the US and Mexico, and migration monitoring (Dunn et al. 2005). A standardized survey protocol was tested in Utah and several other western U.S. states in 2010-11 in anticipation of range-wide application (Slater 2010, FWS in prep.). Flammulated owls generally breed in open tracts of older pine or fir forests of moderate elevation, with cavities for nesting. Patches of deciduous forest (e.g., aspen), are often used as well and could be an important habitat component in an old forest matrix. A range-wide approach to clarifying habitat associations in more detail will be needed, because of regional variability in available habitats. As a secondary cavity nester, using cavities excavated generally by other birds, this species relies on the availability of dead or dying wood, snags, and woodpeckers to excavate the cavities. It also readily uses artificial nest boxes, making feasible the creation of a regularly discoverable, individually-identified, wild population of this otherwise difficult-to-study species.

A series of researchers (predominately Dr. Marcus Mika and Dr. David Oleyar in Utah) have used this species' willingness to use artificial nest boxes to powerful effect: by establishing a network of nest boxes in the 1990s to document site- and pair-fidelity, nest success, adult and juvenile success, and body-condition relationship to the abundance and composition of the local insect community. By maintaining and expanding these nest boxes, researchers have been able to effectively band an entire population and answer many of these questions. Now, using geolocators[67], they have established for the first time definitive linkages between breeding and wintering areas for one of Utah's flammulated owl populations. This linkage has facilitated a proposal at the PIF's Fifth (V) International meeting (2013), centered on developing an international full-lifecycle approach to the species conservation

The focus of the PIF V proposal is promotion of and education about the importance of forest management which retains dead and dying wood, snags, and older growth characteristics. It involves 3 communities each in the U.S. and Mexico, and one in Canada, nest boxes, and school children to build and maintain them. The nest boxes will be the vehicle to help children from local communities learn the importance of cavities for birds, and help a research team mark birds in boxes with geolocators or other devices. Marked birds will then help tell the story of migration across international borders, and of habitat conditions important for the survival and reproduction of this small, partially migratory, insectivorous cavity nester. Schools will then be linked via the web, Skype, and by other means, to share experiences, ask each other questions about the forests near them, and discuss the travels of individual owls. This is a 10-year project. Conceivably, children with connections to individual owls may continue to follow the progress of these birds, and this project, throughout their teen years and grow up with a greater sense of connection to and concern for forest management that retains snags and older growth characteristics, and habitat conditions important for all forest birds.

[67] http://en.wikipedia.org/wiki/Light_level_geolocator accessed February 2, 2015.

Essential Conservation Actions to Address This Crucial Data Gap

Objective #1 for Inadequate Understanding of Ecology and Life History

Managers and conservationists have a sufficient understanding of SGCN and habitat ecologies and life histories to assess, avoid, and mitigate threats to them.

Potential Conservation Actions

- Agencies cooperate on an annual review of existing data gaps impeding conservation action.
- WAP partners allocate staff and resources to meet or incentivize prioritized needs.
- Created or captured data is shared among partner databases.
- Data products and decision-support tools, such as peer-reviewed publications and species-habitat association models, are created and incorporated into threat assessments and strategic planning.
- Managers and conservationists take a three-pronged approach to resolving high priority ecology and life history questions: 1) work collaboratively with the public to engage “citizen scientists” where possible, 2) where public involvement is not possible, agency biologists collaborate with one another to meet research needs, and 3) managers work with academics and contractors to research high-priority ecology and life history questions beyond the scope of agency capacities.

Potential Indicators of Success Reaching this Objective

- Managers identify specific questions impeding conservation action beyond the scope of agency programmatic approaches.
- Questions are communicated to research community.
- Management and research community collectively reduce the number of conservation targets with data gaps by 10% per year.

Likely Authorities, Stakeholders, and/or Partners

- Partnerships will likely be species and habitat specific. Partners will also likely vary with the spatial extents, once determined, and the potential repercussions of conflicts between life histories and specific threats (e.g., golden eagle regional movements and threats posed by wind power). All will need the academic community to be engaged, however, and all will definitely need the credibility and defensibility of peer-reviewed publications.

Inadequate Understanding of Distribution or Range

Table DG3 summarizes the numbers of species and habitats impacted by this Level-2 data gap and by all nested Level-3 data gaps. Data gaps were identified during the threat assessment process, but were not evaluated for scope and severity, and ranked by impact, in the same way as the other threats.

No Level-3 data gaps were identified as important enough to sub-categorize this Level-2 data gap.

Table DG3. Results of Threat Assessment of Priority Level-2 Data Gap, Inadequate Understanding of Distribution or Range

Level 2 Data Gap - Inadequate Understanding of Distribution or Range	Threat Impact (Scope x Severity) NA	Grand Total
Amphibians	**2**	**2**
Mexican Spadefoot	1	1
Plains Spadefoot	1	1
Aquatic Habitats	**3**	**3**
Aquatic-Scrub/Shrub	1	1
Emergent	1	1
Riverine	1	1
Aquatic Inverts	**30**	**30**
[a Species of] Fossaria	1	1
Bifid Duct Pyrg	1	1
Black Canyon Pyrg	1	1
California Floater	1	1
Carinate Glenwood Pyrg	1	1
Cloaked Physa	1	1
Coarse Rams-horn	1	1
Desert Springsnail	1	1
Desert Tryonia	1	1
Fat-whorled Pondsnail	1	1
Green River Pebblesnail	1	1
Hamlin Valley Pyrg	1	1
Kanab Ambersnail	1	1
Lamb Rams-horn	1	1
Longitudinal Gland Pyrg	1	1
Mountain Marshsnail	1	1
Ninemile Pyrg	1	1
Northwest Bonneville Pyrg	1	1
Otter Creek Pyrg	1	1
Rocky Mountain Duskysnail	1	1
Rustic Ambersnail	1	1
Sierra Ambersnail	1	1

Smooth Glenwood Pyrg	1	1
Southern Bonneville Springsnail	1	1
Sub-globose Snake Pyrg	1	1
Top-heavy Column	1	1
Utah Physa	1	1
Western Pearlshell	1	1
Wet-rock Physa	1	1
Widelip Pondsnail	1	1
Birds	**12**	**12**
American Bittern	1	1
American White Pelican	1	1
Bendire's Thrasher	1	1
Black Rosy-finch	1	1
Black Swift	1	1
Boreal Owl	1	1
Burrowing Owl	1	1
Flammulated Owl	1	1
Lewis's Woodpecker	1	1
Northern Pygmy-owl	1	1
Southwestern Willow Flycatcher	1	1
Yellow-billed Cuckoo	1	1
Fishes	**4**	**4**
Bonytail	1	1
Colorado Pikeminnow	1	1
Humpback Chub	1	1
Razorback Sucker	1	1
Mammals	**12**	**12**
[a Race of the] Montane Vole	1	1
Allen's Big-eared Bat	1	1
Canada Lynx	1	1
Dark Kangaroo Mouse	1	1
Dwarf Shrew	1	1
Fringed Myotis	1	1
Idaho Pocket Gopher	1	1
Little Brown Myotis	1	1
Preble's Shrew	1	1
Townsend's Big-eared Bat	1	1
Western Red Bat	1	1
Wolverine	1	1
Reptiles	**8**	**8**
Desert Night Lizard	1	1
Many-lined Skink	1	1

Midget Faded Rattlesnake	1	1
Pyro Mountain Kingsnake	1	1
Smith's Black-headed Snake	1	1
Spotted Leaf-nosed Snake	1	1
Utah Milksnake	1	1
Western Threadsnake	1	1
Terrestrial Inverts	**14**	**14**
[a Race of the] Yavapai Mountainsnail	1	1
Brian Head Mountainsnail	1	1
Cross Snaggletooth	1	1
Deseret Mountainsnail	1	1
Eureka Mountainsnail	1	1
Lyrate Mountainsnail	1	1
Mill Creek Mountainsnail	1	1
Mitered Vertigo	1	1
Montane Snaggletooth	1	1
Ribbed Dagger	1	1
Sluice Snaggletooth	1	1
Southern Tightcoil	1	1
Striate Gem	1	1
Thin-lip Vallonia	1	1
Grand Total	**85**	**85**

Data Gap - Inadequate Understanding of Distribution or Range: Arguably the most fundamental requirement for land and wildlife management is for managers to have reliable information on where conservation targets occur. This need dominates the assessed data gaps for 85 conservation targets, 82 species and 3 aquatic habitats – or nearly a third of all conservation targets.

It is a broad category with identified needs varying from maps, which are too coarse for effective planning, to untested distribution models, to speculation about surmised ranges of newly described species. These data gaps often represent the next step for managers, but not always: some species taxonomic statuses must first be resolved, for example, and a reliable means of identification must be developed for many more.

Generally, however, where uncertainty exists about the location of conservation targets, uncertainty also exists on the threats they face. This limits effective, efficient conservation action. It also highlights the uncertain value of conservation actions taken to improve conditions for WAP species and habitats: without a baseline, it is impossible to assess change.

If there is an inability to assess the effectiveness of conservation actions and make course corrections, then the adaptive management model fails. Proceeding in a targeted manner is not possible without having a baseline, assessing progress toward the objectives, and adjusting course based on findings.

The following list presents a general approach to developing distribution models that are sufficiently accurate, precise, and defensible for use in management and impact analysis. Individual conservation targets will be understood at different initial knowledge levels, and they will require individual evaluation. Once these have been reviewed, opportunities for cooperation and "efficiencies of scale" can be described.

- Draft descriptions of targets' niche envelopes, through literature search and existing data.
- Refine descriptions using pilot study and expert opinion into parameters suitable for modeling.
- Predictively model potential habitat statewide.
- Use potential habitat model to inform sampling frame for field studies.
- Conduct field sampling using predictive model and collect parameter data at positive and negative locations.
- Iteratively refine distribution model until it is useful and defensible.

Case Study: Modeling the Breeding Distribution of Western Yellow-billed Cuckoo in Utah

In 2012, the Bureau of Land Management, Utah Division of Wildlife Resources, and Endangered Species Mitigation Fund entered into a three-year agreement to assess the statewide status of yellow-billed cuckoos in response to regionally-declining populations, degraded habitats in the state, and anticipation of the court-ordered resolution of its 'Candidate' listing status by 2015.

Little work had been consistently done on this elusive bird, and no effort had been made to define potential breeding areas, derive a population estimate for the state, or to establish breeding habitat associations for Utah-specific habitat conditions. While the association of yellow-billed cuckoo breeding habitat with low-elevation riparian vegetation with a closed canopy, dense understory, and large patch sizes was well described in the literature, no sufficiently-accurate statewide map or model of these areas existed at a resolution sufficient to serve as a surrogate sampling frame for an occupancy-modeling approach to describing potential breeding habitat. To appropriately direct field surveys and create a credible and defensible sampling frame for potential breeding habitat in Utah, we applied a recent and successful modeling approach the State of Arizona had taken to estimate potential breeding habitat (Johnson et al, 2012[68]).

Using geographic information system technology, perennial streams below 1800m elevation[69] were identified with NHDPlus[70], and buffered by 400m (far beyond the width of Utah floodplains) to facilitate faster modeling runs. Irrigated lands were excluded by clipping out the hand-digitized (NAIP[71] 2011) data layers of irrigated lands sourced from the Utah Division of Water Resources. A recent (2011)

[68] http://www.lcrmscp.gov/reports/2012/c24_gis_ybcu_mar12.pdf
[69] A reasonable elevation threshold for "low elevation" streams in Utah.
[70] NHDPlus is an integrated suite of application-ready geospatial data sets that incorporate many of the best features of the National Hydrography Data set (NHD), the National Elevation Data set (NED), and the Watershed Boundary Data set (WBD).
[71] National Agriculture Imagery Program, administered by the USDA's Farm Service Agency.

statewide 'cloud-free' LANDSAT image was stitched together; a normalized difference vegetation index (NDVI) surface was then calculated and clipped to the buffered perennial stream layer. The Arizona model was iteratively applied to these data, using a range of greenness and patch-amalgamating thresholds, to select large non-irrigated "green" patches of riparian vegetation as potentially suitable for breeding yellow-billed cuckoos. Selected areas were converted to polygons and overlain by a statewide tessellated sampling grid, and random samples were drawn. Potential sample sites were first examined using aerial photography and ranked for their potential as breeding habitat (1st level of model validation) prior to inclusion into a sampling field schedule. All initially-validated sites were then surveyed using regionally standardized field methods (multiple visits, call-payback), along with point locations for all known previous breeding-season sightings of yellow-billed cuckoos, for three field seasons.

Results from each field season were compiled and reported to the Utah Natural Heritage Program database for storage and dispersal to project partners, and the US Fish and Wildlife Service. The model was found to be over-inclusive generally, though so few yellow-billed cuckoos were located that formal model evaluation was impossible using "probability of occupancy" as our metric.

Caveats:

- *The model was created using an existing model from Arizona, and the habitats used by cuckoos in northern Utah may differ substantially from those used by cuckoos in Arizona. This may require different assumptions than those applied in the creation of the Arizona model.*
- *The intent of the model was to identify areas to survey, not to identify critical habitat, and inclusion or exclusion of a site in the model alone says nothing about the presence of cuckoos, without additional, fairly extensive field work to validate the model.*

The model was based on NDVI values - essentially just looking for large areas of green around the major rivers and streams of Utah. Therefore, green vegetation other than cottonwood galleries is identified, including extensive areas of non-native vegetation thought to compromise the habitat qualities important to the species. This is also an issue in developed areas, where yards (green lawns) are also picked up.

Essential Conservation Actions to Address This Crucial Data Gap

The objectives and actions listed below are presented as starting points in an inclusive discussion, not requirements or decisions that have already been made. Any and all ideas that can result in broadly-acceptable actions to meet the needs of wildlife and Utahns are most welcome. Inclusiveness is a requirement for deciding what conservation actions will actually happen, on whose terms, and when. See the Partnerships and Implementation Mechanisms chapter for more resources.

Objective #1 for Inadequate Understanding of Distribution or Range

All SGCN and key habitats have reliable and defensible distribution information for Utah.

Objective #2 for Inadequate Understanding of Distribution or Range

Distribution information is widely shared and easily accessible for impact analysis, project planning, and monitoring efforts by WAP partners and the public, in keeping with provisions of Utah's Government Records Access and Management Act.

Objective #3 for Inadequate Understanding of Distribution or Range

Distributions are regularly updated. Differences between versions are explained or interpreted.

Potential Conservation Actions

- WAP partners direct staff to address the 85 conservation targets with incomplete or inadequate distribution information.
- Staff are assigned and scheduled to address specific targets.
- WAP partners collaboratively seek funding opportunities.
- Create a central spatial database to store and serve distribution data.
- Field biologists, academics, and modelers work collaboratively to achieve annual goals.
- Models and central spatial database are iteratively updated with field data.
- Distributions are made available to managers and the public, annually.
- Distributions are updated regularly as appropriate.

Potential Indicators of Success Reaching this Objective

- The 85 conservation targets without reliable distribution information are either 1) incorporated into WAP partner workplan processes or are 2) identified as targets better addressed through external research groups.
- 10% of these are addressed annually with regular updates scheduled as appropriate and necessary.
- Distribution information is easily accessed by managers, researchers, and the public, in keeping with provisions of Utah's Government Records Access and Management Act.

Likely Authorities, Stakeholders, and/or Partners

- Given the breadth and scope of this data gap, the list of potential partners will necessarily include all major land- and resource-management agencies. The larger the land area managed, however, the greater the likelihood for the direct participation in meeting these needs. Water-managing entities will need to be included for virtually all aquatic and wetland habitat targets.

Inadequate Inventory and Assessment Methods

Table DG4 summarizes the numbers of species and habitats impacted by this Level-2 data gap and by all nested Level-3 data gaps. Data gaps were identified during the threat assessment process, but were not evaluated for scope and severity, and ranked by impact, in the same way as the other threats.

This Level-2 data gap is further subdivided into three Level-3 data gaps: No Morphological Key or Other Means to Identify, Inventory Techniques Poorly Developed, and No Standardized Condition Assessment Method.

Table DG4. Results of Threat Assessment of Priority Level-2 Data Gap, Inadequate Inventory and Assessment Methods

Level 3 Data Gaps - No Morphological Key or Other Means to Identify, Inventory Techniques Poorly Developed, No Standardized Condition Assessment Method	Threat Impact (Scope x Severity)	
	NA	Grand Total
Amphibians	**2**	**2**
Mexican Spadefoot	1	1
Plains Spadefoot	1	1
Aquatic Habitats	**6**	**6**
Aquatic-Forested	1	1
Aquatic-Scrub/Shrub	1	1
Emergent	2	2
Open Water	1	1
Riverine	1	1
Aquatic Inverts	**24**	**24**
[a Species of] Fossaria	1	1
Bifid Duct Pyrg	1	1
Black Canyon Pyrg	1	1
California Floater	1	1
Carinate Glenwood Pyrg	1	1
Cloaked Physa	1	1
Coarse Rams-horn	1	1
Desert Springsnail	1	1
Desert Tryonia	1	1
Green River Pebblesnail	1	1
Hamlin Valley Pyrg	1	1
Kanab Ambersnail	1	1
Longitudinal Gland Pyrg	1	1

Mountain Marshsnail	1	1
Ninemile Pyrg	1	1
Northwest Bonneville Pyrg	1	1
Otter Creek Pyrg	1	1
Pilose Crayfish	1	1
Rustic Ambersnail	1	1
Sierra Ambersnail	1	1
Smooth Glenwood Pyrg	1	1
Southern Bonneville Springsnail	1	1
Sub-globose Snake Pyrg	1	1
Utah Physa	1	1
Birds	**10**	**10**
American Bittern	2	2
Band-tailed Pigeon	1	1
Bendire's Thrasher	1	1
Boreal Owl	1	1
Burrowing Owl	1	1
Olive-sided Flycatcher	1	1
Peregrine Falcon	1	1
Yellow-billed Cuckoo	2	2
Fishes	**4**	**4**
Bonytail	1	1
Humpback Chub	1	1
Roundtail Chub	2	2
Mammals	**11**	**11**
[a Race of the] Montane Vole	1	1
[a Race of] Botta's Pocket Gopher	1	1
Allen's Big-eared Bat	1	1
Big Free-tailed Bat	1	1
Dwarf Shrew	1	1
Idaho Pocket Gopher	3	3
Little Brown Myotis	1	1
Preble's Shrew	1	1
Spotted Bat	1	1
Reptiles	**4**	**4**
Midget Faded Rattlesnake	1	1

Pyro Mountain Kingsnake	1	1
Utah Milksnake	1	1
Western Threadsnake	1	1
Terrestrial Inverts	**11**	**11**
[a Race of the] Yavapai Mountainsnail	1	1
Brian Head Mountainsnail	1	1
Cross Snaggletooth	1	1
Deseret Mountainsnail	1	1
Eureka Mountainsnail	1	1
Lyrate Mountainsnail	1	1
Mill Creek Mountainsnail	1	1
Mitered Vertigo	1	1
Montane Snaggletooth	1	1
Ribbed Dagger	1	1
Sluice Snaggletooth	1	1
Grand Total	**72**	**72**

Data Gap – Inadequate Inventory and Assessment Methods: The ability of managers and conservationists to 1) describe habitat use and associations, and 2) assess the relevance or effectiveness of different threat-mitigation approaches, hinges on our ability to adequately inventory and assess the status of SGCNs, priority habitats, and threats. This must be achievable in a manner which is reasonable, in terms of cost and effort, and which is reliable and repeatable. For 72 of the 154 conservation targets these methods do not yet exist. Essential actions needed to address these data gaps vary primarily by target group (i.e., fishes, mammals, etc), but all include specific evaluations of past and potential methods, in terms of effectiveness, practicality, and cost.

This level 2 data gap includes three specific Level 3 data gaps:

- <u>No Morphological Key or Other Means to Identify</u> is dominated by morphologically cryptic species that can only be distinguished by specialized laboratory methods, e.g. genetic analysis, which are often too expensive or intensive to be practicable.
- <u>Inventory Techniques Poorly Developed</u> encompasses SGCNs which lack identification keys, or suffer from controversial or inadequate inventory and assessment methods (e.g., most freshwater mollusks and several small mammals).
- <u>No Standardized Condition Assessment Method</u> applies to key aquatic habitats for which the existing approaches to assessing habitat extent and condition fall short of regional or statewide management needs. Existing methods either produce inconsistent or unacceptably coarse results, or are too expensive or intensive to be practicable beyond the site scale.

These differ from situations, also included in this Level 2 category, where there is no consensus on the standardized means for assessing habitat condition, or no consensus on what a habitat condition assessment should include. For example, as there is no consensus on reference conditions for the various riparian habitats, there are - as yet - no standards against which to compare current conditions.

Case Study: Developing and Testing Methods to Map and Assess Riparian Habitat Condition

This project resulted from the sustained interest of the BLM and UDWR, and managers' persistent needs for a reliable map of Aquatic-Forested -- a priority aquatic habitat -- and to assess riparian vegetation conditions in a cost-effective way and at management-relevant scales.

Project Goals

- *Map valley bottoms of all perennial streams of the Colorado Plateau Ecoregion (26,000 km^2).*
- *Accurately delineate existing and potential riverine riparian habitat areas.*
- *Conduct a riparian vegetation condition assessment.*

Filling an Important Data Gap:

Riparian areas of the Colorado Plateau Ecoregion (CPE) are among the most productive and diverse ecosystems in this semiarid region. These small yet vital ecosystems support myriad aquatic and terrestrial species while simultaneously providing valuable ecosystem services such as water quality improvement. Maintenance of these important ecosystems requires accurate delineation and characterization, yet we still lack accurate, comprehensive riparian mapping for most areas.

This project aims to accurately delineate valley bottoms, and characterize riverine riparian habitats throughout the CPE thus filling this important data gap. The spatial data set resulting from this project will provide a comprehensive CPE-wide inventory of the distribution and condition of riverine riparian areas. This riparian inventory will serve as an important baseline tool for threat abatement, and for monitoring ecological responses to natural and anthropogenic changes.

Valley Bottom Delineation. Valley margins occur between the bedrock of adjacent hillslopes and include all of the "alluvial" sediment stores. Within the valley margin is the valley bottom containing the active channel and floodplain (Wheaton et al. 2014[72]). Confinement can be imposed by valley walls, by surficial deposits such as alluvial/debris fans, or by terraces or bedrock outcrops (O'Brien and Wheaton 2014[73]).

The perennial National Hydrography Data set stream network and 10m Digital Elevation Model (DEM) were used within the Fluvial Corridor Valley Bottom Tool to delineate the approximate valley bottom of

[72] Wheaton, J.M., K. Fryirs, G. Brierley, S. Bangen, N. Bouwes, and G. O'Brien. 2014. Geomorphic mapping of riverscapes. USU Etal Internal Document.
[73] O'Brien, G.O., and Wheaton JM. 2014. Draft River Styles Report for the Middle Fork John Day Watershed, Oregon. Ecogeomorphology and Topographic Analysis Lab, Utah State University, Prepared for Eco Logical Research, and Bonneville Power Administration, Logan, Utah, 214 pp.

all perennial streams within the CPE (Roux et al. 2014[74]). The resulting valley bottom was manually edited to remove alluvial fans, terraces, mapping errors and DEM artifacts.

Riparian Mapping. Tamarisk and other invasive species have spread throughout the riparian corridor of this vital ecosystem, compromising habitat quality for many SGCN species. The riparian mapping phase of this project serves to delineate the historic and existing riparian extent using a combination of LANDFIRE vegetation layers, water-related land use, and National Wetland Inventory data sets. The derived spatial data set could then be used by the BLM and other agencies to identify and visualize intact and degraded areas of the riverine corridor.

For example, in the San Rafael River, non-native vegetation encroachment has lead to loss of native riparian vegetation. Invasive riparian species have led to narrowing of the river channel and to the loss of complex habitat used by native fish. Knowledge of the spatial distribution, condition, and recovery potential of these habitats is critical to protecting and mitigating threats to such habitat. As such, this project will provide maps and GIS layers of this habitat.

The project also includes a stream network based riparian vegetation condition assessment of the CPE. This important spatial data set contrasts the LANDFIRE potential (historic) riparian condition with the existing LANDFIRE riparian condition. Thus this data set indicates the level to which the riparian area has been transformed by invasive riparian species. This spatial layer will provide resource managers with a reach-level (300 m resolution) assessment of riparian condition that will be used to gauge current condition and recovery potential across the CPE.

Essential Conservation Actions to Address This Crucial Data Gap

Objective #1 for Inadequate Inventory and Assessment Methods

Accepted and effective methods exist to inventory and assess condition of conservation targets.

Potential Conservation Actions

- Agencies coordinate and collaborate to incentivize research and development of practicable means and methods for inventorying and assessing conservation targets.
- WAP implementation working group(s) convene to research potential solutions, establish priorities and timelines, and look for efficiencies.
- Where there are no existing approaches, working group(s) identify the limiting factors (e.g., defining and achieving consensus on remotely-sensible parameters for riparian condition).
- Working groups communicate needs to conservation and research communities.
- Managers and researchers collaborate on the application, evaluation, refinement, and publication of methods.

[74] Roux, C., A. Alber, M. Bertrand, L. Vaudor, and H. Piégay. 2014. “Fluvial Corridor”: A new ArcGIS toolbox package for multiscale riverscape exploration. Geomorphology.

Potential Indicators of Success Reaching this Objective

- WAP implementation working groups of managers, researchers, and conservationists convene to address this data gap.
- Where no existing approaches exist, limiting factors (e.g., defining and achieving consensus on remotely-sensible parameters for riparian condition) are identified.
- Conservation needs are communicated to the respective research communities.
- Methods are researched, developed, and published, enabling effective inventory and condition assessment of WAP conservation targets.

Likely Authorities, Stakeholders, and/or Partners

- Utah Division of Forestry Fire and State Lands
- US Forest Service
- Bureau of Land Management
- Academia
- Conservation NGOs

Taxonomic Debate

Table DG6 summarizes the numbers of species and habitats impacted by this Level-2 data gap and by all nested Level-3 data gaps. Data gaps were identified during the threat assessment process, but were not evaluated for scope and severity, and ranked by impact, in the same way as the other threats.

This Level-2 data gap is further subdivided into two Level-3 data gaps: the eponymous Taxonomic Debate, and Uncertain Management/Conservation Unit.

Table DG6. Results of Threat Assessment of Priority Level-2 Data Gap, Taxonomic Debate

Level 3 Data Gaps - Taxonomic Debate, Uncertain Management/Conservation Unit	Threat Impact (Scope x Severity) NA	Grand Total
Amphibians	**3**	**3**
Mexican Spadefoot	1	1
Plains Spadefoot	1	1
Western Toad	1	1
Aquatic Inverts	**6**	**6**
[a Species of] Fossaria	1	1
Bear Lake Springsnail	1	1
California Floater	1	1
Fat-whorled Pondsnail	1	1
Green River Pebblesnail	1	1
Kanab Ambersnail	1	1
Birds	**1**	**1**
Yellow-billed Cuckoo	1	1
Fishes	**3**	**3**
Bluehead Sucker	1	1
Colorado River Cutthroat Trout	1	1
Roundtail Chub	1	1
Mammals	**7**	**7**
[a Race of the] Montane Vole	1	1
[a Race of] Botta's Pocket Gopher	1	1
Dark Kangaroo Mouse	1	1
Dwarf Shrew	1	1
Little Brown Myotis	1	1
Preble's Shrew	1	1
Western Red Bat	1	1
Reptiles	**3**	**3**
Midget Faded Rattlesnake	1	1
Pyro Mountain Kingsnake	1	1
Utah Milksnake	1	1

Terrestrial Inverts	**2**	**2**
Deseret Mountainsnail	1	1
Mill Creek Mountainsnail	1	1
Grand Total	**25**	**25**

Data Gap – Taxonomic Debate: This data gap is the most fundamental, going to the identity of the taxon itself. It is also one where there is little current or active scientific inquiry to resolve the question. But when the scientific community, or in some case the courts, has not yet come to consensus on the uniqueness of a given species, everything else managers need to do is called into question. A morphologically cryptic SGCN "species" may in fact be a member of relatively common sub-species requiring no special consideration. Or as in the recently resolved case of the yellow-billed cuckoo, a morphologically cryptic SGCN may suddenly present managers with an emergency. While only crustaceans escaped being identified in this data gap, freshwater mollusks and small mammals dominate this category.

As fundamental as this information is, it does not necessarily impede conservation action, as in the case of potentially "splitting in two" an already rare freshwater mollusk with limited distribution and localized known threats. In others, the resolution of historical taxonomic debates using modern methods (such as genetic analysis) may obviate the need for special management status or action.

Case Study: Addressing Taxonomic Uncertainty to Aid in Conservation

Identification of species can often be difficult especially with small or rare species such as mollusks. Separate species may look very similar or one species may have morphological variations among populations that make it appear to be a distinct species. Uncertainty in whether an individual or population is common or rare can greatly hinder conservation efforts. Genetic tools are becoming easier and cheaper to help clarify these questions.

The Ogden mountainsnail (formerly considered to be Oreohelix peripherica wasatchensis) was included in the 2005 WAP as it was thought to be a rare subspecies which only occurred at a single site. It was placed on the Federal Endangered Species candidate list in 2002 due to its rarity and the threat of stochastic or human-caused events at that site. New genetic studies have clarified the taxonomy of this snail. It was determined that there are actually two separate species residing at this site, but that each of these species is widespread. Due to this new information, the Ogden mountainsnail was removed from the candidate list in 2008.

There are still many species where taxonomic uncertainty remains or where additional genetic work has led to more questions. For example, we are currently working on bluehead sucker which has populations in the Colorado River Basin as well as the Snake River and Bonneville basins. These separate populations have been proposed as a distinct species but there is no consensus on this interpretation. If this species is *split, it would greatly elevate the conservation status of the less common population in the Snake River and Bonneville basins.*

Essential Conservation Actions to Address This Crucial Data Gap

Objective #1 for Taxonomic Debate

Taxonomic debates are resolved to a sufficient degree to enable adequately informed conservation action.

Potential Conservation Actions

- Agencies provide support to resolve taxonomic debate or to study little-known or understood taxa by identifying specific management needs and cooperative funding sources.
- Managers define the "worst-case scenario," or review repercussions of taxonomic splitting or lumping actions in terms of the need to conduct conservation action (e.g., run "what if" scenarios through SGCN flow-chart and rank calculator to technically assess changes prior to a formal re-evaluation of the "lumped" or "split" taxon), manage for potential threats, or restrain on-going impacts.
- Managers identify relevant scientific communities and communicate the need for taxonomic resolution to them (e.g., white papers, open letters to journals, convene workshops, etc.).
- Use incentives and collaborative projects to catalyze resolution of debate (e.g., create an RFP, coordinate regional partners to collect genetic material for later analysis, etc.).

Potential Indicators of Success Reaching these Objectives

- Research community is made aware of managers need for taxonomic resolution.
- Publication of peer-reviewed data progresses active debate in the mammals, mollusk, reptile, and fishes literatures.
- Publication of peer-reviewed data resolves active debate and governing taxonomic body (e.g., American Ornithologists' Union), the US Fish and Wildlife Service makes a determination, or legal action removes the management issue from the scientific realm.

Likely Authorities, Stakeholders, and/or Partners

- Partnerships will be species and impact specific. Partners will also vary with the spatial extents and potential repercussions of the taxonomic debate(s). All will need the academic community to be engaged, however, and all will definitely need the credibility and defensibility of peer-reviewed publications. UDWR and the Bureau of Land Management are the two agencies with lead roles because of the predominance of SGCN small mammals and freshwater mollusks with unresolved taxonomies found on BLM lands.

Abiotic Conditions and Processes

Table DG7 summarizes the numbers of species and habitats impacted by this Level-2 data gap and by all nested Level-3 data gaps. Data gaps were identified during the threat assessment process, but were not evaluated for scope and severity, and ranked by impact, in the same way as the other threats.

This Level-2 data gap is further subdivided into three Level-3 data gaps: the eponymous Abiotic Conditions and Processes, Atmospheric Deposition / Snowmelt Chemistry, and Relationship Between Groundwater and Surface Water.

Table DG7. Results of Threat Assessment of Priority Level-2 Data Gap, Abiotic Conditions and Processes

Level 3 Threats - Abiotic Conditions and Processes, Atmospheric Deposition / Snowmelt Chemistry, Relationship Between Groundwater and Surface Water	Column Labels	
	NA	Grand Total
Amphibians	**4**	**4**
Mexican Spadefoot	1	1
Northern Leopard Frog	1	1
Plains Spadefoot	1	1
Western Toad	1	1
Aquatic Habitats	**5**	**5**
Aquatic-Forested	1	1
Aquatic-Scrub/Shrub	1	1
Emergent	1	1
Open Water	1	1
Riverine	1	1
Birds	**1**	**1**
Mexican Spotted Owl	1	1
Grand Total	**10**	**10**

Data Gap - Abiotic Conditions and Processes: Analogous to the life history data gap (#12.3), a lack of understanding of how abiotic pools and flows interact undermines managers' ability to rank threats and prioritize actions for most aquatic habitats and several amphibians. The three identified Level-3 data gaps in this category were: 1) the impacts of atmospheric chemical deposition, 2) the lack of insight into the interaction of groundwater and surface waters, and 3) the relative threat posed by the deposition or presence of mercury and other heavy metal contaminants into SGCN habitats. The challenge here is for managers to initiate, incentivize, and prioritize relevant and targeted research into these broad and complex areas of inquiry.

Essential Conservation Actions to Address This Crucial Data Gap

Objective #1 for Abiotic Conditions and Processes

The relationship between ground and surface waters are sufficiently well understood that management actions can be formulated and incorporated into management plans to avoid or mitigate threats to conservation targets.

Objective #2 for Abiotic Conditions and Processes

The relative threat posed to aquatic habitats and reliant SGCNs by heavy metal deposition is well enough understood to be effectively avoided or mitigated in management plans and actions.

Potential Conservation Actions

- WAP partners collaboratively rank research needs, and seek funding to fill them.
- Aquatics managers work with academics to refine research questions and craft a widely applicable approach to the questions of ground and surface water interactions.
- Aquatics managers work with UDEQ, Utah Department of Health, and academics to refine research questions and craft a widely applicable approach to the questions of heavy metal deposition impacts and affects on aquatic systems and species.

Potential Indicators of Success Reaching these Objectives

- Identified research needs into heavy metal deposition effects on affected SGCN and habitats are formulated, prioritized, and funded.
- Identified research needs into groundwater/surface-water relationships in priority watersheds are formulated, prioritized, and funded.
- Research needs are communicated to partners and academics.

Likely Authorities, Stakeholders, and/or Partners

- Utah Division of Water Resources
- Utah Division of Water Rights
- Utah Division of Oil, Gas and Mining
- Utah Division of Forestry Fire and State Lands
- Utah Division of Air Quality
- Utah Division of Water Quality
- Utah Department of Health
- US Bureau of Reclamation
- Environmental Protection Agency
- US Forest Service
- Bureau of Land Management
- NGOs and academics with interests in aquatic habitat quality and heavy metals.

Climate Change

Table DG8 summarizes the numbers of species and habitats impacted by this Level-2 data gap and by all nested Level-3 data gaps. Data gaps were identified during the threat assessment process, but were not evaluated for scope and severity, and ranked by impact, in the same way as the other threats.

This Level-2 data gap is further subdivided into three Level-3 data gaps: the eponymous Climate Change, Future Effects of Greater Temperature Variability under Climate Change, and Future Effects of Greater Precipitation Variability under Climate Change.

Table DG8. Results of Threat Assessment of Priority Level-2 Data Gap, Climate Change

Level 3 Threats - Climate Change, Future Effects of Greater Temperature Variability under Climate Change, and Future Effects of Greater Precipitation Variability under Climate Change	Threat Impact (Scope x Severity)	
	NA	Grand Total
Amphibians	**2**	**2**
Mexican Spadefoot	1	1
Plains Spadefoot	1	1
Birds	**3**	**3**
Greater Sage-grouse	1	1
Gunnison Sage-grouse	1	1
Mexican Spotted Owl	1	1
Reptiles	**5**	**5**
Black-necked Gartersnake	1	1
Many-lined Skink	1	1
Midget Faded Rattlesnake	1	1
Pyro Mountain Kingsnake	1	1
Utah Milksnake	1	1
Terrestrial Habitats	**1**	**1**
Mojave Desert Shrub	1	1
Grand Total	**11**	**11**

Data Gap – Climate Change: Climate change is one of the most difficult data gaps for conservationists and managers to address given the uncertainty it inserts into every situation. For example, the two main forecast effects in Utah, increased variability in temperature and precipitation (and both flagged as Level 3 data gaps), are the factors that describe the edges of the niche-envelope for most localized or "specialist" species in a semi-arid state. These same factors are some of the primary abiotic determinants for all target terrestrial and aquatic habitats. Yet relatively few SGCNs and habitats have been identified as having conservation action limited by a lack of understanding the repercussions of a changing climate. Only reptiles and amphibians have been flagged as being immediately vulnerable to changes in temperature and precipitation regimes.

The vastness of this challenge can be overwhelming. But the reluctance of managers to flag climate change as an important data gap for the majority of conservation targets, while simultaneously acknowledging the pervasive threat it poses to all we strive to do, is more a reflection of the management realities we already face. Even where the trajectory of climate change is relatively well described, it may be considered a global threat without a commensurate local action; where it is coarsely described, it may be considered too diffuse to outrank known acute issues.

Further diminishing the rank of climate change is our nearly complete lack of understanding of its ramifications for wildlife. As is shown in the preceding data-gaps discussion, in few cases do we have a sufficient understanding of the total ecology of conservation species or their habitats to permit ranking current threats under assumptions of equilibrium. The assumption of equilibrium conditions is destroyed by climate change. This “no-analog” present in which we find ourselves extends into perpetuity, and stands as the pre-eminent conservation challenge of our generation.

Starting from where we are, we must do what we have always sought to do – conserve species and improve habitats - but with an awareness of shifting contexts and receding baselines. Our task here is to ask useful questions and answer them for future generations of managers and conservationists.

Essential Conservation Actions to Address This Data Gap

<u>Objective #1 for Climate Change</u>

Managers have downscaled climate projections available for use.

<u>Objective #2 for Climate Change</u>

Vulnerability assessments are complete for all WAP conservation targets.

<u>Potential Conservation Actions</u>

- Resources are allocated to source downscaled climate predictions.
- Resources are allocated to fund missing climate vulnerability assessments for SGCNs and habitats.
- Once the general outlines of vulnerabilities are apparent, individual programs and projects may need to investigate mechanisms to mediate effects, or create solutions to keep vulnerable species and habitats on the landscape. For example, recent work has suggested that diurnal lizards may undergo local extinctions due to high daytime temperatures, because the individuals have reduced activity times (i.e., have to remain under cover to avoiding reach thermal maxima) and so are unable to find mates or obtain sufficient food. This could possibly affect diurnal desert snakes as well. It is currently unknown the extent to which this may be a problem in the Utah populations, but research on the range of temperatures in which the species can be active coupled with predictions of temperature changes are needed to assess this potential threat.

Potential Indicators of Success Reaching this Objective

- SGCNs and key habitats are researched for existing and useful vulnerability assessments.
- New generations of downscaled climate predictions are sourced.
- Research priories into vulnerability assessments are identified, ranked, and incorporated into funding initiatives.
- Missing vulnerability assessments are researched.

Likely Authorities, Stakeholders, and/or Partners

- All federal land management agencies, NGOs, and state resource management agencies.

Inadequate Restoration Tools or Methods

Table DG9 summarizes the numbers of species and habitats impacted by this Level-2 data gap and by all nested Level-3 data gaps. Data gaps were identified during the threat assessment process, but were not evaluated for scope and severity, and ranked by impact, in the same way as the other threats.

This Level-2 data gap is further subdivided into three Level-2 data gaps: the eponymous Inadequate Restoration Tools or Methods, and Plant Material Development.

Table DG9. Results of Threat Assessment of Priority Level-2 Data Gap, Inadequate Restoration Tools or Methods

Level 3 Threats - Inadequate Restoration Tools or Methods, Plant Material Development	Threat Impact (Scope x Severity) NA	Grand Total
Birds	**1**	**1**
Mexican Spotted Owl	1	1
Terrestrial Habitats	**6**	**6**
Lowland Sagebrush	2	2
Mojave Desert Shrub	2	2
Mountain Meadow	1	1
Mountain Sagebrush	1	1
Grand Total	**7**	**7**

Data Gap - Inadequate Restoration Tools or Methods: This data gap has been identified six times for four terrestrial habitat targets based on the experience of land managers who have attempted habitat restorations and found their efforts limited by two Level 3 data gaps: 1) the lack of native plant materials (grasses, forbs, shrubs, and trees) suitable for large-scale distribution, specifically for pre- and post-fire restoration work, as well as 2) the development and evaluation of the tools and techniques needed to predictably establish native plants.

There is not a program in place that can reliably provide sufficient native seed for appropriate ecotypes at any given time. Current post-fire rehabilitation policies and procedures create an artificial “boom-bust” seed availability situation tied to acreages burned by wildfires each season. This “boom-bust” cycle is a disincentive to the private sector to develop existing businesses or start new seed companies that can consistently produce the full range of species at the desired quantity in any given year. All of these factors contribute to an inadequate seed supply in big wildfire years.

One boom-bust mitigation approach successfully used in Utah has been the construction of a very large, climate-controlled seed storage warehouse in the central Utah town of Ephraim. UDWR's Great Basin Research Center[75] accumulates large volumes of seed when supply is high and prices are lower, and provides custom seed mixes for a variety of restoration and rehabilitation projects every year. For those

[75] http://wildlife.utah.gov/habitat-restoration.html accessed February 24, 2015.

plant species whose seeds can live in cold storage for several years or more, this has been a very satisfactory means of attenuating some of the extremes in the boom-bust cycle noted above.

In general, seeding methods, seed mixes, and equipment used for post-fire rehabilitation or habitat restoration has not been adequately updated to improve native plant (especially sagebrush) reestablishment. New technologies, such as seed coating to improve the success of native seedings or developing soil pathogens to counter cheatgrass, have been developed but need further testing. These are just a couple of examples of innovative approaches that could be accelerated with additional resources.

Case Study: The Great Basin Native Plant Project[76] - Improving Restoration Methods and Materials

This Great Basin Native Plant Project is a multi-state, collaborative research project initiated in 2001 by BLM and the US Forest Service Grassland, Shrubland and Desert Ecosystem Research Program to provide information that will be useful to managers when making decisions about the selection of genetically appropriate materials and technologies for vegetation restoration. Major objectives are to improve the availability of native plant materials and to provide the knowledge and technology required for their use in restoring diverse native plant communities across the Great Basin. More than 20 federal, state, and private cooperators are involved in this project.

Project Objectives:

- *Increase the availability of native plant materials, particularly forbs, for restoring disturbed Great Basin rangelands.*
- *Provide an understanding of species variability and potential response to climate change; develop seed transfer guidelines.*
- *Develop seed technology and cultural practices for producing native seed in agricultural settings.*
- *Collaborate with seed regulatory agencies and the private seed industry to improve native seed supplies.*
- *Examine interactions of native restoration species and exotic invasive species to aid in formulating seeding prescriptions.*
- *Develop application strategies and technologies to improve the establishment of native seedlings.*
- *Develop demonstration areas, manuals, popular publications, and websites to facilitate application of research results.*

Science delivery is an integral function of the GBNPP and provides a constantly increasing body of knowledge that is published and distributed many ways: journals, theses and dissertations, reports,

[76] http://www.fs.fed.us/rm/boise/research/shrub/greatbasin.shtml

presentations, posters, brochures, flyers and disseminated through email, webinars, and meeting networking. Highlights from this project include deliverable science in genetics and seed zones, plant materials and cultural practices, seed increase, horticultural uses of native plants, species interactions, crested wheatgrass diversification, and restoration strategies and equipment.

Essential Conservation Actions to Address This Crucial Data Gap

<u>Objective #1 for Inadequate Restoration Tools or Methods</u>

Land managers have sufficient plant material options - in terms of species, growth forms, and functional diversity – to restore affected habitats to positive condition trajectories.

<u>Objective #2 for Inadequate Restoration Tools or Methods</u>

A suite of tested tools and techniques exist for land managers to use in restoring affected habitats.

<u>Objective #3 for Inadequate Restoration Tools or Methods</u>

A process exists for the identification of missing materials, tools, and techniques needed to meet as yet unidentified restoration challenges.

<u>Potential Conservation Actions</u>

- An implementation team of involved WAP partners is created to convene an inclusive habitat restoration working.
- Habitat restoration working group receives staff time/prioritization.
- Working group and partners seek funding to develop and test plant materials.
- Working group and partners seek funding to develop and test restoration tools and techniques.
- Working group defines a process by which new or previously undescribed needs are incorporated into existing, defined, and ranked research needs.
- Working group develops lists of missing plants, growth forms, functional traits, restoration tools and techniques for each identified target habitat.
- Working group defines research priorities and partners for each research prospectus.
- Working group seeks funding and academic collaborators for research priorities.
- Working group members implement findings in a monitored applied research framework.

<u>Potential Indicators of Success Reaching this Objective</u>

- Habitat restoration working group of concerned and involved partners is convened to direct the work, minimally including land managers, biologists, plant propagators, and academics.
- Focal list of species, growth-forms, and/or ecological functions are created for each identified target habitat.
- Missing tools and techniques are identified for each species and target habitat.

- Plant materials, tools, and techniques are developed for use at biologically meaningful scales.
- Habitat restoration goals are defined in testable terms of improving habitat condition.
- Habitat restoration goals are defined in testable terms of providing functional habitat for SGCNs.

Likely Authorities, Stakeholders, and/or Partners

- The Nature Conservancy
- US Forest Service
- Bureau of Land Management
- Utah Division of Forestry, Fire, and State Lands
- Utah Division of Oil, Gas, and Mining
- US Bureau of Reclamation
- NGOs with landscape or habitat restoration interests
- Commercial plant propagators
- Academics involved in restoration

Chapter Introduction

In wildlife and habitat management, there are two basic categories of information that monitoring programs are intended to create and communicate:

1. the status of a conservation target
2. the effectiveness of a management action

Assessing target status requires some measurement of current condition. Evaluating conservation effectiveness requires some measurement of the change in target status, resulting from management actions. In natural resource management, "indicators" are often used to detect changes in targets and threats, thus they are equally vital to status assessment and effectiveness monitoring. They are also important to implementation since they are used to make management decisions.

Indicators are meant to integrate many ecological functions and represent aspects of the larger ecological system that are either too expensive or time-consuming to monitor. The best indicators address one or more of the following types of values:

- ecological values - how well the indicator represents our targets and threats, and how those respond to natural and human-driven changes on the landscape
- practical values - how readily the indicator can be monitored and modeled, based on existing programs and resources
- social values - how well the indicator resonates with partners, stakeholders, and other audiences

Indicators always have at least one scale that is used for measurement. A common example from game management is fawn:doe ratio, which is an indicator of fawn production and survival. This indicator's measurement scale (or "measure") is the number of live fawns per 100 doe deer. This measure is derived by a particular set of people, using a defined method.

The purpose of this chapter is to define the indicators, measures, and methods that will be employed to monitor 1) the status of the WAP's monitoring targets and 2) the effectiveness of our management actions to define, maintain, or improve target status.

Periodic Status Assessments of SGCNs

Indicators

For each one of Utah's SGCNs, the fundamental properties to be assessed are "distribution and abundance...indicative of the health of wildlife". The WAP indicators that measure these properties on a statewide basis[77], for each species, are the three conservation status *factor categories* of the NatureServe Conservation Rank Calculator[78]:

- Rarity
- Threats
- Trends

Measures for all of the status factors that make up each of these three factor categories[79] are contained in the Rank Calculator. Users have some choice of which status factors they can use.

The status factor chosen to represent the indicator Rarity in Utah is Area of Occupancy. Here is the measure used for a species' Area of Occupancy (larger grid cells are the default option, while the smaller grid is used for species inhabiting linear habitats, such as river fishes):

NatureServe Code	Number of $4km^2$ grid cells occupied	Number of $1km^2$ grid cells occupied
Z	0	0
A	1	1-4
B	2	5-10
C	3-5	11-20
D	6-25	21-100
E	26-125	101-500
F	126-500	501-2,000
G	501-2,500	2,001-10,000
H	2,501-12,500	10,001-50,000
I	>12,500	>50,000

[77] A minority of SGCNs have their own management plans and are the subject of intensive monitoring programs which produce high-resolution data for those few species. When such data are available, they supplement the Area of Occupancy (AO) factor. For example, Population Abundance is a status factor which can be used in concert with AO to calculate Rarity. But here we are speaking of periodically monitoring all SGCNs, statewide. The vast majority of SGCNs have no population abundance estimates. There are no intentions to develop them.

[78] The Conservation Rank Calculator is a tool that automates the process of assigning a conservation status rank—an evaluation of the level of risk of extinction of species and elimination of ecosystems. It is used extensively by state Natural Heritage Programs, which collect and evaluate data for species and ecosystems of concern using a common methodology. The Rank Calculator tool facilitates the accurate application of this methodology and promotes greater accuracy and consistency of the assessments. It is available for download at http://www.natureserve.org/conservation-tools/conservation-rank-calculator

[79] Master, L. L., et al. 2012. NatureServe Conservation Status Assessments: Factors for Evaluating Species and Ecosystem Risk. NatureServe, Arlington, VA.

U	Unknown	Unknown

The indicator Threats has two status factors used as measures in Utah: Scope and Severity. Threat Scope is measured as the proportion of the species' population in the state that is affected by the threat. It is assessed within a 10-year time frame, and is measured like so:

Pervasive =	Affects all or most (71-100%) of the total population or occurrences
Large	Affects much (31-70%) of the total population or occurrences
Restricted	Affects some (11-30%) of the total population or occurrences
Small	Affects a small proportion (1-10%) of the total population or occurrences

Threat Severity is assessed within the geographic scope, and also within a 10-year time frame:

Extreme	Likely to destroy or eliminate occurrences or reduce the population 71-100%
Serious	Likely to seriously degrade/reduce affected occurrences or habitat or reduce the population 31-70%
Moderate	Likely to moderately degrade/reduce affected occurrences or habitat or reduce the population 11-30%
Slight	Likely to only slightly degrade/reduce affected occurrences or habitat, or reduce the population 1-10%

Severity and Scope are combined into Threat Impact (which was used in the threat prioritization - see the introduction of the Threats and Actions chapter, and the Threats and Actions appendix for more detail). Impact categories are derived this way:

Threat Impact		Threat Scope			
		Pervasive	Large	Restricted	Small
Threat Severity	Extreme	Very High	High	Medium	Low
	Serious	High	High	Medium	Low
	Moderate	Medium	Medium	Low	Low
	Slight	Low	Low	Low	Low

The indicator Trends is measured on two time scales In the Rank Calculator - long-term (~200 years) and short-term (10 years or 3 generations, whichever is longer). Short-term trend is the measure used in the WAP. These rating codes are used to describe the observed, estimated, inferred, or suspected degree of change in Rarity (whichever particular factor was used):

A	Decline of >90%
B	Decline of 80-90%
C	Decline of 70-80%
D	Decline of 50-70%
E	Decline of 30-50%
F	Decline of 10-30%
G	Relatively stable (<10% change)
H	Increase of 10-25%
I	Increase of >25%
U	Short-term trend unknown
Null	Factor not assessed

Methods

Scores for these three factor categories are integrated using the NatureServe Rank Calculator to derive each SGCN's S-ranks and N-ranks. Those ranks were a core component of the process for selecting SGCNs from the entire list of jurisdictional wildlife (see the SGCNs Methods appendix for more details).

UDWR's Natural Heritage Program operates the Rank Calculator to create and update state (S) ranks. Each SGCN (and some other species[80]) will have its state rarity and threat status assessed every three to five years. Data are managed with Biotics 5[81]. State ranks will be updated on a rotational basis: 20% to 35% of SGCNs will be updated every year. Data are regularly shared with NatureServe.

NatureServe updates national ranks on their own schedule, typically on the order of 15-20 years (the Species Accounts section of the SGCNs chapter includes the date of each SGCN's most recent N-rank update). Species may be added to or removed from the Utah SGCN list as a result of these updates to

[80] Some species are just below the current threshold for inclusion on the SGCN list. If they cross that threshold, they should be added to the list. Such a move would trigger consultation with US Fish and Wildlife Service, which administers the SWG program that funds most of the Natural Heritage Program as well as a number of other positions in UDWR.

[81] http://www.natureserve.org/conservation-tools/biotics-5 accessed March 9, 2013.

state and/or national ranks. Such changes would prompt a consultation with USFWS on the need for a major or minor revision of the WAP.

A number of our SGCNs have significant data gaps (e.g., Inadequate Understanding of Distribution or Range, Inadequate Inventory and Assessment Methods, Taxonomic Debate), which impinge on the ability to confidently assess rarity (and thus short-term trends) and threat scope. These data gaps must be filled in order to improve the accuracy and precision of status assessments, as well as to enable development of effective management actions and associated effectiveness monitoring. See the Data Gaps section of the Threats and Actions chapter for more details.

Periodic Status Assessments of Key Habitats

For all of our key habitats, the fundamental properties to be assessed are "location and condition". Adequately describing location requires mapped habitat data. Assessing condition requires a condition assessment methodology. Many habitat condition assessment methodologies exist, but most are intended for use at the site or local scale and are incapable of being used at a landscape or statewide scale.

In developing the WAP it quickly became clear that terrestrial and aquatic habitats would need to be approached in very different ways. The Introduction section of the Key Habitats chapter has more detail on these parallel processes, as does the Key Habitats Methods appendix. Matters most relevant to monitoring are discussed here.

For terrestrial habitats, several statewide spatial data sets were available to describe location. LANDFIRE was chosen because - unlike the other options - it also provided a means of describing and monitoring condition. Some of the indicators and measures selected to monitor terrestrial habitat condition were borrowed directly from the national LANDFIRE program. Other indicators relate more directly to threats than to condition per se. Some threats already have statewide spatial data sets, while others still need to have such data developed (see the Crucial Data Gaps section of the Threats and Actions chapter).

For aquatic habitats, the only applicable statewide spatial data set was the National Hydrographic Data set (NHD). Newly-digitized National Wetlands Inventory (NWI) data became available partway through developing the WAP, and that material, combined with NHD, is the data set that was used to describe location. Recommendations for condition and assessment indicators are based primarily upon methodologies developed by the Utah Geological Survey (UGS) and the Utah Division of Water Quality

(UDWQ) as initially outlined in Utah's Wetland Program Plan[82,83] and further refined in subsequent reports (e.g., Jones et al. 2014[84]).

As is the case for SGCNs, there are also some significant data gaps that interfere with assessing the status of terrestrial and aquatic key habitats. These data gaps must be filled in order to improve the accuracy and precision of status assessments, as well as to develop effective management actions and to monitor the effectiveness of those actions. See the Data Gaps section of the Threats and Actions chapter for more details.

Location and Condition of Terrestrial Habitats

Indicators

The WAP is currently using three monitoring indicators for terrestrial key habitats (others may be added by stakeholder request, or as opportunities emerge):

- Extent
- LANDFIRE Fire Regime Condition (FRC)
- Terrestrial Intactness

Unlike Extent and FRC, Terrestrial Intactness is not a property or indicator of an individual habitat's condition. Instead it is an indicator of landscape condition, integrated over multiple habitat types and also incorporating a number of threats.

Measures

The indicator Extent is measured in acres. Its main purpose is to document conservation or conversion of key habitat land cover.

The indicator Fire Regime Condition (or ecological departure) is its own metric. Low ecological departure is assumed to be best for all-species conservation. This indicator is used to measure and forecast the landscape-scale effects of active and passive management interventions, and natural processes, on a multitude of sites, over years. It is not meant to be used for individual sites or small areas.

The indicator Terrestrial Intactness has its own measure, which is a model output. The model is described briefly, below.

---

[82] Hooker, T. and J. Gardberg. 2011. Utah's Wetland Program Plan. Utah Geological Society. Available from UGS online library, http://geodata.geology.utah.gov/pages/themes.php?header=Wetlands
[83] The UWPP is also available at http://water.epa.gov/type/wetlands/upload/utah_wpp.pdf
[84] Jones, J., Menuz, D., Emerson, R., and Sempler, R. 2014 Characterizing condition in at-risk wetlands of western Utah: Phase II. Available from UGS online library, http://geodata.geology.utah.gov/pages/themes.php?header=Wetlands.

Methods

The WAP uses Hydrologic Unit Code (HUC) 8-digit landscape parcels ("watersheds") in its terrestrial condition assessments. There are nearly 70 of these watersheds in Utah. Each HUC-8 has current measurements of all its WAP indicators.

The principal data set used in terrestrial condition assessment is produced by the national LANDFIRE program. The LANDFIRE program updates its geospatial data sets every two years. US Forest Service, Bureau of Land Management, UDWR, and other WAP partners all contribute detailed project and disturbance data to the LANDFIRE updates. These updates will enable periodically recalculating Extent and Fire Regime Condition[85]. Baseline conditions for the 2015 WAP were derived from LANDFIRE version 1.2 (2012) data. For more detail on LANDFIRE methodology, see the Terrestrial Habitats section of the Key Habitats chapter and references therein.

The formula for calculating Fire Regime Condition (or "ecological departure") is:

$$100\% - \sum_{i=1}^{n} \min\{Current_i, Expected_i\}$$

The following example demonstrates how the formula is used. One of the WAP's terrestrial key habitats is named Aspen-conifer. One of Aspen-conifer's LANDFIRE biophysical (BpS) settings is named Intermountain Basins Aspen-Mixed Conifer Forest and Woodland - High Elevation (BpS code 10612). One of the HUC-8's in Utah is named Bear Lake (HUC 16010201). The Fire Regime Condition, for this BpS in this watershed, is calculated like so:

	Vegetation Age/Structural Class[86]						
	A	B	C	D	E	U	Sum
Expected % of vegetation classes	10	40	45	5	0	0	100
Current % of vegetation classes	0.1	1.2	29.8	68.9	0	0	100
Minimum[87] of Expected and Current	0.1	1.2	29.8	5.0	0	0	36.1
Fire Regime Condition ("ecological departure"): 100% - 36.1% = 63.9%							63.9

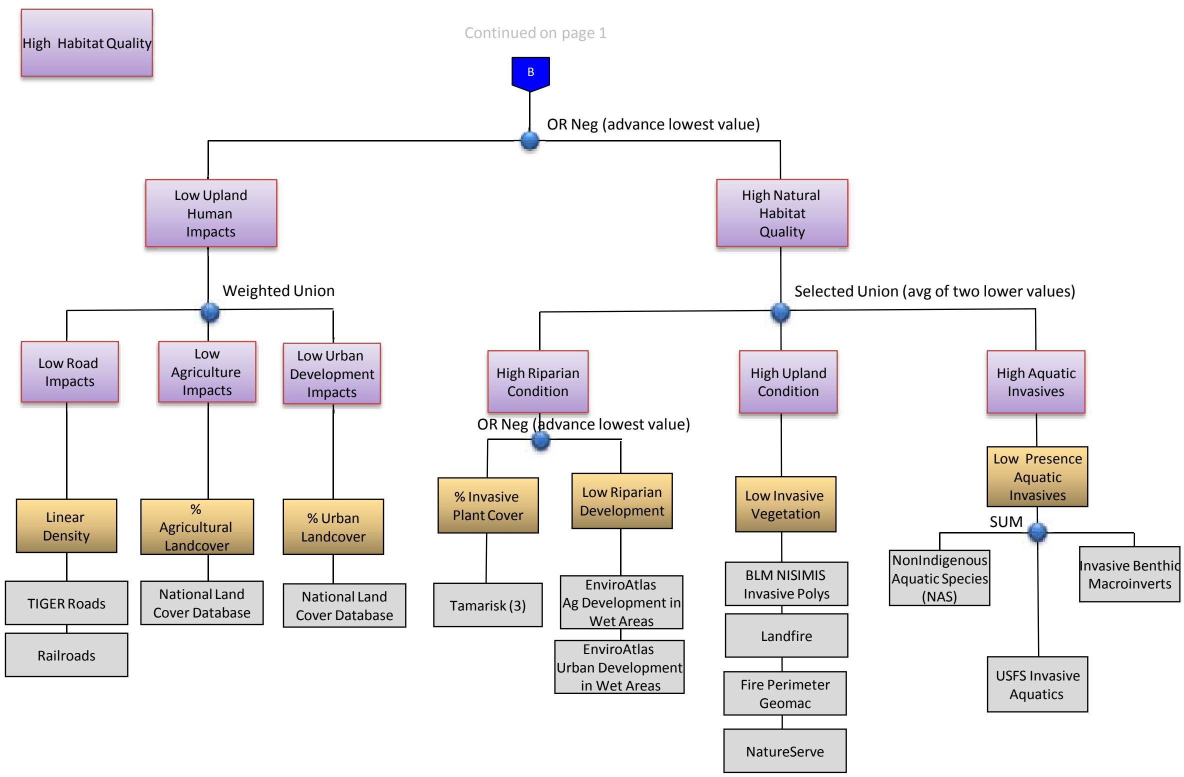
[85] Due to the large land area involved, recalculation of the LANDFIRE metrics every two years would be excessive - very little change is to be expected. Recalculating twice per decade seems more reasonable and useful.
[86] Standard LANDFIRE class coding: A = early-development; B = mid-development, closed structure; C = mid-development, open structure; D = late-development, open; E = late-development, closed; and U = uncharacteristic.
[87] Another way to say this would be "the smaller of the two values" - yellow highlight demonstrates this.

Another way of looking at this can be helpful. Comparing the difference between the expected and current values of vegetation age/structural classes A through U, observe that approximately 64% of the acreage of this habitat is "missing" from classes A, B, and C (i.e., the expected amount sums to 95%; what is currently there sums to about 31%). The same amount is "excessive" in class D (the expected amount is 5%, whereas currently about 69% of the entire BpS acreage, in this watershed, is in this single class). LANDFIRE version 1.2 maps 46,106 acres of this BpS in the Bear Lake watershed. Therefore approximately 32,000 acres are in the wrong class. Looking at the table, one can see these acres are currently all piled into in the D class, and they ought (are expected) to be in the A, C, and especially B (the single most deficient) classes. Improving the condition of this habitat in the Bear Lake watershed will require a series of large vegetation-manipulating projects, or would result from escaped wildfires.

The FRC metric will allow documentation of progress, or lack thereof, towards the overall goal of "low ecological departure", for all terrestrial key habitats, statewide. This metric can be calculated for any sizeable landscape unit (herd management unit, county, BLM Field Office, etc). The WAP chose the 8-digit HUCs.

The Terrestrial Intactness model provides estimates of current terrestrial condition based on the extent to which human activities such as agriculture, urban development, natural resource extraction, and invasive species introductions have impacted the landscape. Terrestrial intactness values will be high in areas where these impacts are low. The Terrestrial Intactness model uses a number of data sets which were created for the Bureau of Land Management's Rapid Ecoregional Assessment (REA) Stepdown Analysis using 1) the best available spatial data and 2) the open-source logic modeling framework[88] Environmental Evaluation Modeling System[89] (EEMS). Here is a portion of an EEMS Intactness model:

[88] Spatially-explicit logic modeling hierarchically integrates numerous and diverse datasets into composite layers, quantifying information in a continuous rather than binary fashion. This technique yields accessible decision-support products that state and federal agencies can use to craft scientifically-rigorous management strategies.
[89] http://consbio.org/products/tools/environmental-evaluation-modeling-system-eems, accessed March 10, 2015.



Data sets that serve as model inputs for Terrestrial Intactness are maintained and updated by several organizations including UDWR. The majority of the data sets are housed at the Utah Automated Geographic Reference Center (AGRC). Diagrams of the fuzzy logic model structure and complete lists of model input data sets are located in the REA's Data Basin[90] workspace. As of March 2015, these data sets are being integrated into a custom online tool that will facilitate assessment of intactness (terrestrial and aquatic) and predicted climate change for any user-defined area of interest.

Location and Condition of Aquatic Habitats

Indicators

In common with terrestrial habitats, the condition of aquatic habitats can be assessed and monitored at varying scales, depending on the management goals, the variables of interest, and the resources available to perform the assessments. Nationally-recognized scales of assessment are based upon EPA’s

[90] Data Basin is a science-based mapping and analysis platform that supports learning, research, and sustainable environmental stewardship. http://databasin.org/

"three-tier framework" for wetland assessment (EPA 2006[91]), and are graded by scope of inquiry and intensity of field effort (which can be considered a surrogate for cost).

- Level I refers to a landscape-scale assessment using GIS and remote sensing tools to map, describe, and analyze watershed condition. Stressors such as road density, fire regime, water diversions, etc. are characterized by type and intensity, and summarized by the degree to which they affect wetland condition. Level I analysis is typically utilized to target watersheds for restoration, and help prioritize areas for more intensive levels of assessment (i.e. Level II).

- Level II is considered a rapid wetland assessment to evaluate the condition of specific wetlands using field techniques that are relatively simple to implement. These techniques include site-level characterization of stressors, as well as metrics representative of hydrologic and vegetative condition. Level II assessment also helps guide restoration activities and prioritizes areas for Level III assessment and effectiveness monitoring.

- Level III is intensive site assessment which monitors extensive quantitative indices of biological integrity and hydrogeomorphic function to diagnose causes of wetland degradation (EPA 2006).

Both Level I and Level II data can be used to determine the extent to which on-site conditions can be predicted by landscape data. Level III data are generally used to refine and validate Level I and II methods, though to some extent calibration can occur among all three levels. Intensive Level III data can be used to determine the degree to which rapid-assessment scores are reflected in more detailed measures of wetland condition.

Currently, there are two Level I aquatic-focused landscape assessments slated for completion in 2015:

- the Bureau of Land Management Rapid Ecoregional Assessment (REA) for the Colorado Plateau
- the Utah Geological Survey (UGS) landscape integrity model

UGS has developed a level II wetland assessment tool, the Utah Rapid Assessment Procedure[92] (URAP), that has been used in several watersheds in the state and has been validated with plant community composition data. UGS has also been working on developing Level III metrics, with a particular focus on indices developed from plant community composition data. UGS plans to continue to refine Level I, II, and III methods over at least the next two to four years as more data become available for calibration and validation. Additional Level III metrics, particularly indices related to habitat quality for target groups of species, would be a benefit to UDWR to verify that the Level II assessment protocol is adequately capturing habitat condition as it relates to wildlife species.

[91] U.S. Environmental Protection Agency. 2006. Application of Elements of a State Water Monitoring and Assessment Program For Wetlands. http://water.epa.gov/type/wetlands/assessment/index.cfm accessed March 9, 2015.

[92] Menuz, D., J. Jones, and R. Sempler. 2014. Utah rapid assessment procedure: method for evaluating ecological integrity in Utah wetlands: User's Manual, Version 1.0- Draft. Utah Geological Survey.

There is a tremendous amount of exciting, constructive work occurring at present in Utah, among a diversity of water quality and wetlands stakeholders including UDWR. This ongoing work (some of it mentioned in more detail below) includes the development and adoption of indicators of aquatic habitat condition. These nascent indicators incorporate physical, chemical, and biological aspects of habitat structure and function, and some of them will be adopted for use in WAP status assessment and effectiveness monitoring.

For now though, the WAP is using the following monitoring indicators for location and condition of aquatic key habitats[93]:

- Extent
- Aquatic Intactness

Unlike Extent, Aquatic Intactness is not a property or indicator of an individual habitat's condition. Instead it is an indicator of landscape condition, integrated over multiple habitat types and also incorporating a number of threats. These threats include ones mainly sited in the terrestrial realm, whose effects are transmitted into the aquatic realm.

Measures

The indicator Extent is measured in acres. Its main purpose is to document conservation or conversion of key habitat land cover. The acreage of key aquatic habitats will be estimated from the most current NWI and NHD data available. As of February 2015, much of the NWI data set available for the state is significantly outdated. However, UGS has a wetland mapping program seeking to create updated NWI data in project areas as funding becomes available.

Two separate measures of Aquatic Intactness are being developed by WAP partners, in complementary projects. First, the Bureau of Land Management's Rapid Ecoregional Assessment (REA) for the Colorado Plateau and State of Utah is a landscape-integrity modeling project slated for completion in 2015 (Bryce et al. 2012). The REA project uses multiple data sets (road density, resource development metrics, invasive / detrimental species occurrence data, climate data and projections, fire history, sensitive species distribution, presence of dams and diversions, water quality, etc.) to characterize stressors and changes imposed on the landscape, all summarized to the 12-digit HUC scale. Second, UGS is creating a high resolution[94] landscape model focused specifically on stressors to wetlands using similar inputs as the REA project. In the UGS model, the effect of different stressors (i.e., roads, mines, etc.) are modeled with distance-decay functions - stressor effects are highest at the stressor's precise location, and decrease with increasing distance from the stressor. Users will be able to summarize model outputs at a variety of scales - NHD+ catchments, HUC watersheds, or many others. The UGS model is slated for completion at the end of June 2015. Both models equate to an EPA Level I wetland assessment.

[93] As with terrestrial key habitats, additional indicators may be added by stakeholder request, or as opportunities emerge. Aquatic habitat condition assessment methodology is in a state of rapid, positive change.
[94] Possibly at the 100-m pixel scale. Undecided as of February 2015.

Both the indicators and their measures for the location and condition of aquatic habitats will likely be refined or augmented, by combining NWI and NHD data with new data from an ongoing Utah riparian mapping project (Wheaton 2014). This riparian mapping effort, led by USU and BLM in partnership with UDWR, ESMF, and UGS, is 1) using digital elevation models to delineate both extant and potential riparian areas, and 2) assigning stressor scores to sites based on departure values (derived similar to the LANDFIRE methodology described above) and recovery potential of riparian areas. Besides utility for monitoring, this project holds great potential for improving the restoration and stewardship of riparian habitat values in Utah.

Methods

Our aspirations for aquatic habitat mapping and condition assessment are based primarily upon methodologies developed by UGS and UDWQ, as outlined in Utah's Wetland Program Plan (UWPP) and further refined in supporting documents (Hooker and Gardberg 2011; Emerson and Menuz 2014; Menuz, Jones, and Sempler 2014).

All methodologies are subject to revision and modification, as needed to meet the fluid, partially-overlapping needs of both UWPP and WAP partners. The Aquatic Habitat Subcommittee of the 2015 Wildlife Action Plan Revision Joint Team, or a portion thereof, will be retained to collaborate with UWPP partners to help finalize the methodology, and prioritize the implementation of aquatic habitat condition assessment and monitoring within Utah.

Extent can currently be calculated from existing NWI data, though results in many areas would be inaccurate due to changes in wetland areas since mapping was originally done. Calculations from NWI should at least provide a rough approximation of the distribution and abundance of different aquatic habitats. Three potential future projects may improve our ability to estimate extent, including:

1. Combining newly mapped riparian data with NWI data to better determine habitat extent.
2. Supporting projects undertaken by UGS and others to map the current extent of wetlands to NWI standards, focusing on areas with the greatest change, the greatest threats, and/or with sensitive resources.
3. Exploring the best methods to measure the change in extent of aquatic habitats. There is too much variability in the NWI mapping process to compare previously mapped wetlands with newly mapped wetlands, but other possibilities for measure change should be explored.

Aquatic Intactness models developed by REA and UGS will both result in a geospatial layer with a continuous measure of stress that can then be classified, e.g., "no stress", "low stress", etc. Applying both models to the best available extent data should be the first step to determining aquatic habitat condition. These models will need to continue to be refined to improve their utility in monitoring aquatic habitat condition. Since the REA model generalizes to the 12-digit HUC scale, it will not be able to distinguish differences in stress between e.g., valley and mountain area with the same watershed. Since the UGS model relies on accuracy of input data due to its higher resolution, there will be constraints on what data sets will be appropriate for use in the models. Last, a shared challenge of both models is that water use and water control data are not summarized in easy to use forms[95]. For example, surface water-use point data may be better summarized as water withdrawals per unit flow or in some other manner to distinguish the relative amount of water being used. Fortunately, outputs of both models will include intermediate modeling steps so that variables can be combined in different ways or different weights to better serve modeling purposes. The following future efforts would improve our ability to assess and monitor Aquatic Intactness:

- Improve data inputs for Aquatic Intactness models by, for example, digitizing important features (e.g., area of disturbance associated with mines), calculating better predictor variables (e.g., surface water use adjusted by stream flow), or connecting important features (e.g., dams, major point source dischargers) to networks so that their total impact can be better modeled (e.g., total upstream water regulation, total upstream public treatment plant discharge).

- Encourage collection of Level II and Level III data by UGS to provide data to be used to calibrate and validate Aquatic Intactness models.

- Support development of additional Level III metrics (e.g., Presence of Indicator Species, Richness of Riparian Bird Species) to calibrate Aquatic Intactness models and determine the degree to which the model is able to capture habitat condition in the field.

There are numerous ongoing activities, undertaken by UDWR and many partners and stakeholders, which already do, or with better coordination could, contribute to periodic status assessments of terrestrial and aquatic habitat. These ongoing activities, which vary in the degree to which they are presently coordinated or integrated with WAP implementation, include:

- Extensive, low-resolution efforts such as Bureau of Land Management's rangeland inventory, monitoring, and evaluation program, and the National Wetlands Inventory.
- Intermediate-scope and -resolution efforts such as UDWR's Range Trend program and Utah Division of Water Quality's water quality monitoring program.
- Intensive, restricted-scope, high-resolution efforts such as National Park Service's riparian monitoring program.

Periodic Status Assessments of Threats

The status of the threats impacting conservation targets need to be measured periodically for several important reasons. Threats are:

- an integral component of the five-factor analysis that FWS uses to make its decisions about threatened and endangered species listing and recovery

[95] There is broad awareness of this deficiency, and there are ongoing attempts to correct it. For example, see the Water Management Data Model (WaM-DaM), http://ci-water.org/water_modeling/presentations/WaM-DaM_UWUG.pdf accessed February 19, 2015.

- one of three factor categories used in the NatureServe Rank Calculator, which is how this Plan proposes to periodically determine SGCN performance and conservation status
- an integral part of the WAP's habitat condition assessments
- what we seek to prevent or reduce with our conservation management interventions

The fundamental property to be assessed for threats is threat impact. The earlier section of this chapter, Periodic Status Assessments of SGCNs, has more detail on the target-by-target scale of inquiry, and how impact is calculated. This section, however, is concerned with "rolling up" threats in order to characterize their impact across the state, and across the entire suite of SGCNs and key habitats.

Indicators

An evaluation of the statewide scope, severity, timing, and reversibility of every standardized threat for every target resulted in the statewide threat assessment. This assessment's data set was then subjected to a prioritization scheme. The prioritization scheme used a screening and averaging algorithm to yield a set of priority threats at Threat Levels 2 and 3. Each priority threat has a defined, categorized degree of impact (Very High, High, or Medium) to a quantified set of targets. An example from the Threats and Actions chapter helps to demonstrate the sole indicator for the statewide status of threats:

- Level 3[96] Impact Category.:

Table T13. Results of Threat Assessment of Priority Level-2 Threat, Habitat Shifting and Alteration

Level 3 Threat - Increasing Stream Temperatures	Threat Impact (Scope x Severity)			
	Very High	High	Medium	Grand Total
Amphibians			**1**	**1**
Relict Leopard Frog			1	1
Fishes	**4**	**3**	**9**	**16**
Bluehead Sucker			1	1
Bonneville Cutthroat Trout		1		1
Bonytail			1	1
Colorado Pikeminnow			1	1
Colorado River Cutthroat Trout		1		1
Desert Sucker	1			1
Flannelmouth Sucker			1	1
Humpback Chub			1	1
June Sucker			1	1
Razorback Sucker			1	1
Roundtail Chub			1	1
Southern Leatherside Chub			1	1
Virgin Chub	1			1
Virgin Spinedace	1			1
Woundfin	1			1

96 A few priority threats were only defined at Level 2. In those cases, the indicator is its Level 2 impact category.

Yellowstone Cutthroat Trout		1		1
Grand Total	**4**	**3**	**10**	**17**

Measures

The sole measure for the indicator Impact Category is the number of targets impacted, in each category and in total, by each priority threat. In the example above, the impact categories are Very High, High, and Medium, and the numbers of impacted targets are VH-4, H-3, M-10, total-17.

Methods

It should be clear that in order to accurately measure the scope (and thus derive the impact) of a threat, it is necessary to have accurate, current distribution maps of both the target and the threat. Many existing spatial data sets for threats serve as model inputs for Terrestrial and Aquatic Intactness. These existing data sets are maintained and updated by several organizations including UDWR. Some data sets are housed on UDWR or other WAP partners' servers, but many are housed at the *Utah Automated Geographic Reference Center (AGRC), which makes them available to the public*[97]. Comparing current and older versions of these spatial data sets will enable UDWR and partners to track changes in the distribution of targets and threats, and thus judge the implementation and effectiveness of the WAP. As the previous section illustrates, the realm of spatial data sets for both threats and targets is one of constant change and improvement.

However, as is the case for SGCNs and key habitats, there are also some significant data gaps that interfere with assessing the status (scope and severity) of certain threats. These data gaps – most often, the absence of an initial baseline – must be filled in order to improve the accuracy and precision of our periodic status assessments. In some cases, such data gaps are due to existing data not yet having been developed into spatial data sets. In other cases, the raw data have yet to be collected, or they only exist for limited areas and are unsuitable for statewide use. In the absence of appropriate data, we will continue to rely on the best judgment of subject matter experts. See the Data Gaps section of the Threats and Actions chapter for more details.

Periodic Status Assessments of Data Gaps

The status of the data gaps impinging upon the management of conservation targets also need to be measured periodically for several important reasons. Fundamentally, data gaps can pose severe impediments to vital conservation, sometimes to the degree that nothing useful can be done until the data gap is filled. On the other hand, data gaps can also cause undue concern for cryptic or unstudied species that are, in reality, secure. These are the extremes on a continuum. Unfortunately, discerning

[97] Some WAP partner agencies, including UDWR, make some spatial data sets available to the public via their own web sites.

where reality falls on this continuum, in any given situation, cannot be clarified without some cost and effort.

Data gaps impede status assessment and effectiveness monitoring in the following general ways:

- obscuring the true abundance and/or distribution of SGCNs
- obscuring the true location and/or condition of key habitats
- obscuring the true scope and/or severity (thus impact) of threats
- obscuring the actual need for, and/or the effectiveness of, conservation actions

The fundamental property to be assessed for data gaps is, "Do they still exist?" As in the previous section on threats, the concern here is with "rolling up" data gaps in order to characterize their statewide status across the entire suite of SGCNs and key habitats, and the threats thought to be impacting them.

Indicators

There is still a lot to learn about most conservation targets, but not all of the data gaps prevent action, and not all data gaps are *crucial*. This is an important distinction, which needs to be taken into account in applying the following two indicators of progress towards filling data gaps.

- The number of crucial data gaps remaining.
- The types of questions those crucial data gaps represent.

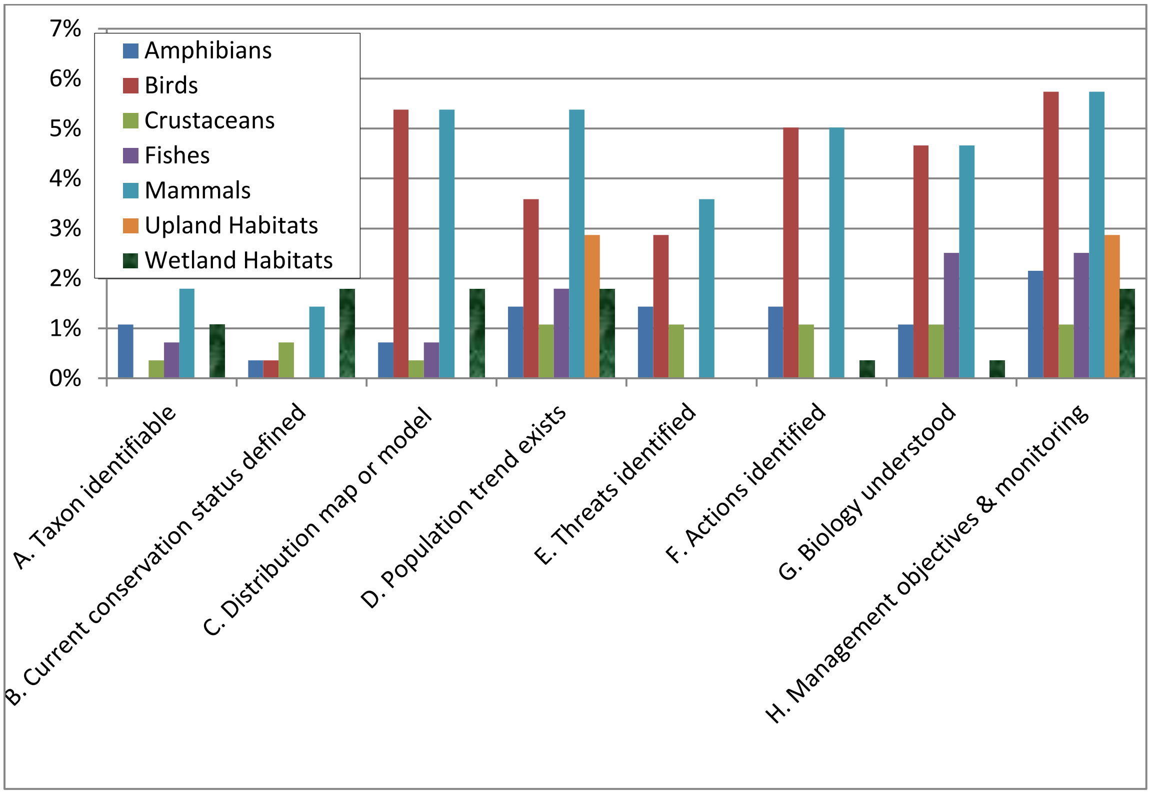
Measures

Measures for these two indicators are embodied in the indicators themselves. See below (methods section and Figure DG1) for further discussion.

Methods

WAP implementation partners will need to consider the whole set of data gaps comprehensively. Strengths and capacities vary among partners, and the fullest understanding of actual needs and priorities will come from maximum collaboration. In any scheme for filling data gaps, there is an implicit “order of operations” for many steps in the information needed to effectively conserve WAP targets. Yet some information needs can be met concurrently with the abatement of known threats. The work to resolve data gaps will also need to be staged over time to make the most efficient use of resources, or pulsed to make use of sporadic or otherwise unpredictable funding sources. Having data gaps identified and prioritized will allow for productive and strategically-beneficial use of opportunistic funding or other resources.

Figure DG1. Summarized state of conservation knowledge. Plotted values are the relative amount (%) of “no” answers to the eight essential knowledge questions. The numbers of conservation targets in each target category (amphibians, birds, etc.) considered deficient in one or more essential knowledge areas are shown, standardized to the total of all conservation targets. For example, there are 3 SGCN amphibians for which taxonomic uncertainty impedes conservation progress, which represents roughly 1% of the total information needs for all SGCNs and key habitats.



There are potential efficiencies of scale to be realized by organizing and tackling data gaps by such themes as:

- their stakeholders and/or partners (e.g., consult all known springsnail taxonomists)
- their place in the logical order of operations (e.g., identify taxon before identifying actions; see column labels in Figure DG1)
- their essential knowledge question (e.g., conduct genetic testing or distribution modeling in batches; see column labels in Figure DG1)

These concepts may be best addressed by an implementation team (also see the Partnerships and Implementation Mechanisms chapter) with the means and motivation to address data gaps, but this knowledge summary establishes a baseline.

Measuring the Effectiveness of Conservation Actions

Verifying and Tracking WAP Implementation

Before the effectiveness of actions can be determined, it is necessary to first document that the actions were actually taken as intended and designed. There are several reasons for this, including:

- If an action has not been taken, then looking for a resulting effect might be a waste of resources.
- On the other hand, if no action has been taken, but an effect that would be expected to result from that action is still observed, further investigation would be warranted. Specifically, the "problem - action - effect - solution" results chain might need to be refined.
- If some action other than the intended action has been taken, then making inference to the efficacy of the untaken, intended action would be spurious.
- Time lags between actions and outcomes are very common. Tracking outcomes, but not actions, is likely to result in negatively-biased perceptions of conservation effectiveness.

Actions taken to address certain threats and data gaps, and for most routine status assessment work, are relatively easy to track. Reporting systems exist for key UDWR and DNR implementation programs (e.g., see ESMF and SWG accounts in the Partnerships and Implementation Mechanisms chapter). In addition, all WAP partners and stakeholders already have a powerful tool for tracking implementation of many projects undertaken to reduce threats – the Watershed Restoration Initiative (WRI) online project database[98]. This database is currently (March 2015) being revamped, and its WAP-implementation tracking and reporting functionality is being significantly enhanced. Finally, many partners doing their own monitoring and threat abatement have in-house project tracking and accounting systems.

<u>Indicators</u>

- Projects which address WAP priority threats or crucial data gaps.
- Programs conducting periodic status assessments of SGCNs, key habitats, and priority threats.

<u>Measures</u>

- Numbers of projects completed.
- Expenditures on such projects.
- Number of partners submitting implementation data formatted to standard threats and actions, and to our status-assessment indicators.
- Quantity of data submitted.

<u>Methods</u>

By adopting the standardized naming system for threats and actions, and reporting their efforts via the online WRI project database, any current or future WAP partner can contribute to the efforts to monitor some aspects of WAP implementation – mainly, on-the-ground direct actions.

However, relying solely on indicators and measures related to completed projects and expended funds as indicators and measures of implementation might be inadequate and problematic. As described in the Threats and Actions chapter, some of the highest-impact threats to Utah species and habitats are especially challenging to address. A number of factors contribute to this, e.g., there may be questions or

[98] http://wri.utah.gov/WRI/ accessed February 16, 2015.
This database is used to track on-the-ground work, as well as supporting actions (e.g., archaeological surveys) plus pre-and post-project research and monitoring.

confusion surrounding legal authority to take action, there are always conflicting resource demands, and there are often strongly-influential factors which are outside the purview of conservation organizations.

Taking effective action against such complex, challenging threats will require cooperation among the agencies and organizations that are the administrators and stakeholders of those threats. Those actions currently listed in the WAP, for which UDWR lacks full capacity and authority to undertake, have been presented as starting points in an inclusive discussion, not as requirements or decisions that have already been made. To not be cooperative and inclusive is, in effect, deciding that the most-challenging, highest-impact threats *are not going to be addressed*. The statewide, all-targets threat assessment demonstrates that failing to address such threats to wildlife would likely lead to numerous ESA listings, a disastrous outcome for Utahns and an abdication of many WAP stakeholders' public responsibilities.

This raises some interesting difficulties for traditional natural resource professionals. Besides the indicators of *natural resource outcomes* described elsewhere in this chapter, it could be beneficial to note indicators that assess and can improve joint performance navigating *social processes* such as facilitating meetings, involving stakeholders in planning and decision-making, optimizing communication among stakeholders, and two-way learning. Sound results come from sound processes. What are the indicators and measures of sound social (or *stakeholder*) processes?

As of 2015, UDWR would be challenged to establish or conduct such social-processes monitoring. However, with increasing desire to improve workforce skills in collaborative management, it is possible that UDWR will engage some social-science experts to help the Joint Team and other wildlife stakeholders design and deploy a social processes monitoring program. Such a program would have its own indicators, measures, and methods.

Measuring and Verifying Overall WAP Effectiveness

Despite the paradox noted above, WAP partners still need some way to determine whether or not they are being effective[99]. Effectiveness is ultimately defined as meeting the stated purpose of the WAP: *The purpose of Utah's 2015 Wildlife Action Plan is to manage native wildlife species and their habitats to help prevent listings under the Endangered Species Act.*

The target status indicators help detect degraded or precarious wildlife populations and habitats that are often precursors to ESA listings. Measures for all of those indicators have already been obtained, such that, in 2015 all chosen target status indicators have baseline values. If filling the crucial data gaps and taking action to address the priority threats succeed, then those successes will be reflected in future measurements of the chosen indicators. It will be evident that the status of targets has improved and that degraded or precarious wildlife populations and habitats have been restored and conserved. This is the conceptual model for preventing ESA listings and resulting negative impacts to Utah. This is how overall WAP effectiveness should be measured, verified, and judged.

[99] For example, see the 2006 Legislative audit of ESMF: http://le.utah.gov/audit/06_08rpt.pdf. The 2015 WAP indicators for SGCNs provide a means of "prioritization of sensitive species by various risk factors" and also "measurable species recovery criteria", which are 2 of the 3 recommendations made to DNR in the audit.

Chapter Introduction

Although UDWR is the lead agency for Utah's Wildlife Action Plan, the WAP is not a single-agency strategy. UDWR does not bear the sole responsibility or authority for its implementation. Ultimately, success in preserving and managing Utah's fish, wildlife, and habitats depends on many organizations working together across borders and territories. There must be a spirit of collaboration and support, acknowledging the differences in individual strengths, passions, and perspectives. Organizational missions may vary, but all WAP stakeholders represent legitimate interests.

Before going on, it bears noting that:

- The WAP is not meant to duplicate or circumvent anyone's efforts or authorities. All other public-resource plans that have gone through a legitimate process[100] of development and approval will be respected. Where contradictions arise, established procedures will be employed to come to agreement or determine priority.
- The WAP is not a regulatory document or a decision document. Such compulsory documents take legal precedence over a voluntary one such as this. However, voluntary efforts have their place in government and society, and enjoy some advantages over compulsory efforts.
- Representatives from many partner and stakeholder organizations participated in the preparation of the WAP. Unless directed otherwise by their governing boards or executives, those parties will consider the WAP to be voluntary guidance as they pursue their own interests and follow their own requirements.
- Many more stakeholder organizations did not participate in preparing the WAP. We will seek them out, request their help, and offer them roles in implementing the WAP.
- The WAP is intended to facilitate cooperation with adjacent states, as well as local and regional conservation organizations, to achieve range-wide species and habitat conservation.

To effectively focus conservation efforts in Utah, UDWR will work with traditional partners who manage lands and waters in Utah and who administer programs with significant conservation effects. It would be preferable to work with those willing to help develop and implement proposals for abating priority threats and filling data gaps, and to improve the focus and effectiveness of ongoing projects. To develop broad support, it will be necessary to join or initiate working groups to help identify specific actions and potential partners to accomplish these tasks. These working groups will focus on prescribing actions that require coordination and collaboration with other agencies, organizations, and private landowners. The WAP offers a framework for organizing such actions at a variety of scales, around objectives, indicators, conservation actions, and authorities and other stakeholders. Most of the species identified as at-risk in the WAP will only be secured by tackling tough issues embodied in such topics as the management of water, invasive species, and fire and fuels. These issues are largely beyond UDWR's statutory authority and will require working with other authorities and stakeholders to prevent further species declines and possible ESA listings.

[100] as defined by the legal codes and administrative rules under which they are authorized and by which they are evaluated

The goal of this chapter is to describe and suggest the core requirements for collaboratively implementing the WAP. The chapter is arranged in these sections:

- Partnering and Coordination in Planning
- Program Support Systems
- Implementation Mechanisms

Collaborative Planning and Implementation

Organizing Collaborative Work by Sectors

One potentially useful way to organize WAP implementation around tough, complicated issues is by "sector". Sectors:

- are a way to organize thoughts and actions - there are no set rules for how they should be defined, and they can have some overlap in the boundaries between them
- have at least one authority-bearing agency, board, or commission in state government
- may have one or more authority-bearing agencies, boards, or commissions in federal and/or local government
- have at least one strategic or long-term directional plan, with "priority themes" (e.g., data sharing, economic development, water supply, etc.), and associated goals and actions
- may have many shorter-term management plans, and associated goals and actions
- have a community of stakeholders with shared areas of interest (though their specific desires may be common, competing, or conflicting)
- intersect in some way with wildlife management

One way sectors can be related to the WAP is via the Threats and Actions chapter. If some potential sectors were conceived, then the priority threats could be associated with one or more sectors and relevant plans. In this way likely authorities and stakeholders who need to be gathered, consulted, or informed can be assembled to develop the final WAP objectives and conservation actions. Some potential sectors include:

- Academic and Citizen Science
- Agriculture
- Consumptive and Recreational Uses
- Energy
- Fire and Fuels
- Local Planning
- Transportation
- Water Management

This list of potential sectors is not meant to be all-inclusive or exclusive. There are big, complicated threats that one agency or organization cannot address alone. Additional multi-stakeholder engagement could yield mutual benefits for all the parties.

The following tables attempt to group authorities, likely stakeholders, relevant strategic plans, and WAP priority threats and data gaps, into potential sectors. The tables are not meant to be read straight across, row-by-row. Instead, each column is a grouping that relates to the other columns to varying degrees, but enough to be lumped into a potential sector.

Potential Sector - Academic and Citizen Science

Crucial Data Gaps of Wildlife and Habitats	Some Relevant Strategic Plans and Policies	Some Authorities and Likely Stakeholders
Inadequate Understanding of Distribution or Range	Utah Wildlife Action Plan	Cooperative Research Unit Program
Inadequate Inventory and Assessment Methods	Utah's Wetland Program Plan	Utah Geological Survey
Inadequate Understanding of Ecology and Life History		Federal Natural Resource Management Agencies
Taxonomic Debate		Universities
Abiotic Conditions and Processes		State Fish and Wildlife Agencies
Climate Change		State Environmental Health Agencies
Inadequate Restoration Tools or Methods		Science-oriented Non-governmental Organizations

Potential Sector - Agriculture

Priority Threats to Wildlife and Habitats	Some Relevant Strategic Plans and Policies	Some Authorities and Likely Stakeholders
Droughts	President's Climate Adaptation Strategy	Utah Department of Agriculture and Food
Invasive Plant Species - Non-native	President's Pollinator Strategy	Cooperative Weed Management Areas

Improper Grazing	2012-2014 Utah Integrated Report	Natural Resources Conservation Service
Water Allocation Policies	Utah's Nutrient Strategy	Bureau of Land Management
Agricultural / Municipal / Industrial Water Usage	Utah NRCS Emergency Watershed Protection Program Plan	US Forest Service
Problematic Animal Species - Native	NRCS Working Lands For Wildlife - Southwestern Willow Flycatcher Project	Utah Farm Bureau Federation
Sediment Transport Imbalance		

Potential Sector - Consumptive and Recreational Uses

Priority Threats to Wildlife and Habitats	Some Relevant Strategic Plans and Policies	Some Authorities and Likely Stakeholders
Invasive Wildlife Species - Non-native	USFS and BLM travel management plans	Governor’s Balanced Resource Council
Inappropriate Fire Frequency and Intensity	UDWR species management plans	Utah Outdoor Recreation Advisory Group
Invasive Plant Species - Non-native		Utah Outdoor Recreation Office
Recreational Activities		Utah Outdoor Industry Association
		Utah Division of State Parks and Recreation
		Bureau of Land Management
		US Forest Service

Potential Sector - Energy

Priority Threats to Wildlife and	Some Relevant Strategic	Some Authorities and Likely

Habitats	Plans and Policies	Stakeholders
Agricultural / Municipal / Industrial Water Usage	Utah Energy Initiative	Utah Energy Advisory Committee
Increasing Stream Temperatures	Utah State Water Plan	Utah Office of Energy Development
Droughts		Utah Division of Water Resources
Water Allocation Policies		Utah Division of Water Rights

Potential Sector - Fire and Fuels

Priority Threats to Wildlife and Habitats	Some Relevant Strategic Plans and Policies	Some Authorities and Likely Stakeholders
Sediment Transport Imbalance	Governor's Catastrophic Wildfire Reduction Strategy	Utah Division of Forestry Fire and State Lands
Invasive Plant Species - Non-native	Utah Fire Action Plan	US Forest Service
Droughts	Utah NRCS Emergency Watershed Protection Program Plan	Bureau of Land Management
Inappropriate Fire Frequency and Severity	National Fish, Wildlife and Plants Climate Adaptation Strategy	Utah Permanent Community Impact Fund Board
Improper Grazing		Utah Department of Agriculture and Food
Other Ecosystem Modifications		
Increasing Stream Temperatures		

Potential Sector - Local Planning

Priority Threats to Wildlife and	Some Relevant Strategic	Some Authorities and Likely

Habitats	Plans and Policies	Stakeholders
Housing and Urban Areas	County general plans and zoning ordinances	County commissions
OHV Motorized Recreation	Municipal zoning ordinances	City councils
Roads - Transportation Network	National Fish, Wildlife and Plants Climate Adaptation Strategy	County and city planning departments
		Real estate development community
		Legislature
		Envision Utah

Potential Sector - Transportation

Priority Threats to Wildlife and Habitats	Some Relevant Strategic Plans and Policies	Some Authorities and Likely Stakeholders
Roads - Transportation Network	Utah NRCS Emergency Watershed Protection Program Plan	Utah Department of Transportation
Problematic Native Species	Statewide Transportation Improvement Program (STIP)	Counties and County Association of Governments
Housing and Urban Areas		Federal Highway Administration
Channelization / Bank Alteration		

Potential Sector - Water Management

Priority Threats to Wildlife and Habitats	Some Relevant Strategic Plans and Policies	Some Authorities and Likely Stakeholders

Presence of Dams	Governor's Water Initiative	US Bureau of Reclamation
Presence of Diversions	Utah State Water Plan	Utah Division of Water Rights
Dam/Reservoir Operation	Utah Energy Initiative	Utah Division of Water Resources
Channelization/Bank Alteration (direct, intentional)	2012-2014 Utah Integrated Report	Utah State Water Development Commission
Agricultural/Municipal/Industrial Water Usage	Utah's Nutrient Strategy	Utah Division of Water Quality
Water Allocation Policies	Utah NRCS Emergency Watershed Protection Program Plan	Utah Division of Drinking Water
Sediment Transport Imbalance	National Fish, Wildlife and Plants Climate Adaptation Strategy	Utah Drinking Water Board
		Metropolitan Water and Water Conservancy Districts
		Utah Permanent Community Impact Fund Board

Identifying Stakeholders

As noted above, every sector - no matter where the boundaries are drawn - has its community of stakeholders. "Stakeholder" is used in the WAP many times. It is an important concept that is often confused with "partners". They are not the same thing, and it is important to know the difference. This section provides WAP implementers with a few resources that can help them 1) identify who their stakeholders are, and 2) decide how and why to approach them.

Stakeholders are people who: 1) have an opinion on an issue, 2) are affected by an issue, and/or 3) can influence the outcome of an issue. They may already be, or they might become, partners. Equally possible, they may be hostile or suspicious. Regardless, they should not be ignored or excluded from WAP implementation planning or action.

Individual stakeholders can group or align themselves, or be classified, in the following ways (these are just examples, there may be others):

- subject matter
- geography
- demographics
- institutional role
- politics
- economics

The three essential questions to ask about each stakeholder (whether an individual or a group) are:

1. What do they care about?
2. How does the issue or proposal affect them?
3. What do you need from them?

Once those questions have been discussed in some detail and answered ("we don't know" is an acceptable answer - often better than making assumptions), then strategies for choosing how and when to involve stakeholders[101] can be selected based on what is needed from the stakeholders (e.g., social license, matching funding, technical expertise, authorization, leadership, etc.).

1) **Inform**. E.g., "These are the top threats to wildlife in Utah."

- To pursue this strategy with stakeholders, an important early question is, "*Where are they getting their information?*"
- Put information where people get their source. TV and radio still reach the most people. Professionally developed outreach materials can also be effective.
- An important caveat: people *almost never* get their information via agency public meetings. Therefore, it is an unreliable mode of disseminating information and is not a good use of public meetings.

2) **Consult**. E.g., "How do you think we should go about managing these threats to wildlife in Utah?"

- To pursue this strategy with stakeholders, an important early question is "*What scientific resources are available to find out a) what people think and b) what people want?*"
- Managing by anecdote or assumption is precarious. Design and conduct a good survey that will gather reliable data, analyze the results, and develop sensible decisions.

3) **Collaborate**. E.g., "Can we work together to manage these threats to wildlife in Utah?"

- To pursue this strategy with stakeholders, an important early question is "*What is our latitude, willingness, and capacity to collaborate with these people every step of the way, from group formation, to agreement that there is a threat, development of possible response actions, and eventually, identification of the preferred course of action?*"

[101] additional resources - Cornell Human Dimensions Research Unit, Colorado State University Human Dimensions in Natural Resources
also www.iap2.org and www.wildlifeplanners.org

- This is the point at which stakeholders become partners. There are many potential benefits to partnering, which is why it's so popular. But, partnering is not a low-cost or risk-free activity.
- Recognize and respect that there is self-interest in the motivation of all partners. Each one will need to see benefits from collaboration.
- Risks and costs include much slower decision-making, loss of autonomy, and situations where the interests of the partnership diverge from those of individual partners.

WAP Implementation Joint Team

UDWR began review and revision of the 2005 WAP in 2012. They solicited active participation from government and non-governmental organizations that were active on the 2005 WAP Joint Implementation Team. This "Joint Team" was formed by the merger of two formerly parallel entities: the 2005 WAP Partner Advisory Group and UDWR's WAP Internal Team.

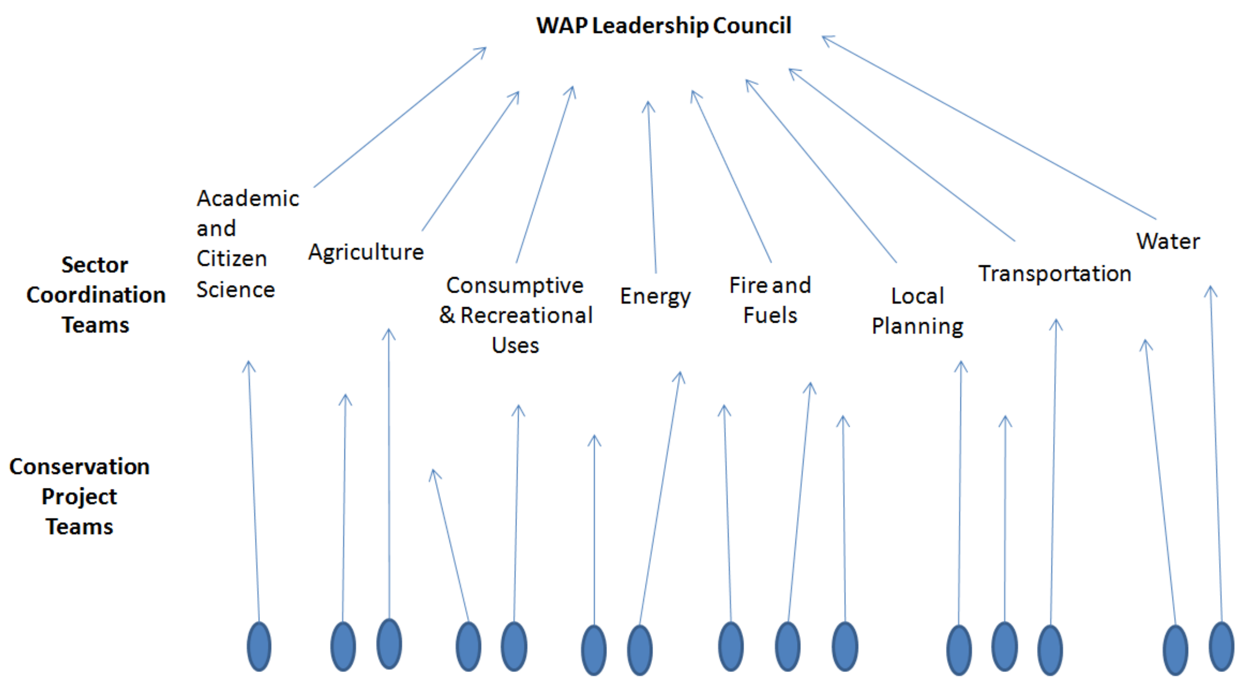
Members of the Joint Team developed the 2015 WAP by actively participating in creating new processes[102], by drafting, reviewing, and editing text, and by ensuring that the interests of their organizations and various other stakeholders have been addressed. The organizations represented on the Joint Team are strongly encouraged to incorporate the WAP into their own management and conservation plans, and to partner with stakeholders, including UDWR, in regional and local implementation throughout the state. Implementing the WAP has been, and will continue to be, the work of a willing coalition.

Various UDWR staff associated with the WAP have conducted many meetings to inform, consult, and/or collaborate with numerous partners and stakeholders across the state, throughout the implementation period of the 2005 WAP and also through the developmental period of the 2015 WAP. It is UDWR’s intent to continue these activities for the next decade in order to maintain awareness, increase participation, and stimulate implementation of the WAP.

An important task to complete in the latter half of 2015 is to create an implementation charter for the 2015 WAP. This will present the existing Joint Team an opportunity to invite the many authorities and stakeholders identified in the 2015 WAP's Threats and Actions chapter, to help create a reconstituted Joint Team whose purpose will be to steer WAP implementation. The purpose of the new charter will be to define the purpose of the team, how it will work, and what outcomes it expects to generate. This charter will provide clarity and direction to all Team members, including UDWR. Members can then transmit that direction back into their home organizations, and their various levels of planning - strategic, programmatic, and project-scale. In this way, WAP implementation can be loaded into the direction and decision apparatus of all the partners.

This is a diagram of possible functional relationships between partner leadership, the sectors, and various project teams:

[102] E.g., the SGCN designation process, the Key Habitats selection process, and the threat assessment process.



WAP Leadership Council – Administrator level, with representation from UDWR and all interested threat-management authorities and stakeholders. Responsible for ensuring the conservation approach is balanced across multiple competing stakeholder interests. Responsible for ensuring their program managers and coordinators have the resources they need, and ensuring their staffs collaborate across organizational boundaries to harmoniously address threats.

Sector Coordination Teams – Manager and coordinator level, with representation from UDWR and all interested threat-management authorities and stakeholders. Responsible for prioritizing and resourcing threat abatement actions and ensuring their implementation, within the balanced conservation approach defined by administrators. Members of the reconstituted WAP Joint Team will be encouraged to join these groups.

Conservation Project Teams – Technical level work groups, with representation from UDWR and all willing partners and interested stakeholders. Responsible for developing and completing threat abatement projects, monitoring and reporting their effectiveness, and adapting strategy if necessary. Each sector may have multiple project teams depending on need.

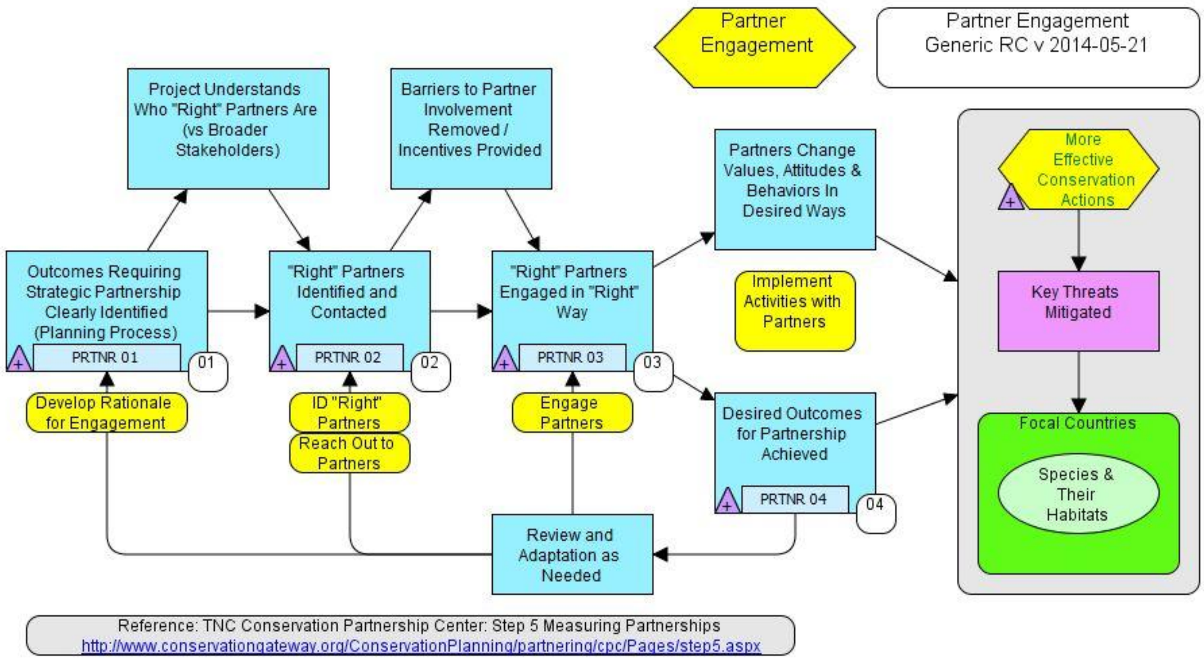
Results Chains

Results chains[103] are a useful tool for helping teams clearly specify their theory of change (the sequence of outcomes that is expected to occur) behind the actions they are implementing. Results chains help

---

[103] Margoluis, R.C. et al. 2013. Results chains: a tool for conservation action design, management, and evaluation. Ecology and Society 18(3):22.

teams clarify and make explicit their assumptions behind a proposed action or desired outcome. This clarity positions the team to develop relevant objectives and indicators, and to monitor and evaluate whether their actions are having the intended impact. This is an example of a results chain that could be used to help determine the makeup and function of a coordination or project team:



Program Support Systems

Successful delivery of a long-running series of effective conservation projects is completely dependent on maintaining healthy conservation programs. Programs conduct a variety of supporting actions that take place far from the problems on the ground. Those supporting actions are critical, but often invisible, prerequisites to effectively addressing a threat. Thus, the scope and time frame required to maintain healthy programs can be very different from the time frame required to develop and deliver specific conservation projects.

Projects require administrative support before, during, and after execution. Conservation programs create and maintain an organization's or coalition's ability to develop and execute projects. Programs cannot be neglected or dismantled, and then rebuilt on short notice. Therefore, they require sustained organizational commitment and reliable funding.

Successful implementation of the WAP will depend on all partners, including UDWR, to maintain, and in some cases increase, investments in program support systems such as marketing and development, collaborative planning, improved human and material infrastructure for monitoring and data analysis, and effective stakeholder engagement.

Implementation Mechanisms

Utah has a diversity of mechanisms that are vital to WAP implementation. These mechanisms all share the WAP's function of precluding the need for ESA listing, and provide each other some of the necessary ingredients to enable operation as a functional group. Individually, these mechanisms play various roles in enabling, coordinating, or funding conservation programs and projects. Descriptions of the most important ones follow.

Resource Development Coordinating Committee[104]

The Utah Legislature created the Resource Development Coordinating Committee (RDCC) in order to:

- Assist the state planning coordinator in fulfilling the responsibilities of reviewing and coordinating technical and policy actions that may affect the physical resources of the state.
- Facilitate the exchange of information on those actions among state agencies and other levels of government.

Federal law provides for state collaboration and participation throughout the federal project planning process. The RDCC includes representatives from state agencies, which are generally involved in public

[104] Utah Code 63J-4-501

lands management. Committee members communicate through the RDCC by submitting projects for review, and by commenting on federal, state, or local proposed actions.

State agency comments make known a project's potential for positive or adverse impacts, and provide recommendations for mitigation. When necessary, the RDCC staff coordinates and facilitates state agency comments by publishing a unified state comment. Comments may be most important in accomplishing successful outcomes. The RDCC coordinates the review of many proposed public land planning and development projects, including:

- forest health and watershed improvement plans
- wetland reviews
- use of public range resources by livestock operators and wildlife
- oil and gas and mining development
- use of public lands by off-road vehicles and other recreational opportunities

Current status of every project can be viewed through the RDCC Project Management System[105]. The WAP was submitted to RDCC for review.

State agencies represented on the RDCC include:

- Office of the Governor
- Utah Department of Natural Resources
- Utah Department of Environmental Quality
- Utah Department of Agriculture and Food
- Utah School and Institutional Trust Lands Administration
- Utah Department of Transportation
- Utah Department of Public Safety
- Utah Department of Heritage and Arts

The formal RDCC process and preliminary informal consultations are a very important mechanism for local, state, and federal projects or developments to come to the attention of DNR and UDWR. This awareness is crucial, as these projects or developments may be a substantial source of threats to wildlife or their habitats. Informing, consulting, and/or collaborating with DNR and other RDCC subject matter experts, who can suggest helpful project modifications, is a key mechanism for project proponents to avoid, minimize, and mitigate impacts which can accumulate into ESA listing threats.

[105] http://rdcc.utah.gov/plpco/public/home.action

State Species of Concern and Habitat Designation Advisory Committee[106]

The Wildlife Species of Concern and Habitat Designation Advisory Committee (Committee) also plays an important role in state wildlife management. Designation and management of species of concern is another part of Utah's capacity to preclude listings under the ESA, via effective conservation actions.

The Committee is composed of the DNR Executive Director, and the Directors of three DNR Divisions: Wildlife Resources; Oil, Gas and Mining; and Water Resources.

One purpose of the Committee is to review all proposed designations or re-designations of each wildlife species of concern, or those species for which there is credible scientific evidence to substantiate a threat to continued population viability.

By rule, wildlife species in any of the following designations automatically qualify for inclusion on the Utah Sensitive Species List Species[107,108]:

- species for which a voluntary conservation agreement is in effect
- wildlife species or subspecies listed under the ESA, and now or previously present in Utah
- wildlife species or subspecies de-listed under the ESA during the past six months that are now or were previously present in Utah
- wildlife species or subspecies now or previously present in Utah that are currently proposed by the U.S. Fish and Wildlife Service for listing under ESA
- candidate wildlife species or subspecies under the ESA now or previously present in Utah
- wildlife species or subspecies removed from the ESA candidate list during the past six months that are now or were previously present in Utah

An additional designation for the Utah Sensitive Species List, *wildlife species of concern*, is available "for those species for which there is credible scientific evidence to substantiate a threat to continued population viability". The purpose of the designation is to identify species for which conservation actions are needed, with the intent that timely and appropriate conservation actions implemented on their behalf will preclude the need to list them under the provisions of the ESA.

---

[106] Utah Administrative Rule R657-48

[107] http://dwrcdc.nr.utah.gov/ucdc/viewreports/sslist.htm accessed March 9, 2015.

[108] As of February 2015, there is a functional relationship between the SGCN list and the Sensitive Species list - with the result that most Sensitive Species are 2015 SGCNs. The greatest disparity lies in the Species of Concern. Changes are anticipated in the way species of concern are proposed by UDWR to the Committee. These changes are expected to clarify and improve the functional relationship between the SGCN and Sensitive Species lists, with the result of better meeting legislative intent to prevent ESA listings.

Regional Advisory Councils and Utah Wildlife Board Processes[109]

UDWR's Regional Advisory Councils (RACs) and Wildlife Board (Board) together are the policy arm of UDWR. As the ultimate decision-makers for matters over which the agency has sole or lead authority, they play a vital role in adapting state wildlife management to new realities.

In each of the five administrative regions within the state, a RAC exists to recommend actions and advise the Board in wildlife and habitat management decisions. Each 15-member RAC includes representatives of agriculture, sportsmen, non-consumptive wildlife, local government, U.S. Forest Service, Bureau of Land Management, Indian Tribes (where appropriate), and the public at large. The RACs gather and compile information from UDWR staff, the public, and government agencies before making recommendations to the Board.

The Board establishes policies designed to accomplish the purposes and fulfill the intent of all laws pertaining to wildlife and the preservation, protection, conservation, perpetuation, introduction, and management of wildlife in Utah. In developing wildlife policy, the Board considers the recommendations of UDWR personnel and each RAC, but may reject recommendations with written explanation. Similar to RACs, the Wildlife Board has open meetings where public comment is welcome prior to the finalization of any policy decisions. The governor-appointed Board is composed of seven members with expertise or experience in at least one of the following: 1) wildlife management or biology; 2) habitat management, including range or aquatic; 3) business, including knowledge of private land issues; or 4) economics, including knowledge of recreational wildlife uses.

The WAP was directed through these channels as it was developed. Draft versions of the document were open to review by Joint Team members, the public, stakeholders, and FWS via the Internet. RACs also reviewed the plan and heard comments from the public, before making recommendations to the Board. Before final approval, the Board, again, requested and reviewed public comments. Submission of the WAP to FWS's Regional Review Team (RRT) for formal review, critique, and potential recommendation to the National Advisory Acceptance Team (NAAT) follows consideration of the WAP by the Board on June 4, 2015.

Endangered Species Mitigation Fund[110]

The Endangered Species Mitigation Fund (ESMF) is a state grant program enabled during the general session of the 1997 State Legislature. The program is administered by the DNR. The purpose of the ESMF is to facilitate the conservation of fish and wildlife species and their habitats in greatest need of protection. An underlying motive of this purpose is to avoid, minimize, or mitigate the impacts of ESA listings on the people of Utah. The primary ESMF objective is to fund projects that:

- Protect, conserve, and recover ESA-listed or State Sensitive species.

[109] Utah Administrative Rule R657-39
[110] Utah Code 79-2-303

- Help preclude the need for listing additional species under the ESA.

ESMF is funded through a portion of a 1/16th percent sales tax on water, and also by a tax provided for in the Brine Shrimp Royalty Act[111]. Up to $3 million is available on an annual basis. Through multi-partner cooperative agreements, Utah is committed to participating in three[112] recovery implementation programs for ESA-listed and -Candidate fish species. Utah's fiscal contribution to these programs is provided through the ESMF program. Although it is not required by legislation, DNR has opted to distribute the remainder of ESMF funds through a competitive grants program.

To receive funding, grant applications must meet the legislative intent, and also be consistent with the mission and objectives of the DNR. Conservation organizations are encouraged to apply for funding on an annual basis. UDWR has competed annually for ESMF grants in order to secure the required 1:1 state matching funds to complement federal State Wildlife Grants appropriations. There is no guarantee that ESMF funding will be available in future years.

State Wildlife Grants

The State Wildlife Grants (SWG) Program provides federal grant funds for developing and implementing their WAPs. Grant funds must be used to address conservation needs such as research, surveys, species and habitat management, and monitoring, identified within a State's WAP. These funds may also be used to update, revise, or modify a State's WAP.

Congress appropriates funds for the SWG Program on an annual basis. Funds are then apportioned to States, commonwealths, and U.S. territories based on a formula. In addition, Congress has authorized funding since 2008 for a competitive SWG Program to encourage multi-partner projects that implement actions contained in WAPs.

By federal fiscal year, here are the SWG funds apportioned to Utah since the first WAP was developed:

FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15
857,526	836,578	836,578	849,971	886,192	1,096,527	693,687	696,403	694,484	696,658	669,265

As described in the ESMF section, any SWG dollar accepted by Utah must be matched with at least one state dollar. UDWR has devoted these pooled funds to develop and maintain program capacity in three

[111] Utah Code 59-23-4
[112] These are the:
1) Upper Colorado River Endangered Fish Recovery Program: http://www.gpo.gov/fdsys/pkg/PLAW-106publ392/pdf/PLAW-106publ392.pdf
2) Virgin River Resource Management and Recovery Program: http://www.virginriverprogram.org/wp-content/uploads/2011/11/VRRMRP-PROGDOC-Dec-1-01.pdf
3)June sucker Recovery Implementation Program: http://www.junesuckerrecovery.org/

of its sections: Habitat (WAP, Geographic Information Systems, and Natural Heritage programs), Aquatics (Native Aquatics program), and Wildlife (Native Wildlife program).

Most of the target inventory and periodic status assessment work required for WAP implementation will be accomplished by WAP partner staff and citizen scientists, with ESMF, SWG, and other leveraged funding from diverse sources. Most of the intensive research needs will be addressed by the academic sector, which competes for and receives funding from WAP partner agencies (e.g., DNR, UDWR, BLM, USFS, FWS, BOR, etc.) as well as diverse other sources, including private and public charities.

Utah's Watershed Restoration Initiative

Utah's Watershed Restoration Initiative (WRI) is a partnership-driven effort to conserve, restore and manage ecosystems in priority areas across the state to enhance Utah's:

- Wildlife and biological diversity
- Water quality and yield for all uses
- Opportunities for sustainable uses

The WRI is a Utah Partners for Conservation and Development (UPCD) sponsored initiative that serves as a clearinghouse to coordinate and share participants' conservation concerns and priorities, discuss and implement solutions, and promote an atmosphere of collaboration among landowners, private organizations, and state and federal agencies.

A unifying concern and priority for all UPCD partners and WRI participants is to preclude the need for ESA listings.

WRI is committed to providing novel and dynamic solutions for statewide issues of soil, water, and species health. In an unprecedented collaborative effort, WRI combines the resources of agencies and organizations with long histories of ecosystem management and restoration endeavors in Utah into a single, functional partnership. From 2005 through 2014, WRI has leveraged well over $100 million to affect the management of over 1.1 million acres. Recent years have seen approximately $12-15 million in diverse public and private funding applied to dozens of projects totaling 85,000-100,000 acres annually.

The WRI has developed three general approaches to address the risks to the shared interests of the partnership:

- Ecosystem restoration through physical manipulations such as seeding, reconstruction, vegetation management, and other means.
- Administrative changes in land management, made through permitted or allowed uses and management prescriptions.

- Communication and team building among public, stakeholders, and UWRI to promote the understanding of risks to natural resources and values, and to improve cooperation and problem solving across boundaries.

The partnership is represented at four levels of organization.

- Director's Council—Agency and organization administrators meet regularly.
- Statewide Core Teams—Each member has a representative on a state-level team that meets regularly alongside of conservation organizations to monitor the effectiveness of each group's involvement in the partnership, share information about new programs, discuss problems, and address resource-allocation needs.
- Regional Teams—Organized in each of the Utah Division of Wildlife Resources' five administrative regions, these teams consist of UPCD members, conservation organizations, and stakeholders who meet to discuss priority conservation focus areas, identify potential projects, and pool resources (funding, technical assistance, logistics support) needed to implement restoration projects.
- Local Conservation Work Groups—Identify local conservation concerns and develop strategies to meet local needs.

Of all these levels of organization, the Regional Teams fill the important role of acting as clearinghouses for conservation priorities and actions. Each team defines focus areas for their region and habitat restoration objectives for those areas. Objectives are developed collaboratively while focusing on management plans, the best available science, and outreach to targeted publics.

Each year, resource managers within the partnership propose projects to the Regional Teams. Proposals are entered into a statewide projects database and reviewed at Regional Team meetings. This approach helps the partners share information and resources, and many of the projects receive support from several partners. Three basic criteria are used to evaluate the merits of project proposals:

- How well the project proposal ties to meeting goals and objectives in plans such as the WAP, which have been approved through a public process.
- How well the project mitigates threats to land, water, and species health.
- Whether the project maximizes the return on an investment made to implement the project.

Part of the implementation vision for the 2015 WAP, is that most on-the-ground habitat work will be accomplished via projects initiated within or routed through the WRI. This will strengthen and formalize the consensus that has developed since approval and adoption of the 2005 WAP, which coincided with the formation of WRI.

Creating the Species[113] List for Utah's 2015-2025 Wildlife Action Plan

The express purpose of Utah's 2015-2025 Wildlife Action Plan (WAP) is :*To manage native wildlife species and their habitats, sufficient to prevent the need for additional listings under the Endangered Species Act*. The purpose of Utah's Species of Greatest Conservation Need (SGCN) list is to identify native wildlife species that do, or plausibly could, present the possibility of an ESA listing. The 2015 Utah WAP SGCN list was created by operating the SGCN decision process flowchart (Figures 1 and 2). The flowchart includes a left and right side species assessment. There were 916 animal candidate[114] species passed through the flowchart's left side and, if necessary, its right side to determine their inclusion on the 2015 Utah WAP SGCN list. The following describes the flowchart and the rationale behind Utah's SGCN listing process.

Left side - Biological Status Assessment

The purpose of this section of the decision process is to evaluate the potential for a native species being a candidate for Endangered Species Act (ESA) listing. Three essential questions were asked:

1) Is it legally listable?

2) Is it native to Utah?

3) What is its vulnerability to extinction?

Step 1: Listable entity (valid taxon, or Significant Portion of Range)

Since the intended outcome of the WAP is no need for additional ESA listings, if the entity under consideration is not an ESA-listable entity - neither a "real" taxon nor a listable subdivision of a taxon - then it **should not** be considered a “Utah Species of Greatest Conservation Need”.

Step 2: Native to Utah (S-Rank[115] is not SRF, SE, SZ, or SA)

Species that are not practically considered to be part of the native fauna of Utah **should not** be designated “Utah Species of Greatest Conservation Need”.

SRF = reported falsely from Utah

SE = exotic in Utah

[113] For simplicity, the term "species" is used throughout the WAP to represent any ESA-listable taxonomic entity - species, subspecies, Significant Portion of Range, Evolutionarily Significant Unit, etc.

[114] Known native animal species that occur within Utah and that are under the management authority of the Utah Division of Wildlife Resources.

[115] S-ranks and N-ranks are discussed in the SGCNs chapter of the 2015 WAP.

SZ = zero definable occurrences (not of practical conservation concern, e.g., long-distance migrants that pass through occasionally) in Utah

SA = accidental (e.g., Siberian birds occasionally seen here) in Utah

Step 3: N-Rank = N1 or N2 or N3 or "no N-rank", regardless of S-Rank

If a native species is nationally-ranked “extremely rare, rare, or at moderate risk of extinction”, then it **should** be considered a “Utah Species of Greatest Conservation Need”, regardless of state status.

N1 = extremely rare in USA

N2 = rare in USA

N3 = at moderate risk of extinction in USA

Step 4: N-Rank = N5 or NX, regardless of S-Rank, unless ID'd in step 1 as a locally- listable entity

N5 = widespread, abundant, and secure in USA

NX = extinct in USA

If a species is nationally-ranked “widespread, abundant, and secure” (and thus extremely unlikely to be ESA listed), or nationally-extinct, then it **should not** be considered a “Utah Species of Greatest Conservation Need”. The only exception would be if there is a Significant Portion of Range or other listable entity in Utah, which poses a plausible, credible listing threat.

Step 5: N-Rank = N4, and S-Rank = S4, S5, or SX

N4 = usually widespread, abundant, and secure in USA; some local or long-term concern

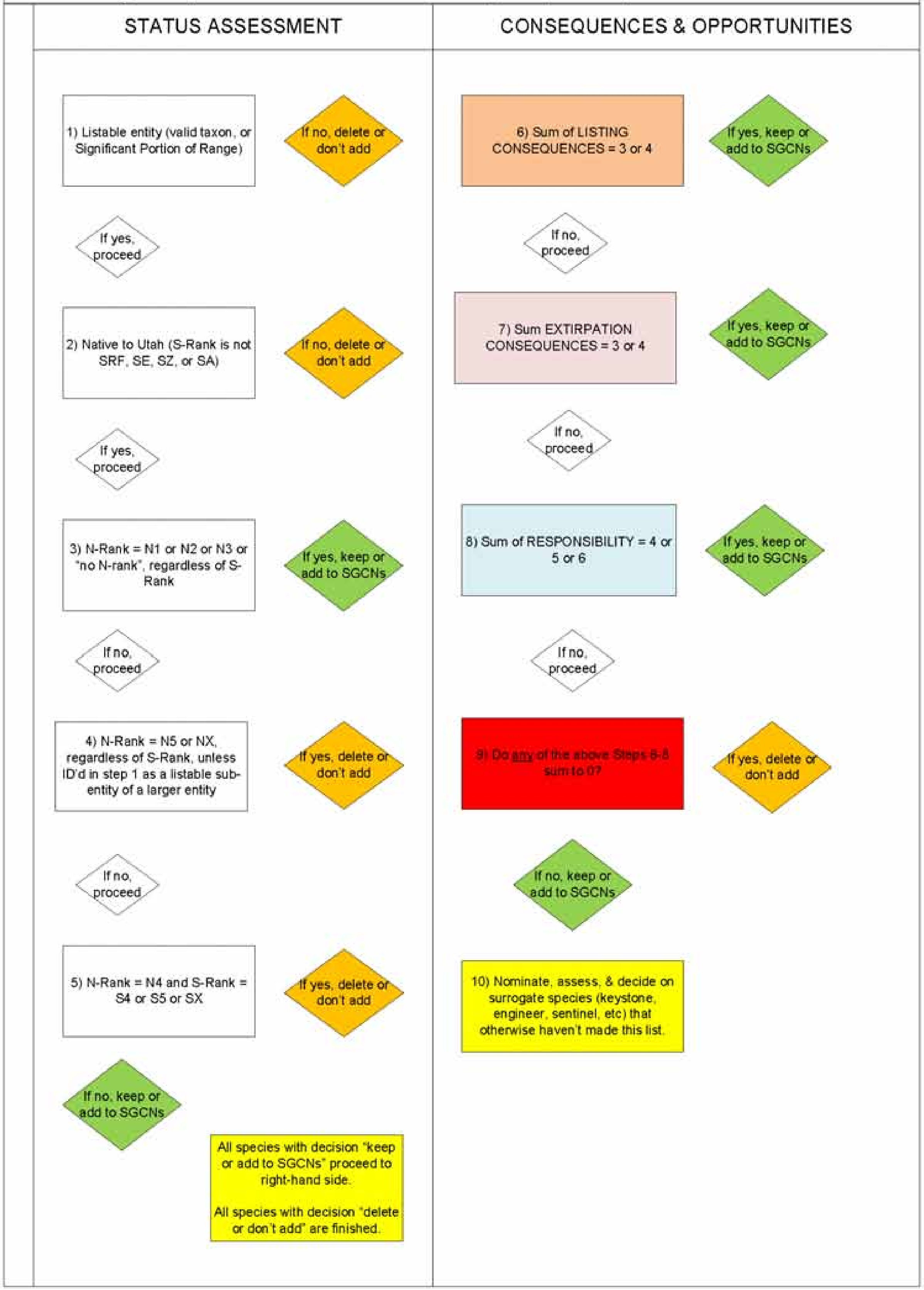
S4 = apparently secure in Utah

S5 = secure in Utah

SX =extirpated from in Utah

If a native species is nationally-ranked "usually widespread, abundant, and secure with some local or long-term concern" (N4), and also state-secure, -apparently secure, or -extirpated, then it **should not** be considered a “Utah Species of Greatest Conservation Need”. The only exception would be if there is a Significant Portion of Range in Utah, which poses a plausible, credible listing threat.

Figure 1. Species of Greatest Conservation Need (SGCN) decision process flowchart.



Right side - Consequences and Responsibility Assessment

The purpose of this section of the decision process is to evaluate two aspects of a species becoming ESA-listed or severely depleted. These aspects are 1) what might happen to Utah, and 2) what could we do about it here in Utah? To conduct the evaluation, there are essentially three questions being asked:

1) What are the socioeconomic scope and severity of listing or depletion?

2) What are the ecological scope and severity of listing or depletion?

3) Where does Utah's responsibility lie for maintaining a species viability?

There are 4 steps on the right side of the SGCN decision process flowchart which are intended to help answer these questions in a consistent manner.

- Steps 6-8 identify reasons to add a species to the SGCN list.
- Step 9 identifies reasons to exclude a species from further consideration as an SGCN.

Step 6: Sum of Listing Consequences = 3 or 4

This step considers the summed scores of two criteria that assess the scope and severity of socioeconomic impacts to Utah of a species future or current Endangered Species Act listing. The range of possible values here is 0-4.

If the existing or potential negative socioeconomic consequences of an ESA listing are in the upper half of the possible range, then that species should be considered a provisional "Utah Species of Greatest Conservation Need", subject to the results of Step 9.

Step 7: Sum of Extirpation Consequences = 3 or 4

This step considers the summed scores of two criteria that assess the scope and severity of ecological impacts to Utah of a species future or current severe decline or extirpation. The range of possible values here is 0-4.

If the existing or potential negative ecological consequences of a severe decline in Utah, or an extirpation from Utah, are in the upper half of the possible range, then that species should be considered a provisional "Utah Species of Greatest Conservation Need", subject to the results of Step 9.

Step 8: Sum of Responsibility = 4, 5, or 6

This step considers the summed scores of three criteria that assess the degree of responsibility that Utah holds for a species viability. The three criteria consider how much of a role Utah plays in a species abundance, range, and annual life cycle. The range of possible values here is 0-6.

If Utah's responsibility for a species' viability falls in the upper half of the possible range, then that species should be considered a provisional "Utah Species of Greatest Conservation Need", subject to the results of Step 9.

Step 9: Sum of Listing Consequences, Extirpation Consequences, or Responsibility = 0

This step revisits the scores given to a "provisional SGCN" for each of the previous three steps. Consider the following possibilities:

1) Step 6 - Sum of Listing Consequences = 0.

2) Step 7 - Sum of Extirpation Consequences = 0.

3) Step 8 - Sum of Responsibility = 0.

- If any of these three criteria are met, the "provisional SGCN" species will not be added to the final SGCN list.

Step 10: Nominate, assess, and decide on surrogate species

This final step is a chance to correct any glaring oversights or mistakes which are likely to undermine the role of the SGCN list in achieving the purpose of the Wildlife Action Plan. If there are any ecosystem engineers, keystone or other vital surrogate species that have been overlooked so far, then that species should here be named a "Utah Species of Greatest Conservation Need".

Results

By passing the 916 animal candidate[116] species through the flowchart, the following results were obtained:

- 147 species were retained for consideration after passing through the left side; 769 species were not.
- Another 23 species were dropped after passing through the right side.
- The initial SGCN list consisted of 124 taxa.
- 18 species (Table 1) were deemed to have been incorrectly dropped or that meaningful considerations were not fully accounted for by the left hand side of the flowchart (e.g., subspecies issues, isolated populations for which Utah may have stewardship responsibility, etc.). All 18 species successfully passed through the right side of the flowchart.

[116] Known, native animal species that occur within Utah and that are under the management authority of the Utah Division of Wildlife Resources.

- 1 species (Snake River Pilose Crayfish) was dropped very late in the review and revision process. The only 2 Utah specimens believed to represent this species were DNA tested and to actually be samples of the Pilose Crayfish (another SGCN).
- 141 species make up the 2015 Utah WAP SGCN list.
- Concerning ESA-listed and -candidate species:
  - Passage through the flowchart resulted in all extant, native ESA-listed and -candidate species being retained for the 2015 Utah WAP SGCN list.
  - All non-native and all extirpated species listed as Threatened or Endangered were excluded from the 2015 Utah WAP SGCN list.
  - The extirpated Relict Leopard Frog, *Rana onca,* is listed as a Candidate and was retained for the 2015 Utah WAP SGCN list.

Figure 2. SGCN decision process flowchart - right-side scoring.

Criterion	Definition	Scoring
social, economic scope of listing	how extensive in scope would be/are the additional social and/or economic impacts in Utah, of this species' warranting (or having) ESA listing?	2 = more than 4 Utah counties directly affected
		1 = 2-4 counties affected
		0 = 1 county affected
social, economic severity of listing	how severe would be/are the additional social and/or economic impacts in Utah, of this species' warranting (or having) ESA listing?	2 = species lives in an environment with no other T&E species
		1 = 1-2 listed species already present
		0 = >2 T&E species already present
ecological scope of decline or extirpation	how extensive in scope would be/are the additional impacts to other Utah species or habitats, of this species' decline or extirpation?	2 = species currently occupies >10% of Utah <u>or</u> of aquatic/riparian habitats
		1 = species occupies 1-10% of Utah or of aquatic/riparian
		0 = species occupies <1% of Utah or of aquatic/riparian
ecological severity of decline or extirpation	how severe would be/are the additional impacts to other Utah species or habitats, of this species' decline or extirpation?	2 = species is an ecosystem engineer or keystone, or >2 other left-side survivors are dependent on it
		1 = species is an ecosystem engineer or keystone, or 1-2 other left-side survivors are dependent on it
		0 = neither situation applies
area responsibility	how much of the species' current US georgraphic range lies in Utah?	2 = more than 20% of the current lower-48 range is in Utah
		1 = 5-20% of the current lower-48 range is in Utah
		0 = less than 5% of the current lower-48 range is in Utah
numerical responsibility	how much of the species' current US population lives in Utah some time?	2 = more than 20% of the current lower-48 population lives in Utah
		1 = 5-20% of the current lower-48 population lives in Utah
		0 = less than 5% of the current lower-48 population lives in Utah
temporal responsibility	how much of the year does the species live in Utah?	2 = all year long
		1 = for a crucial life stage
		0 = just a brief pass-through

Table 1. 18 species or subspecies initially dropped from the 2015 Utah WAP SGCN list and selected to be added to the right side of the flowchart.

Amphibians	Birds	Fishes	Mammals	Reptiles
Great Plains Toad	Bald Eagle	Bonneville Cutthroat Trout	American Pika	Black-necked Gartersnake
Mexican Spadefoot	Golden Eagle		Gunnison's Prairie Dog	Desert Night Lizard
Northern Leopard Frog				Many-lined Skink
Plains Spadefoot				Midget-faded Rattlesnake
				Smith's Black-headed Snake
				Spotted Leaf-nosed Snake
				Utah Banded Gecko
				Utah Milksnake
				Western Threadsnake

Species Accounts

Amphibians

Arizona Toad (*Anaxyrus microscaphus*)

Description

- Highly variable in color with small warts. Call resembles a rapid trill, ending abruptly.
- Found in lowland riparian habitat.

Abundance and Distribution

- NatureServe 2013[117]; S3/N4
- In Utah occurs only in the Virgin River Basin.
- Population trends are relatively stable.
- Range overlaps with Woodhouse's toad and hybridization may occur.

Columbia Spotted Frog (*Rana luteiventris*)

Description

- Aquatic specialist usually observed in water. Commonly orange or salmon colored belly, dark spots on back. Call sounds like rapidly tapping a hollow log.
- Inhabits a range of aquatic habitats including isolated desert springs, riverine wetlands, and high-altitude riparian areas. Breeds in shallow, warm water, often close to shore and emergent vegetation.
- Petitioned for ESA listing in 1989 – finding of warranted but precluded in 1993 – removed from candidate list in 2002.
- Managed under a voluntary, multi-agency Conservation Agreement and Strategy (UDWR 2006[118]).

Abundance and Distribution

- NatureServe 1997; S3/N4
- Utah populations are located in the Bonneville Basin, and comprise the far southeastern extent of the species' overall range.

Great Plains Toad (*Anaxyrus cognatus*)

Description

[117] Dates accompanying the term "NatureServe" signify the last update of an N-rank by NatureServe. S-ranks have all been updated since 2010 by the Utah Natural Heritage Program. See the Introduction section of this chapter, the Monitoring chapter, and the Species Methods Appendix for more details.
[118] Bailey, C. L., K. W. Wilson, and M. E. Anderson. 2006. Conservation Agreement and Strategy for Columbia Spotted Frog (Rana Lutieventris) in the State of Utah. Utah Division of Wildlife Resources Publication 06-01.

- Large, well-defined pale-bordered dark blotches on back occur in symmetrical patterns. Call sounds like a jackhammer.
- Found in prairies and grasslands. Use temporary and permanent water for breeding.

<u>Abundance and Distribution</u>
- NatureServe 1996; S1/N5.
- Found only in SE corner of Utah.
- Rare in Utah but more common in the Great Plains
- Recent surveys have documented additional Utah occurrences.

<u>**Mexican Spadefoot (*Spea multiplicata*)**</u>

<u>Description</u>
- Has vertical copper colored iris and spade-like hind feet. Call sounds like metallic vibrating snore.
- Found in arid and semiarid areas. Can remain dormant for long periods of drought in underground burrows. Breeding is triggered by monsoon rains.

<u>Abundance and Distribution</u>
- NatureServe 1996; S1/N5
- Utah is far NW extent of species range. Found only in SE corner of the state.
- Recent surveys have documented additional occurrences in Utah.

<u>**Northern Leopard Frog (*Lithobates pipiens*)**</u>

<u>Description</u>
- White or cream colored belly; well defined, pale-bordered, dark spots on back.
- Highly aquatic frog found in streams, rivers, ponds, lakes, and meadows for breeding and overwintering.
- Western US population petitioned for ESA listing in 2006 – found not warranted for listing in 2011.

<u>Abundance and Distribution</u>
- NatureServe 1996; S3/N5
- Widespread in Utah. Found in most counties.
- Short and long-term trend in Utah is thought to be relatively stable (recent surveys have documented populations in all but four counties with historic observations).

<u>**Plains Spadefoot (*Spea bombifrons*)**</u>

<u>Description</u>

- Vertical iris. Call sounds like a quacking duck.
- Found in pinyon-juniper, sagebrush, and desert grassland habitat. Can remain dormant for long periods of drought in underground burrows. Breeding is triggered by monsoon rains.

<u>Abundance and Distribution</u>

- NatureServe 1996; S1/N5
- Lack of information on status and trends in Utah.
- Distributed mainly along Great Plains from Alberta and Saskatchewan to Chihuahua. In Utah found only in SE corner of the state.

Relict Leopard Frog (*Lithobates onca*)

<u>Description</u>

- Inhabits springs, streams, and wetlands with clean, clear water.
- Petitioned for ESA listing in 2002 – finding of warranted but precluded in 2002.
- Managed under a voluntary, multi-party Conservation Agreement and Strategy (2005[119]).

<u>Abundance and Distribution</u>

- NatureServe 2010; SX/N1N2
- Occupies only 10-20% of historic range.
- Historically, populations in Utah were found in the Virgin River.

Western (Boreal) Toad (*Anaxyrus boreas*)

<u>Description</u>

- Has a white or cream colored stripe down the center of its back. Call is quiet and sounds like a distant flock of geese.
- Adults are largely terrestrial except during breeding. Capable of traveling > 4 miles over land.
- Petitioned for ESA listing in 2011 – substantial 90-day finding – decision pending.
- Managed under a state conservation plan (UDWR 2005[120]).

<u>Abundance and Distribution</u>

- NatureServe 1996; S3/N4
- Occurs in a wide range of habitats in multiple mountain ranges in Utah typically at high elevations >7000 feet.
- Genetic work indicates the Utah populations form a clade with those in Colorado and Wyoming with a genetically unique population on one Utah mountain range in southern Utah.

---

[119] Relict Leopard Frog Conservation Team. 2005. Conservation Agreement and Rangewide Conservation Assessment and Strategy for the Relict Leopard Frog (Rana Onca).

[120] Hogrefe, T. C., C. L. Bailey, P. D. Thompson, and B. Nadolski. 2005. Boreal Toad (Bufo Boreas Boreas) Conservation Plan in the State of Utah. Utah Division of Wildlife Resources. Publication 05-37.

Birds

American Bittern (*Botaurus lentiginosus*)

Description

- A stocky and secretive marsh bird in the heron family with a 3 foot wingspan. Their brown-and tan-striped plumage makes them well camouflaged in dense reeds and freshwater wetlands they inhabit. While difficult to see, their booming call carries far.
- Protected under the Migratory Bird Treaty Act of 1918[121].

Abundance and distribution

- NatureServe 1997; S3S4B/S3N/N4B/N4N
- Found throughout the state in marshes and wetland habitats in summer, it migrates to open water in the southern US, Mexico, and the Caribbean in winter.
- Uncommon and infrequently detected even during focused survey efforts.
- Population trend inadequately monitored by Breeding Bird Survey in Utah, declining regionally at -3.2% (-6.7, -0.9) per year (BBS 2015).

American White Pelican (*Pelecanus erythrorhynchos*)

Description

- Utah's largest (breeding) waterbird has all white plumage with black primary flight feathers, a long yellow-orange bill and characteristic throat pouch. Adults can weigh up to 20 pounds, have wingspans that top 8 feet, and can live over 20 years.
- Very social, cooperatively feeding on small freshwater fish and traveling in groups; nest colonially on a small number of suitable islands free of disturbance.
- Reach sexual maturity after 3 years
- Protected under the Migratory Bird Treaty Act of 1918, covered by Pacific Flyway management[122] and monitoring[123] plans, and is a Utah State Sensitive Species[124].

Abundance and distribution

- NatureServe 2008; S3B/N4
- Occur west of the Great Lakes from central Canada to southern Mexico. In Utah they are a common summer, and occasional winter, resident at the Great Salt Lake and surrounding wetlands; also found occasionally at fresh water bodies throughout the state.

---

[121] 50 CFR 78.212, 2013
[122] Pacific Flyway Council. 2012. Pacific Flyway Plan: A Framework for the Management of American White Pelican Depredation on Fish Resources in the Pacific Flyway. Pacific Flyway Council, U.S. Fish and Wildlife Service, Portland, Oregon. 49pp.
[123] Pacific Flyway Council. 2013. A Monitoring Strategy for the Western Population of American White Pelicans within the Pacific Flyway. Pacific Flyway Council, U.S. Fish and Wildlife Service, Portland, Oregon. 22p
[124] UDWR AR R657-48, 2011

- Poorly monitored by BBS in Utah, Western BBS regional trends increasing 4.87% (1.39, 8.05) per year
- There are two breeding colonies in Utah. One is the most important nesting colonies for the species range wide (about 20% of the population, roughly 12,000 breeding adults) found on Gunnison Island in the north arm of the Great Salt Lake.

Bald Eagle (*Haliaeetus leucocephalus*)

Description

- Utah's third-largest raptor; adults (5 years or older) are identified by the contrasting white head and tail with the dark brown body.
- Found throughout North American, populations recovering from rangewide declines due to DDT and persecution.
- Extremely large nest; requires substantial trees for nest placement.
- Delisted from Threatened (72 FR 37346, 2007), 5-year post-delisting monitoring complete.[125]
- Protected under the Bald and Golden Eagle Protection Act[126] and the Migratory Bird Treaty Act of 1918, it is also a Utah State Sensitive Species.

Abundance and Distribution

- NatureServe 1997; S2B/S4N/N5B/N5N
- Dramatic increase in numbers and distribution since ESA listing and the ban on DDT.
- Breeding population not well monitored by the Breeding Bird Survey for Utah; Western BBS region population increasing at 4.0% (2.8, 5.2) per year (BBS 2015). Wintering populations monitored by the Mid-winter Bald Eagle Survey; publication of (widely increasing) trend results anticipated in 2016.
- Northern populations winter in Utah in the hundreds; small (< 20 pairs) but increasing nesting population.

Band-tailed Pigeon (*Columba fasciata*)

Description

- Nest in low densities in mountainous forest and woodland habitats in western North America, Central America, and northern South America.
- Gregarious, flocks are nomadic during fall and winter.
- Protected under the Migratory Bird Treaty Act of 1918; Utah population covered by a Pacific Flyway management plan[127].

---

[125] U.S. Fish and Wildlife Service. 2009. Post-delisting Monitoring Plan for the Bald Eagle (*Haliaeetus leucocephalus*) in the Contiguous 48 States. U.S. Fish and Wildlife Service, Divisions of Endangered Species and Migratory Birds and State Programs, Midwest Regional Office, Twin Cities, Minnesota. 75 pp

[126] 16 U.S.C. 668-668d, 2009

Abundance and Distribution

- NatureServe 2001; S3B/N4B/N4N
- Uncommon summer and rare winter residents.
- Largest Utah breeding populations are in the Four Corners region, and in the central mountains from Cedar City to Nephi.
- Population not adequately monitored by the Breeding Bird Survey for Utah; Western BBS region population decreasing at -2.2% (-7.8, -1.1) per year (BBS 2015).

Bendire's Thrasher (*Toxostoma bendirei*)

Description

- Grey-brown, robin-sized bird with faint spots on breast and belly and a large decurved bill
- Prefers sparse desert scrub, small trees and cactus.
- Omnivorous, feeds on the ground or in the lower canopy.
- Protected under the Migratory Bird Treaty Act of 1918.

Abundance and Distribution

- NatureServe 1997; SHB/SU/N4B/NNRN
- Inhabits lowland (Mojave) desert habitats from southeast California to central New Mexico and from southern Utah to northern Mexico. Extremely limited habitat extent in Utah.
- Abundance and distribution are not well understood in Utah as records are sparse. Most observations are from Washington County.
- Northern populations thought to migrate south in the winter.
- Population trend not adequately monitored by the Breeding Bird Survey for Utah; Western BBS region population decreasing at -4.5% (-6.7, -2.6) per year (BBS 2015).

Black Rosy-Finch (*Leucostricte atrata*)

Description

- Found in alpine habitat of the central Rocky Mountains, nesting above treeline in cliffs or talus.
- Males defend a floating territory around the female.
- Gregarious in non-breeding seasons, forms large flocks (up to 1,000) with other species of rosy-finches. May use winter roost sites (caves, wells, mine shafts, and buildings).
- Protected under the Migratory Bird Treaty Act of 1918.

Abundance and Distribution

- NatureServe 1997; S1/N4

[127] Pacific Flyway Study Committee and Central Flyway Webless Migratory Game Bird Technical Committee. 2001. Pacific and Central Flyways management plan for the Four Corners population of band-tailed pigeons. Pacific Flyway Council, U.S. Fish and Wildlife Service, Portland, Oregon. 43pp

- locally common in the Uinta and Wasatch Mountains during the breeding season.
- No trend or population estimate available. Populations not well monitored by the Breeding Bird Survey for any part of its range (BBS 2015).
- An altitudinal migrant, moving to sagebrush or shrubland in lower elevation valleys, benches, and foothills during winter.

Black Swift (*Cypseloides niger*)

Description

- Occurs in mountainous regions of the western United States and Canada
- An aerial insectivore, it is known only to nest near or behind waterfalls with suitable characteristics including water, high relief, inaccessibility, shade, unobstructed flyways and ledges or cracks for nest placement.
- A very rare breeder in Utah
- Protected under the Migratory Bird Treaty Act of 1918.

Abundance and Distribution

- NatureServe 1997; S2B/N4B
- Fewer than five known nesting sites in Utah. Known to have bred historically at waterfalls in the Mt. Timpanogos area of the Wasatch Mountains.
- Recent sightings in Salt Lake County and Duchesne County in the Uinta Mountains have expanded the known range.
- Population trend not adequately monitored by the Breeding Bird Survey for Utah; Western BBS region population decreasing at -6.4% (-9.6, -3.2) per year (BBS 2015).

Boreal Owl (*Aegolius funereus*)

Description

- A small yellow-eyed ‘earless ‘owl, white face bordered by black, with spots on head
- Found throughout northern boreal forests in Alaska, Canada, and northern Eurasia, it uses high-elevation spruce and fir habitat in Utah.
- An obligate cavity nester, nests are often in old woodpecker holes.
- Forages nocturnally primarily by ear for voles, shrews, mice, and small birds.
- Protected under the Migratory Bird Treaty Act of 1918.

Abundance and Distribution

- NatureServe 1997; S2/N4
- Rare and infrequently detected during dedicated survey efforts. Very few casual observations are made outside survey efforts.

- Known In Utah from northern Utah from the Bear River Mountains, Wasatch Mountains and Uinta Mountains, it is found in lower elevations and different habitats in adjacent states.
- No trend or population estimate available. Populations not well monitored by the Breeding Bird Survey for any part of its range (BBS 2015).

Burrowing Owl (*Athene cunicularia*)

Description

- This small terrestrial crepuscular owl nests and roosts in underground burrows in open and short-grass habitats. Burrows are often dug by mammals such as prairie dogs.
- Migrates out of Utah during winter; little is known of its winter ecology.
- Protected under the Migratory Bird Treaty Act of 1918 and is a Utah State Sensitive Species.

Abundance and Distribution

- NatureServe 1997; S3B/N4B/N4N
- Declining populations and contracting distribution documented in the northern and eastern portion of the species' range in North America.
- This owl is currently widespread in Utah, but ephemeral; disappears from sites where it has been common.
- Population trend imprecise for Utah (increasing, 0.24%,-5.2/6.9); Western BBS region population stable at -0.6% (-1.9, -0.7) per year (BBS 2015).

California Condor (*Gymnogyps californianus*)

Description

- The largest North American land bird is a member of the vulture family and subsists entirely on carrion; reproduces very slowly, highly susceptible to lead poisoning which impedes population increase and subsequent recovery.
- Inquisitive birds, not especially afraid of people. Recovery team partners have developed programs to train condors, to the degree possible, to avoid humans.
- Low reproductive potential and small population size are being addressed through continued, bi-annual releases of captive-reared birds.
- One of the most endangered birds in the world, with fewer than 500 individuals in existence. ESA-listed as Endangered, with 10j Status in the southwestern Utah, and is a Utah State Sensitive Species.

Abundance and Distribution

- NatureServe 2006; S1/N1
- A small (~72) population has been established in northern Arizona and southern Utah since 1996 through releases of captive-reared birds. This population is classified as "experimental, non-

essential" under the species recovery program. Nearly all of this experimental population spends time in Utah between spring and fall each year.

Caspian Tern (*Hydroprogne caspia*)

Description

- A long-lived, gull-sized tern with white body, black cap, and a large coral-red bill
- Forages on small fish
- Nest singly or colonially on remote islands and beaches associated with playa and lentic wetland habitats.
- Protected under the Migratory Bird Treaty Act of 1918.

Abundance and Distribution

- NatureServe 1997; S3B/N4N5B/N4N
- Uncommon summer residents, breeding colonies are typically on islands and dikes associated with Great Salt Lake wetlands, though nesting has been documented at Utah Lake and Neponset Reservoir.
- Colonies are few in number and small (< 100 nests). A state-wide survey in 2009-2010 identified 19 nests, while a Great Salt Lake only survey in 2013 found 94 nests.
- Population trend not adequately monitored by the Breeding Bird Survey for Utah; Western BBS region population stable at 0.8% (-3.4, 3.6) per year (BBS 2015).

Columbian Sharp-tailed Grouse (*Tympanuchus phasianellus columbianus*)

Description

- Medium sized, spotted brown-and-white grassland grouse associated with transitional zones between sagebrush communities, mountain shrub, and riparian communities.
- Covered by a state management plan[128] that allows harvest under a limited draw permitting system.

Abundance and Distribution

- NatureServe 1996; S2/N4
- Found in northern Utah in grassland and shrubland areas of Box Elder, Cache, Weber and Morgan counties.
- Population trend not adequately monitored by the Breeding Bird Survey for Utah; Western BBS region population increasing at 2.5% (-4.5, 10.1) per year (BBS 2015).
- Utah populations have been reduced to 4% of historic levels (UDWR, unpublished data).

[128] Utah Division of Wildlife Resources. 2002. Strategic management plan for Columbian sharp-tailed grouse. Utah Department of Natural Resources, Division of Wildlife Resources, Publication 02-19, Salt Lake City, Utah, USA.

Ferruginous Hawk (*Buteo regalis*)

Description

- Largest North American hawk with rufous back, legs, and wings, mostly white head and underparts.
- Found in grassland and shrub-steppe habitats. Juniper trees are the primary nesting substrate in Utah, but will also nest on the ground or power line structures.
- Preys primarily on rabbits and ground squirrels.
- Protected under the Migratory Bird Treaty Act of 1918, and is a Utah State Sensitive Species.

Abundance and Distribution

- NatureServe 1997; S3B/N4B/N4N
- This hawk is found statewide in suitable grassland and shrub-steppe habitats, usually in lower elevations (<7,000’).
- Ferruginous hawks often winter around agricultural habitats.
- Population trend imprecisely monitored by the Breeding Bird Survey for Utah (-1.98%/year, -7.7/2.1); Western BBS region population increasing at 1.5% (0.2, 2.9) per year (BBS 2015).

Flammulated Owl (*Psiloscops flammeolus*)

Description

- A six-inch tall, gray-brown, insectivorous migratory owl with dark eyes.
- Nest and roost in old woodpecker holes or other cavities formed by large woodpeckers.
- Protected under the Migratory Bird Treaty Act of 1918.

Abundance and distribution

- NatureServe 1997; Utah rank S3S4/N4
- This species migrates to wintering grounds in central Mexico and Central America.
- Common in mature, montane forests throughout Utah, though primarily in the north central and southwestern ranges.
- No trend or population estimate available. Populations not well monitored by the Breeding Bird Survey for any part of its range (BBS 2015).

Golden Eagle (Aquila chrysaetos)

Description

- The largest raptor in North America is a gold-and-brown colored, long-lived bird found throughout western North America.
- Found in open country with sufficient mammalian, avian, and reptilian prey, or carrion in winter.
- Nest primarily on cliffs, secondarily on trees or human structures; defend large territories, and are generally wary of human disturbance.

Abundance and Distribution

- NatureServe 1997; S4/N5B/N5N
- Home to year-round resident population of breeding golden eagles, Utah also hosts migrants and over-wintering eagles from further north.
- Northern Great Basin and Book Cliffs nesting areas in Utah have been monitored for many years, with apparent breeding declines associated with fire, shrub loss and jackrabbit declines in the Great Basin area (Slater et al. 2013, Keller 2014)[129130]. Little data on nesting in southeastern Utah exists.
- Some resident eagles remain in the vicinity of their breeding territory all year while wintering eagles regularly scavenge (Kochert et al. 2002)131 and may be attracted to areas of high carrion density (unpublished tracking data, Department of Defense and HawkWatch International).
- Utah population imprecisely monitored by Breeding Bird Survey (-1.98% per year, -6.1, 0.8); western regional populations stable at -0.1% (-1.1, 0.6) per year.

Greater Sage-grouse (*Centrocercus urophasianus*)

Description

- Largest North American grouse with adult males weighing 4-7 lbs (1.7-2.9 kg) and females weighing 2-4 lbs (1.0-1.8 kg).
- A sagebrush obligate species dependent on sagebrush ecosystems for breeding, brood rearing and winter survival.
- Harvested in Utah under a limited draw permitting system, and are covered by a State Conservation Plan[132] and Governor's Executive Order[133].

Abundance and Distribution

- NatureServe 2010; S3/N3N4
- Petitioned for listing, currently a Candidate species under the Endangered Species Act.
- The species is found throughout Utah in suitable sagebrush habitat, however distribution in Utah now covers only 41% of historic habitat in several disjunct populations.
- Utah populations are monitored annually by UDWR with significant contributions from partners.

[129] Slater, S. J., K. W. Frye Christensen, R. N. Knight, K. Keller, and R. MacDuff. 2013. Great Basin bird species-at-risk and invasive species management partnership. Final Report – Phase 3. Department of Defense, Legacy Resources Management Program (Project #10–102)
[130] Keller, K. R. 2014. Golden Eagle nesting survey report for the central Utah study area, March–July 2014. Report submitted to the Utah Division of Wildlife Resources and Natural Resources Department, U.S. Army Dugway Proving Ground.
[131] Kochert, M. N., K. Steenhof, C. L. Mcintyre and E. H. Craig. 2002. Golden Eagle (Aquila chrysaetos), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/684
[132] Utah Governor's Office. 2013. Conservation Plan for Greater Sage-grouse in Utah. Utah's Public Lands Policy Coordination Office, Salt Lake City, UT, USA.
[133] http://publiclands.utah.gov/wp-content/uploads/2015/02/EO-Sage-Grouse1.pdf accessed March 9, 2015.

Gunnison Sage-grouse (*Centrocercus minimus*)

Description

- Differentiated from greater sage-grouse by smaller body size, distinct plumage, behavioral differences, and a non-overlapping range.
- A sagebrush obligate species, dependent on sagebrush ecosystems for breeding, brood rearing and winter survival.
- Listed as a Threatened species under the Endangered Species Act.
- Covered by a joint Utah–Colorado management plan[134].

Abundance and Distribution

- NatureServe 2004; S2/N1
- In Utah the species is found in a limited area of eastern San Juan County. Slightly more widely distributed in western Colorado.
- Very low population size of 100-120 individuals (UDWR unpublished data).
- Populations not well monitored by the Breeding Bird Survey for any part of its range (BBS 2015).

Lewis's Woodpecker (*Melanerpes lewis*)

Description

- Jay-sized woodpecker with dark green back and wings, pale red belly, dark red face, and characteristic flight pattern.
- Primary breeding habitat is open ponderosa pine forest with a shrub/grass understory. Secondary breeding habitat includes aspen patches surrounded by shrubs, and riparian cottonwood bottoms.
- Forages for insects during the breeding season, and fruit and nuts during the winter. It catches insects in the air and also picks them off foliage and the ground.
- Nests holes are excavated in large diameter dead or dying ponderosa pine, aspen, and cottonwood trees.
- Protected under the Migratory Bird Treaty Act of 1918.

Abundance and Distribution

- NatureServe 2001; S3/N4B/N4N
- Lewis's woodpecker range not well described in Utah.
- Population trend not adequately monitored by the Breeding Bird Survey for Utah; Western BBS region population decreasing at -2.7% (-5.5, -1.0) per year (BBS 2015).

Mexican Spotted Owl (*Strix occidentalis lucida*)

[134] GSGRSC (Gunnison Sage-grouse Rangewide Steering Committee). 2005. Gunnison sage-grouse rangewide conservation plan. Colorado Division of Wildlife, Denver, Colorado, USA.

Description

- Medium-sized, earless, dark-eyed owl with white spots on lower chest and abdomen.
- Nests in caves, roosts in trees and on ledges of deep, long canyons.
- Primarily nocturnal forager; preys on variety of small mammals especially wood rats (Neotoma spp.).
- Protected under the Migratory Bird Treaty Act of 1918; is a Utah State Sensitive Species, and listed as Threatened by USFWS[135]; Recovery Plan published in 1995 and revision published in 2012[136].

Abundance and Distribution

- NatureServe 2013; S2/N3N4
- Found in canyons and forests from Utah and Colorado to central Mexico. In Utah, is sparsely distributed throughout the canyons of southern and eastern Utah.
- Population size difficult to estimate; number of known nesting sites approximately 1400 across the entire range and likely around 120 in Utah (UDWR unpublished data).
- Populations not well monitored by the Breeding Bird Survey for any part of its range (BBS 2015).

Northern Pygmy Owl (*Glaucidium gnoma*)

Description

- A small (7”) brown-and-buff spotted above, whitish with brown streaks below owl with yellow-eyes; dark patches on the back of their heads, resembling eyes. Eye-markings may serve to confuse potential predators as these owls are mostly diurnal.
- Protected under the Migratory Bird Treaty Act of 1918.

Abundance and distribution (1996)

- NatureServe 1997; S3S4B/N4N5
- Common throughout the montane forests of Utah, yet little is known of their breeding distribution. Usually are found at higher elevations, but are known to descend in winter, sometimes appearing in urban areas.
- Population trend not adequately monitored by the Breeding Bird Survey for Utah; Western BBS region population stable at 0.8% (-1.6, 2.4) per year (BBS 2015).

Olive-sided Flycatcher (*Contopus cooperi*)

Description

- A large flycatcher with a brownish olive-gray on its back, gray sides and flanks, and a white throat and center of breast.

[135] 68 FR 65020 65023, 1993

[136] U.S. Fish and Wildlife Service. 2012. Final Recovery Plan for the Mexican Spotted Owl (Strix occidentalis lucida), First Revision. U.S. Fish and Wildlife Service. Albuquerque, New Mexico, USA. 413 pp.

- Breed in coniferous habitats throughout their range.
- They feed primarily by sallying and hovering after being perched on a high, exposed perch. The diet is made almost exclusively of flying insects.
- Protected under the Migratory Bird Treaty Act of 1918 (50 CFR 78.212, 2013)

Abundance and Distribution

- NatureServe 2001; S3S4B/N4B
- Breeding range of Olive-sided Flycatcher extends from Alaska south to western Texas; winter primarily in southern Central America and South America.
- Primarily found in high elevation conifer forests and clearings in Utah, especially at high elevations.
- Population trend imprecisely monitored by the Breeding Bird Survey for Utah (-3.1%/year, -7.3/2.8); Western BBS region population decreasing at -3.0% (-3.5, -2.6) per year (BBS 2015).

Peregrine Falcon (*Falco peregrinus*)

Description

- Nests in scrapes on cliffs and occasionally tall buildings; a fast and athletic predator that primarily takes birds on-the-wing
- Susceptible to toxin bioaccumulation.
- Listed as a federally endangered species in 1970 due to the impacts of DDT on reproduction, delisted in 1999[137]
- This species is protected under the Migratory Bird Treaty Act of 1918, is regulated for falconry take[138], and is covered by a post de-listing monitoring and recovery plan, due to conclude in 2015 [139].

Abundance and Distribution

- NatureServe 1997; S3B/N4B/N4N
- In Utah, as elsewhere in North America, populations have recovered after restrictions to pesticides, but post-delisting monitoring is to continue through 2015.
- Population trend imprecisely monitored by the Breeding Bird Survey for Utah (2.5%/year, -3.6/10.5); Western BBS region population stable at 2.4% (-2.3, 5.6) per year (BBS 2015).

Snowy Plover (*Charadrius alexandrines nivosus*)

Description

- A small shorebird with tan back white belly, and partial black "collar".

[137] 35 Federal Register 8495; June 2, 1970, Delisted: 64 Federal Register 46541-558, August 25, 1999
[138] 73-236-FR-74508, 2008
[139] U.S. Fish and Wildlife Service. 1984. American Peregrine Falcon Recovery Plan (Rocky Mountain Southwest Populations), and U.S. Fish and Wildlife Service, July/August 1999. Endangered Species Bulletin.

- Nests on coastal beaches, and inland at salt flats, playas, river sandbars, alkaline lakes, and agricultural ponds.
- Pacific coastal populations (within 50 miles of ocean) listed as Threatened (FR 5 March 1993), petitioned for de-listing (FR 22 March 2004), and retained as a Threatened under ESA (FR 21 April 2006). Both coastal and interior populations are covered by the Migratory Bird Treaty Act of 1918.

Abundance and Distribution

- NatureServe 1997; SNR/N3B/N3N
- Occurs in North America and South America, along the Pacific and Gulf of Mexico coasts, nest mainly in northern Utah in playa habitats surrounding Great Salt Lake.
- A 2008-2009 international snowy plover survey in Mexico and the United States estimated the breeding population to be 25,869[140].
- Common summer residents in Utah; an intensive sampling protocol at Great Salt Lake estimated a population size of 5,511 during the breeding season – approximately 21% of the continental population.
- Populations not well monitored by the Breeding Bird Survey for any part of its range (BBS 2015).

Southwestern Willow Flycatcher (*Empidonax trailii extimus*)

Description

- Small, buff-gray flycatcher, with eye ring and two wings-bars.
- Breeds in low-elevation areas of southwestern desert riparian systems.
- Protected under the Migratory Bird Treaty Act of 1918; is a Utah State Sensitive Species, and listed as Endangered under the Endangered Species Act, managed under a recovery plan[141].

Abundance and Distribution

- NatureServe 2007; S1B/N1B
- Populations declining due to altered water regimes, invasive plants, improper riparian grazing, development and nest parasitism.
- A small breeding population, the only one known in Utah, exists along the Virgin River in and around St. George.
- Populations not well monitored by the Breeding Bird Survey for any part of its range (BBS 2015).

Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*)

Description

- A brown-backed and white-bellied secretive bird with a black and white patterned undertail.
- Prefers thick riparian vegetative communities with dense overstory of mature trees.

---

[140] Thomas, S.M., et al. 2012. Population size of snowy plovers breeding in North America. Waterbirds 35(1):1-14.
[141] U.S. Fish and Wildlife Service. 2002. Southwestern willow flycatcher recovery plan. Albuquerque, New Mexico.

- Has a notably late and accelerated breeding season that begins in late June and is completed by mid-September.
- Protected under the Migratory Bird Treaty Act of 1918; is a Utah State Sensitive Species, and the Western Distinct Population Segment is listed as Threatened[142].

Abundance and Distribution

- NatureServe 2013; SNR/N3B
- Rare west of the Rocky Mountains; populations in Utah have experienced significant declines.
- Distribution and habitat use in the state are poorly understood. Most frequently found along the Green River near Vernal, near the town of Green River, and one portion of the San Juan River.
- Populations not well monitored by the Breeding Bird Survey for any part of it range (BBS 2015).

White-faced Ibis (*Plegadis chihi*)

Description

- A long-legged wader with a long slender decurved bill and chestnut plumage, glossed with green and purple (breeding adult); looks all-dark at a distance. Adults have red eyes and legs. Immature birds are dark with some lighter coloring or streaking on the head and neck.
- Prefers emergent and open-water habitats, and flooded or irrigated farmland. Feeds on aquatic invertebrates and vertebrates.
- Colonial breeder, nests in marshes, usually above the ground. Colony sites often shift from year to year with changes in water levels.
- Protected under the Migratory Bird Treaty Act of 1918.

Abundance and Distribution

- NatureServe 1997; S2S3B/N4B/N4N
- North and South America. In the US, breeds from Oregon sporadically east to Minnesota and south to New Mexico and Texas, and east to coastal Louisiana. Winters from southern California and the Gulf Coast of Texas and Louisiana.
- Highly mobile and opportunistic, finds & uses ephemeral habitats after rains or river flooding.
- Great Salt Lake hosts the largest nesting colony anywhere.

.

[142] http://www.gpo.gov/fdsys/pkg/FR-2014-10-03/pdf/2014-23640.pdf

Crustaceans

Pilose Crayfish (*Pacifastacus gambelii*)

Description

- Found in cool water ponds, lakes, and stream or river habitats.

Abundance and Distribution ()

- NatureServe 1996; S2/N4N5
- Found throughout the Pacific Northwest and Rocky Mountains. In Utah, found only in the northern portion of the state.

Utah Amphipod (*Stygobromus utahensis*)

Description

- Medium sized (55 mm) amphipod.
- Cave dwelling endemic.

Abundance and Distribution

- NatureServe 2004; SNR/N1N2
- Known from only one location in a cave in NE Utah.

Fishes

Bear Lake Sculpin (*Cottus extensus*)

Description

- Benthic species found from shoreline to 53m depth.
- Managed under Bear Lake Management Plan (2010[143]).

Abundance and Distribution

- NatureServe 2011; S1/N3
- Large population but limited distribution. Native only to Bear Lake.
- Monitored by bottom trawling at standardized sites.

Bear Lake Whitefish (*Prosopium abyssicola*)

Description

- Found at depths greater than 40m.
- Managed under Bear Lake Management Plan (2010[144]).

Abundance and Distribution

- NatureServe 1996; S1/N3
- Large population but limited distribution. Native only to Bear Lake.
- Monitored by gill net catch rates.

Bluehead Sucker (*Catostomus discobolus*)

Description

- Large, migratory fish can live up to 20 years.
- Occurs in mainstem and tributary locations. Is able to persist in some reservoirs.
- Populations in the Bonneville and Snake River Basins have recently been found to be genetically distinct and have been proposed to be a separate species. If designated as a distinct species, the bluehead suckers in these basins will be added as a new distinct species in the WAP.
- Managed under a Utah[145] and Range-wide[146] Conservation Agreement and Strategy intended to take voluntary actions to address threats and reduce the need to list the species.

---

[143] Tolentino and Teuscher. 2010. Bear Lake Fisheries Management Plan 2010. Utah Division of Wildlife Resources, Idaho Department of Fish and Game. IDFG Boise.

[144] Tolentino and Teuscher. 2010. Bear Lake Fisheries Management Plan 2010. Utah Division of Wildlife Resources, Idaho Department of Fish and Game. IDFG Boise.

[145] UDWR. 2006. Conservation and Management Plan for Three Fish Species in Utah: Addressing needs for Roundtail Chub (*Gila Robusta*), Bluehead Sucker (*Catostomus discobolus*), and Flannelmouth Sucker (*Catostomus latipinnis*). UDWR 06-17.

Abundance and Distribution

- NatureServe 1996; S3/N4
- Found in the Colorado, Snake, and Bonneville River Basins.
- Habitat and populations have been lost from water diversions and barriers to movement.

Bonneville Cisco (*Prosopium gemmifer*)

Description

- Can be identified from the other whitefish species in Bear Lake by pointed snout.
- Managed under Bear Lake Management Plan (2010[147]).

Abundance and Distribution

- NatureServe 2007; S1/N3
- Large population but limited distribution.
- Monitored through hydroacoustic sampling.

Bonneville Cutthroat Trout (*Oncorhynchus clarkii utah*)

Description

- Popular sport-fish.
- Needs cool, well-oxygenated water.
- Petitioned for ESA listing multiple times. Actions taken have significantly reduced threats and greatly improved status, resulting in not warranted finding in 2008.
- Managed under a Range-wide Conservation Agreement and Strategy[148] intended to take voluntary actions to address threats and reduce the need to list the species.

Abundance and Distribution

- NatureServe 2002; S4/N4
- Occur in streams and high lakes in the Bonneville Basin.

Bonneville Whitefish (*Prosopium spilonotus*)

Description

- Found in depths to 40m.
- Managed under Bear Lake Management Plan (2010[149]).

[146] UDWR. 2006. Range-wide Conservation Agreement and Strategy for Roundtail Chub *Gila robusta*, Bluehead Sucker *Catostomus discobolus*, and Flannelmouth Sucker *Catostomus latipinnis*. UDWR 06-18.

[147] Tolentino and Teuscher. 2010. Bear Lake Fisheries Management Plan 2010. Utah Division of Wildlife Resources, Idaho Department of Fish and Game. IDFG Boise.

[148] Lentsch, L. D., C. A. Toline, J. Kershner, J. M. Hudson, and J. Mizzi. 2000. Range-wide Conservation Agreement and Strategy for Bonneville Cutthroat Trout (*Oncorhynchus clarki utah*). UDWR 00-19.

Abundance and Distribution

- NatureServe 2007; S1/N3
- Large population but limited distribution. Occurs only in Bear Lake.
- Monitored by gill net catch rates.

Bonytail (*Gila elegans*)

Description

- Large chub with very narrow caudal peduncle.
- Prefers swift, deep canyon bound reaches.
- Federally listed as Endangered since 1980.
- Managed under Upper Colorado River Recovery Program[150].

Abundance and Distribution

- NatureServe 1996; S1/N1
- Has been functionally extirpated from large portion of its range.
- Occurs in Colorado River Basin.
- Populations in Utah maintained by stocking program – wild fish have not been documented since 1990.

Colorado Pikeminnow (*Ptychocheilus lucius*)

Description

- Largest cyprinid in North America. Long lived (40+ years) and can reach sizes of 1.8 m and 36 kg.
- Makes long distance spawning migrations.
- Federally listed as endangered in 1973.
- Managed under Upper Colorado River and San Juan River Recovery Programs[151].

Abundance and Distribution

- NatureServe 1996; S3/N1
- Native to the Colorado River Basin.
- Current populations are relatively stable in size and distribution, but much reduced from historic levels.
- Reductions due to effects of dams, diversions, and water withdrawals.

---

[149] Tolentino and Teuscher. 2010. Bear Lake Fisheries Management Plan 2010. Utah Division of Wildlife Resources, Idaho Department of Fish and Game. IDFG Boise.
[150] U.S. Fish and Wildlife Service. 1987. Bonytail Chub (Gila elegans) Recovery Plan. U. S. Fish and Wildlife Service, Region 6, Denver, Colorado.
[151] U. S. Fish and Wildlife Service. 1978. Colorado Squawfish Recovery Plan. U. S. Fish and Wildlife Service, Region 6, Denver, Colorado.

Colorado River Cutthroat Trout (*Oncorhynchus clarkii pleuriticus*)

Description
- Popular sport-fish.
- Need cool, well-oxygenated water.
- Petitioned for ESA listing multiple times. Actions taken have significantly reduced threats and greatly improved status, resulting in not warranted finding in 2007.
- Managed under a Range-wide Conservation Agreement and Strategy[152] intended to take voluntary actions to address threats and reduce the need to list the species.

Abundance and Distribution
- NatureServe 1996; S3/N2N3
- Occupy approximately 1/3 of historic habitat.
- Occur in streams and high lakes in the Colorado River Basin.
- Populations have become isolated and fragmented.

Desert Sucker (*Catostomus clarkii*)

Description
- Medium sized sucker. Found in small to medium size rivers with gravel substrate. Scrapes algae and invertebrates from rocks.
- Not ESA listed, but Virgin River Recovery Program actions on behalf of other species (providing water to sustain flows, and removing non-native fish) have also benefited desert sucker.

Abundance and Distribution
- NatureServe 1996; S3/N3N4
- Habitat and populations have been lost due to diversions and barriers to movement.
- Virgin River Basin in Utah, the lower Colorado River and other systems in the desert southwest.

Flannelmouth Sucker (*Catostomus latipinnis*)

Description
- Large, long-lived, migratory fish.
- Managed under a Utah[153] and Range-wide[154] Conservation Agreement and Strategy intended to take voluntary actions to address threats and reduce the need to list the species.

---

[152] CRCT Conservation Team. 2006. Conservation agreement for Colorado River cutthroat trout (*Oncorhynchus clarkii pleuriticus*) in the States of Colorado, Utah, and Wyoming. Colorado Division of Wildlife, Fort Collins.

[153] UDWR. 2006. Conservation and Management Plan for Three Fish Species in Utah: Addressing needs for Roundtail Chub (*Gila Robusta*), Bluehead Sucker (*Catostomus discobolus*), and Flannelmouth Sucker (*Catostomus latipinnis*). UDWR 06-17.

[154] UDWR. 2006. Range-wide Conservation Agreement and Strategy for Roundtail Chub *Gila robusta*, Bluehead Sucker *Catostomus discobolus*, and Flannelmouth Sucker *Catostomus latipinnis*. UDWR 06-18.

Abundance and Distribution

- NatureServe 1996; S3/N3N4
- Endemic to the Colorado River Basin.
- Locally abundant in some places. Habitat and populations have been lost due to diversions and barriers to movement.

Humpback Chub (*Gila cypha*)

Description

- Large chub with prominent hump behind flattened head.
- Require eddies and sheltered shorelines maintained by high spring flows.
- Federally listed as Endangered since 1973.
- Managed under Upper Colorado River Recovery Program[155].

Abundance and Distribution

- NatureServe 1996; S2/N1
- Population and distribution has been highly reduced from historic range. Native to Colorado River system.
- Restricted to deep, swift, canyon-bound reaches of large rivers.

June Sucker (*Chasmistes liorus*)

Description

- Lake sucker that spawns in tributary rivers.
- Feeds in the water column rather than scraping rocks.
- Federally listed as endangered in 1986.
- Managed under the June Sucker Recovery Program[156].

Abundance and Distribution

- NatureServe 2013; S2/N2
- Endemic to Utah Lake.
- Lack of Recruitment is a limiting factor. Populations are maintained by stocking but natural recruitment is increasing. Habitat restoration, carp removal, and flow releases in the Provo River to maintain flows while spawning have benefited June sucker.

Least Chub (*Iotichthys phlegethontis*)

Description

- Small cyprinid that inhabits spring and wetland systems.

---

[155] U.S. Fish and Wildlife Service. 1979. Humpback Chub Recovery Plan. U.S. Fish and Wildlife Service Region 6.
[156] U.S. Fish and Wildlife Service. 1999. June sucker (*Chasmistes liorus*) Recovery Plan. U.S. Fish and Wildlife Service, Denver, Colorado.

- Tolerant of range of water quality parameters.
- Petitioned for listing in 1998 – found not warranted. Petitioned for listing in 2007 – warranted but precluded finding in 2010. Found not warranted in 2014.
- Managed under multi-agency voluntary Conservation Agreement and Strategy[157].

Abundance and Distribution

- NatureServe 2013; S2/N2
- Endemic to the Bonneville Basin of Utah.
- Six remaining wild populations. Numerous additional refuge populations have been established.

Northern Leatherside Chub (*Lepidomeda copei*)

Description

- Occupy similar habitat to trout species but are more tolerant of lower water quality conditions.
- Typically inhabits unaltered reaches with no or few non-native fishes.
- Included in 2005 WAP as leatherside chub – has since been split into two species.
- Petitioned for Federal listing in 2009 – found not warranted 2011.
- Managed under a multi-state and multi-agency Conservation Agreement and Strategy[158].

Abundance and Distribution

- NatureServe 2012; S2?/N3
- Disjunct populations in Bear River and Snake River basins of UT, ID, NV, and WY.

Razorback Sucker (*Xyrauchen texanus*)

Description

- Large, long-lived, migratory sucker with prominent narrow ridge along its spine.
- Reliant on periodic inundation of floodplain habitats to complete life cycle.
- Federally listed as endangered in 1991.
- Managed under the Upper Colorado River Recovery Program[159].

Abundance and Distribution

- NatureServe 1996; S2/N1
- Endemic to the Colorado River Basin.
- Populations in Utah are maintained by stocking.

---

[157] UDWR. 2005. Conservation Agreement and Strategy for Least Chub (*Iotichthys phlegethontis*) in the State of Utah. UDWR 05-24.
[158] UDWR. 2009. Rangewide Conservation Agreement and Strategy for Northern Leatherside (*Lepidomeda copei*). UDWR 09-11.
[159] U.S. Fish and Wildlife Service. 1998. Razorback sucker (*Xyrauchen texanus*) Recovery Plan. Denver, Colorado.

Roundtail Chub (*Gila robusta*)

Description
- Tolerant of high sediment loads and variable flow conditions.
- Managed under a Utah[160] and Range-wide[161] Conservation Agreement and Strategy intended to take voluntary actions to address threats and reduce the need to list the species.

Abundance and Distribution
- NatureServe 2001; S2/N3
- Native to Colorado River system.
- Population and distribution has been highly reduced from historic range.

Southern Leatherside Chub (*Lepidomeda aliciae*)

Description
- Occupy similar habitat to trout species but are more tolerant of lower water quality conditions.
- Typically inhabits unaltered reaches with no or few non-native fishes.
- Included in 2005 WAP as leatherside chub – has since been split into two species.
- Managed under a multi-agency Conservation Agreement and Strategy[162].

Abundance and Distribution
- NatureServe 2005; S2/N2
- Native only to the Bonneville Basin. Disjunct populations in the Provo, Spanish Fork, San Pitch, and Sevier River Basins.
- Introduced populations occur in the Fremont River.

Virgin River Chub (*Gila seminuda*)

Description
- Habitat includes rocky runs, rapids, pools, and undercut banks.
- Most common in deeper areas with swift but not turbulent water.
- Federally listed as Endangered since 1989.
- Managed under Virgin River Recovery Program[163].

---

[160] UDWR. 2006. Conservation and Management Plan for Three Fish Species in Utah: Addressing needs for Roundtail Chub (*Gila Robusta*), Bluehead Sucker (*Catostomus discobolus*), and Flannelmouth Sucker (*Catostomus latipinnis*). UDWR 06-17.
[161] UDWR. 2006. Range-wide Conservation Agreement and Strategy for Roundtail Chub *Gila robusta*, Bluehead Sucker *Catostomus discobolus*, and Flannelmouth Sucker *Catostomus latipinnis*. UDWR 06-18.
[162] UDWR. 2010. Conservation Agreement and Strategy for Southern Leatherside (*Lepidomeda aliciae*) in the State of Utah. UDWR 10-19.
[163] U.S. Fish and Wildlife Service. 1994. Virgin River Fishes Recovery Plan. Salt Lake City, Utah.

Abundance and Distribution

- NatureServe 1996; S1/N1
- Occurs only in the Virgin and Muddy drainages in Utah, Arizona, and Nevada.
- Population and distribution has been reduced from historic range.

Virgin Spinedace (*Lepidomeda mollispinis*)

Description

- Commonly found in runs and pools, mostly in deeper water, over sand, and near cover such as boulders or overhanging trees and shrubs.
- Typically inhabits unaltered reaches with no or few non-native fishes.
- Petitioned for Federal listing in 1994 – found not warranted in 1996. Petitioned again in 2012 – currently under review.
- Managed under a multi-agency Conservation Agreement and Strategy[164].

Abundance and Distribution

- NatureServe 2012; S2/N2
- Occurs only in Virgin River Basin. Majority of extant population occurs in Utah.
- Extensive removal of non-native fishes, acquisition of water to maintain instream flows, and reintroduction program have reduced these threats and resulted in restoring populations to 80% of historic range.

Woundfin (*Plagopterus argentissimus*)

Description

- Small minnow most commonly found in moderately flowing runs with sand substrates or habitats adjacent to riffles.
- Fares best in unaltered reaches where non-native fish abundance is low.
- Federally listed as endangered in 1970.
- Managed under Virgin River Recovery Program[165].

Abundance and Distribution

- NatureServe 1996; S1/N1
- Current distribution restricted to Virgin River Basin. Historically found in Virgin, lower Colorado, and Gila River basins.
- Populations are maintained through stocking program.

[164] Lentsch, L.D., M.J. Perkins, H. Maddux, and T.C. Hogrefe. 2002. Virgin Spinedace (*Lepidomeda mollispinis mollispinis*) Conservation Strategy. UDWR 02-22.
[165] U.S. Fish and Wildlife Service. 1994. Virgin River Fishes Recovery Plan. Salt Lake City, Utah.

Yellowstone Cutthroat Trout (*Oncorhynchus clarkii bouvieri*)

Description

- Needs cool, well-oxygenated water.
- Actions taken to remove non-native fishes and reintroduce Yellowstone cutthroat have significantly reduced threats and improved status.
- Determined not warranted for ESA listing in 2006.

Abundance and Distribution

- NatureServe 2013; S3/N3
- Occurs in streams and high lakes in the Raft River and Goose Creek drainages of NW Utah.

Mammals

Allen's Big-eared Bat (*Idionycteris phyllotis*)

Description

- Allen's big-eared bat is a mid-sized, highly agile bat that feeds by gleaning larger, soft-bodied insects from foliage.
- This species is known from a range of habitats including shrublands, woodlands, and forests.
- Maternity roosts are known to occur in cracks in cliffs, mines, large boulder piles, and under exfoliating bark of large ponderosa pine snags.
- Little is known of seasonal movements or behavior during the cold season.
- Managed under the Utah Bat Conservation Plan.[166]

Abundance and Distribution

- NatureServe 1996; S3/N3N4
- Allen's big-eared bats are considered rare and are infrequently detected during survey efforts.
- The species is found in Utah from the LaSal Mountains, Henry Mountains, Capitol Reef National Park, Grand Staircase-Escalante National Monument, and St. George southward.

American bison (*Bos bison*)

Description

- Weighing as much as 2,000 lbs., the American bison is the largest existing North American land mammal.
- Bison once roamed the continent in the tens of millions, and were a keystone species of prairie ecosystems.
- Bison are hunted in Utah and are managed as a once-in-a-lifetime species.
- Management information is found in the Henry Mountains and Book Cliffs bison herd management plans.

Abundance and Distribution

- NatureServe 2006; S2/N4
- The Henry Mountains herd is managed for 325 adult and yearling bison, post-hunt season. Established in 2008, the Book Cliffs herd is managed for 450 animals.
- The bison occurring on Antelope Island are managed by the Utah Division of Parks and Recreation as domestic livestock, although they spend much of their lives roaming open lands.

American Pika (*Ochotona princeps*)

[166] Oliver, G., K. Hersey, A. Kozlowski, K. Day, and K. Bunnell. 2009. Utah bat conservation plan. Utah Division of Wildlife Resources. Salt Lake City, Utah, USA.

Description
- The American pika is a small lagomorph with short limbs and rounded ears.
- Pikas inhabit high-elevation talus slopes, boulder fields, and adjacent meadows.
- Petitioned for ESA protection primarily due to the potential impacts of climate change. Determined not warranted (2010).

Abundance and Distribution
- NatureServe 2011; S4/N5
- Surveys in Utah since 2008 have documented high occupancy rates and reconfirmed pika presence in all historically documented mountain ranges.
- The range includes high mountainous area of western North America including the Rocky Mountains, Great Basin ranges, Sierra Nevada Mountains, and Cascade Mountains.
- In Utah, pikas are found in most mountains and high plateaus.

Big Free-tailed Bat (*Nyctinomops macrotis*)

Description
- The big free-tailed bat is a relatively large bat with a tail extending well beyond the tail membrane. It has long, tapered wings enabling it to fly long distances to feed on moths.
- The species often roosts and forms maternity colonies in massive sandstone cliffs near bodies of open water in a variety of habitats. It is presumed that big free-tailed bats migrate out of Utah for the winter.
- Managed under the Utah Bat Conservation Plan.[167]

Abundance and Distribution
- NatureServe 1996; SU/N3N4
- Generally considered rare in Utah, although they can be locally common. Long-term trend is unknown.
- Distribution is widespread, but discontinuous, from western North America to South America.
- Capture records in Utah are primarily from the southern half of the state. However, in recent years, capture and acoustic records have expanded the known range over much of eastern Utah.

Bighorn Sheep (*Ovis canadensis*)

Description
- Bighorn sheep can weigh up to 300 pounds and are known for their large, curled horns.
- Two subspecies are known from Utah; Rocky Mountain bighorn sheep *(Ovis canadensis canadensis)* and desert bighorn sheep *(Ovis canadensis nelsoni)*.

[167] Oliver, G., K. Hersey, A. Kozlowski, K. Day, and K. Bunnell. 2009. Utah bat conservation plan. Utah Division of Wildlife Resources. Salt Lake City, Utah, USA.

- Bighorn sheep prefer open habitat types with adjacent steep rocky areas for escape and safety. Habitat is characterized by rugged terrain including canyons, gulches, talus cliffs, steep slopes, mountaintops, and river benches.
- Bighorn sheep are hunted in Utah and are managed as a once-in-a-lifetime species by subspecies. Management information is found in the Utah Bighorn Sheep Management Plan.[168]

Abundance and Distribution

- NatureServe 2006; S3/N4
- Rocky Mountain bighorn sheep currently exist in the northern half of the state with a population estimate of nearly 2,200 and an increasing trend over the past 15 years.
- Desert bighorn sheep inhabit the slickrock canyon areas of southern Utah. The current population estimate is 2,000 sheep and has been relatively stable for the past 10 years.
- Bighorn sheep are found in western North America from central British Columbia to Mexico and from California to the Dakotas. They were nearly extirpated from Utah, but have been reestablished in numerous populations through an aggressive transplant program. Still absent from most of its historic range in Utah and around the west.

Black-footed Ferret (*Mustela nigripes*)

Description

- The black-footed ferret is a relatively small member of the weasel family with an elongated body and a black face mask, black feet, and a black-tipped tail.
- Black-footed ferrets depend upon prairie dogs for food and shelter and thus live exclusively in prairie dog colonies in grassland and shrubland habitats.
- Listed as endangered since 1967 and managed by a recovery plan.[169] The Utah population is considered nonessential, experimental - 10(j).

Abundance and Distribution

- NatureServe 2006; S1/N1
- Once thought to be extinct, but rediscovered in 1989. As of 2014, the minimum number of known ferrets in the wild was 295 animals.
- In Utah, black-footed ferrets were introduced in the Coyote Basin/Snake John Reef area of Uintah County beginning in 1999. Although the population remains small, multiple generations of wild-born kits have been documented.
- The historical range of the black-footed ferret coincided with ranges of the black-tailed prairie dog, Gunnison's prairie dog, and white-tailed prairie dog, which collectively occupied

[168] Utah Bighorn Sheep Statewide Management Plan. 2013. Utah Division of Wildlife Resources. Salt Lake City, UT.
[169] U.S. Fish and Wildlife Service. 2013. Recovery plan for the black-footed ferret (*Mustela nigripes*). U.S. Fish and Wildlife Service, Denver, Colorado. 130 pp.

approximately 100 million acres (40 million hectares) of grasslands. Through 2014, there were 20 existing reintroduction sites, with more planned.

[a Race of the] Botta's Pocket Gopher (*Thomomys bottae robustus*)

Description

- *Thomomys bottae robustus,* also known as the "Skull Valley pocket gopher," is considered a subspecies of Botta's pocket gopher, which ranges over a large area of the western United States. They spend almost all their life underground in a network of burrows.
- Further work is needed to determine the taxonomic validity of this animal.

Abundance and Distribution

- NatureServe 2013; S2/N3
- Abundance is unknown.
- Range includes the vicinity of the Skull Valley, Lakeside Mountains, Cedar Mountains, Camels Back Ridge, and Granite Peak area, primarily in Tooele County.

Canadian Lynx (*Lynx canadensis*)

Description

- The lynx is a medium-sized cat with long legs, large paws, and long tufts of fur on its ears.
- The preferred habitat of the Canadian lynx is montane coniferous forest, where they are closely associated with snowshoe hare populations.
- The contiguous United States population is ESA-listed as threatened.
- Managed according to the Canadian lynx conservation assessment and strategy.[170]

Abundance and Distribution

- NatureServe 1997; S2/N4?
- No known population of Canadian lynx exists in Utah. Lynx radio collared in Colorado, as part of a reintroduction, have been documented visiting Utah, but none are known to have stayed.
- The Uinta Mountains are considered peripheral lynx habitat that may contribute to lynx persistence by enabling successful dispersal and recolonization of core areas, but the role of peripheral habitat in sustaining populations remains unknown. Further monitoring is needed to determine whether lynx have reestablished a population in Utah.
- Ranges throughout Alaska and Canada south through the Rocky Mountains, northern Great Lakes region, and northern New England.
- Declines have occurred in some populations, but apparently still widespread and relatively abundant in most of historic range.

[170] Interagency Lynx Biology Team. 2013. Canada lynx conservation assessment and strategy. 3rd edition. USDA Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management, and USDI National Park Service. Forest Service Publication R1-13-19, Missoula, MT. 128 pp.

Chisel-toothed Kangaroo Rat (*Dipodomys microps celsus*)

Description

- *Dipodomys microps celsus* is one of 13 recognized subspecies of the chisel-toothed kangaroo rat, a rodent with large hind legs and feet and chisel-shaped lower incisors specialized for eating shadscale and saltbrush.
- The chisel-toothed kangaroo rat is found in desert valleys throughout most of the Great Basin.
- Further work is needed to determine the taxonomic validity of this subspecies.

Abundance and Distribution

- NatureServe 1997; S1?/N4
- Short and long-term trends are unknown.
- As traditionally arranged (e.g., Hall 1981), *D. m. celsus* occurs in southwestern Utah (Washington County), in northwestern Arizona (Mohave and Coconino counties), and hypothetically in southeastern Nevada (Lincoln County).

Dark Kangaroo Mouse (*Microdipodops megacephalus*)

Description

- The dark kangaroo mouse is a burrow-dwelling bipedal rodent. It eats primarily seeds and stores fat reserves in its tail.
- Found in isolated habitat islands in desert areas of the Great Basin. Habitat generally consists of sandy, semi-desert shrubland with sparse vegetative cover.

Abundance and Distribution

- NatureServe 2005; S3/N4
- Although the documented distribution has changed little since the 1930s, there is concern that many northern populations have declined and are now small, fragmented, or locally extinct.
- In Utah, the species is most often found in stabilized dunes found along the margins of historical Lake Bonneville.

Dwarf Shrew (*Sorex nanus*)

Description

- A rare shrew in most of its range, and little is known of its natural history.
- Generally associated with high-elevation habitats in Utah, but known from a broad range of elevations elsewhere.

Abundance and Distribution

- NatureServe 1996; S3/N4

- Short and long-term trend is unknown.
- Has been historically been recorded in the Uinta, La Sal, Abajo, and Henry Mountains. In recent years, the range has been expanded to include the Wasatch Plateau, Tushar Mountains, Fishlake Plateau, and Markagunt Plateau.
- Further work is needed to determine the distribution of this species in Utah, including in insufficiently sampled habitats (e.g., juniper woodlands).

Fringed Myotis (*Myotis thysanodes*)

Description

- The fringed myotis is a small bat with a characteristic fringe of stiff hairs along the edge of the tail membrane. Beetles, which are plucked from vegetation or the ground, are the major prey item of the fringed myotis.
- The fringed myotis has been found a variety of habitats most often in desert and woodland areas.
- Maternity roosts have been reported in caves, mines, and buildings. The species hibernates in caves and crevices and may be susceptible to white-nose syndrome.
- Managed under the Utah Bat Conservation Plan.[171]

Abundance and Distribution

- NatureServe 2012; S2B/N4
- Overall, the fringed myotis is uncommon in Utah. However, its abundance varies locally.
- The fringed myotis occurs in most of the western United States, as well as in much of Mexico and part of southwestern Canada.
- The species is widely distributed throughout Utah.

Gray Wolf (*Canis lupus*)

Description

- Possibly the most conflict-ridden species in the western US. For years, northern Rocky Mountain gray wolves have been on and off the Endangered Species List. In April 2011, the U.S. Congress intervened and permanently delisted wolves, officially removing them from the Endangered Species List in parts of many western states, including a small portion of northern Utah. In 2013, the U.S. Fish and Wildlife Service proposed to remove the gray wolf from the list of threatened and endangered species under the ESA.
- In 2010, the Utah Legislature directed UDWR to prevent any packs of wolves from establishing within the delisted portion of Utah (S.B. 36, Wolf Management Act). The law also directs UDWR

[171] Oliver, G., K. Hersey, A. Kozlowski, K. Day, and K. Bunnell. 2009. Utah bat conservation plan. Utah Division of Wildlife Resources. Salt Lake City, Utah, USA.

to request that FWS immediately remove any wolves discovered in areas of Utah where they are still ESA-listed.
- When wolves are delisted statewide, the Utah Wolf Management Plan will be fully implemented.[172]

Abundance and Distribution
- NatureServe 1996; SX/N4
- There have been scattered confirmed individual wolves dispersing from Idaho and Wyoming into Utah. Yet, as of 2015, there is no conclusive evidence that wolves have established packs or territories within the state.
- Formerly ranged throughout nearly all of North America. Also native to Europe and Asia.

Gunnison's Prairie Dog (*Cynomys gunnisoni*)

Description
- One of three species of prairie dogs found in Utah. Approximately a foot tall with a short, light colored tail.
- Found in open grassy and brushy areas of high mountain valleys and lower dry habitats.
- Petitioned for ESA listing, found not warranted in 2013.
- Managed under Utah Gunnison's prairie dog and white-tailed prairie dog conservation plan.[173]

Abundance and Distribution
- NatureServe 2008; S3/N5
- Populations are highly variable with habitat conditions. Occupancy estimates based on surveys since 2007 show a stable trend.
- The Gunnison's prairie dog's historical range included large portions of New Mexico, Colorado, Utah, and Arizona. The species is now largely restricted to the Four Corners region.
- Approximately 3% of the current range occurs in Utah. Active colonies are found in Grand and San Juan Counties, and 267,870 acres of habitat are estimated to be in suitable condition.

Idaho Pocket Gopher (*Thomomys idahoensis*)

Description
- The Idaho pocket gopher is the smallest of the three species of pocket gophers native to Utah. It is adapted to a life of digging and burrowing with strong front limbs, long nails, small ears, small eyes, and fur-lined cheek pouches used to carry food.

[172] The Utah Division of Wildlife Resources and The Utah Wolf Working Group. 2005. Utah Wolf Management Plan, Utah Division of Wildlife Resources Publication 05-17.
[173] Lupis, S. G., K. D. Bunnell, T. A. Black, and T. A. Messmer. 2007. Utah Gunnison's prairie dog and white-tailed prairie dog conservation plan: Draft #5. Utah Division of Wildlife Resources, Salt Lake City, Utah.

- Little is known about its habitat but its distribution suggests a preference for mountain foothill shrubland and a higher tolerance for rocky soils than the northern pocket gopher.

Abundance and Distribution
- NatureServe 1997; SH/N4
- Seven specimens were captured in 2013 and represent the first observations of the species in Utah since 1964. Given those captures, the S-rank will be revised accordingly.
- In Utah, only known to occur in Rich and Daggett counties. It also occurs in disjunct populations from southwestern Montana, through eastern Idaho to southwestern Wyoming.

Kit Fox (*Vulpes macrotis*)

Description
- The kit fox is a house-cat sized canid well adapted for desert conditions with large ears and long legs.
- Kit foxes eat rodents and other small animals including kangaroo rats, prairie dogs, jackrabbits, and cottontails. They are primarily nocturnal and live in underground dens year round.
- The fox is found in desert areas dominated by sagebrush, desert scrub, or grasslands.

Abundance and Distribution
- NatureServe 1996; S3/N4
- Individual home ranges of kit foxes in the Great Basin of Utah are among the largest reported and have increased in the last decade, suggesting a potential decline in population density and abundance.
- Surveys found the fox was relatively more abundant in the Mojave Desert of Utah.
- Kit foxes are found in the deserts and semi-arid regions of the southwestern United States and northern and central Mexico.
- In Utah, kit foxes are found in desert regions statewide including the Great Basin, Mojave, and Colorado Plateau regions.

Little Brown Myotis (*Myotis lucifugus)*

Description
- The little brown bat is a common and widely distributed species. The bat ranges across much of North America where it uses a variety of habitats and roosts including houses and other human-made structures. Little brown bats are known to hibernate.
- Since 2008, populations in eastern North America have been decimated by white-nose syndrome and the disease continues to spread westward.

- Managed under the Utah Bat Conservation Plan.[174]

Abundance and Distribution

- NatureServe 2012; S4/N3
- Little brown bats are currently common and abundant in Utah.
- Possibly found statewide, but unreported from parts of northwestern, southwestern, and south-central Utah.

[a Race of the] Montane Vole (*Microtus montanus rivularis*)

Description

- *Microtus montanus rivularis* is known as the Virgin River montane vole, and is a small rodent with small ears. Montane voles are herbivores, eating grasses, roots, and other plant material.
- The preferred habitats of the montane vole are meadows and fields in mountain valleys.
- Further work is needed to determine the taxonomic validity of this subspecies.

Abundance and Distribution

- NatureServe 1996; SH/N2
- *M. m. rivularis* traditionally has been considered to be geographically restricted to a small area in extreme southwestern Utah; however, specimens from all published localities other than the type locality (St. George) have been assigned by various authors to other subspecies (e.g., *M. m. micropus*, *M. m. nanus*, and *M. m. nexus*, a synonym of *M. m. nanus*) or have been considered intergrades.

Preble's Shrew (*Sorex preblei*)

Description

- One of the rarest of American shrews. Almost nothing is known concerning its natural history, including its diet, reproduction, ontogeny, predators, habits, and behavior.

Abundance and Distribution

- NatureServe 1996; S2/N4
- Short and long-term trends are unknown.
- Although *S. preblei* is known in Utah from only three localities in the northwestern part of the state (Tooele and Box Elder counties), both its distribution in neighboring states and its ecology suggest that it may occur in almost any part of Utah except the extreme southwestern corner.

Pygmy Rabbit (*Brachlylagus idahoensis*)

[174] Oliver, G., K. Hersey, A. Kozlowski, K. Day, and K. Bunnell. 2009. Utah bat conservation plan. Utah Division of Wildlife Resources. Salt Lake City, Utah, USA.

Description

- The pygmy rabbit is the smallest of all North American rabbits and is the only one that excavates its own burrow.
- Pygmy rabbits are considered a sagebrush obligate requiring areas with tall dense sagebrush. Pygmy rabbits primarily eat sagebrush, but other vegetation is also consumed.
- A 2010 status review found that federal ESA listing was not warranted.

Abundance and Distribution

- NatureServe 2011; S3/N4
- Population status is unknown, but it is likely that while current distribution is similar to historical range, abundance has decreased.
- The range includes most of the Great Basin and some of the adjacent intermountain areas of Idaho, Utah and Wyoming, as well as a disjunct population in Washington.
- Utah's known pygmy rabbit distribution can be divided into 5 core areas that appear geographically separated from each other: Rich County; Box Elder County; Ibapah Valley; Southern Great Basin; and valleys of the Sevier and Awapa Plateaus.

Spotted Bat (*Euderma maculatum*)

Description

- Spotted bats are relatively large insectivorous bats with large pink ears and three distinctive white spots on its black back.
- This bat has been found across elevations and in at least 23 land cover types.
- The spotted bat is associated with cliffs and rocky escarpments, where it roosts in cracks and crevices, probably singly or in small groups. Wintering habits are unknown.
- Managed under the Utah Bat Conservation Plan.[175]

Abundance and Distribution

- NatureServe 1996; S3/N3N4
- Though distributed throughout much of the west, spotted bat records are rare when compared to most other bat species. There is no reliable information on population status.
- This species is likely present statewide, although it is most prevalent in the extreme southern portions of Utah.

Townsend's Big-Eared Bat (*Corynorhinus townsendii*)

Description

- A medium-sized bat with very large ears. This bat preys primarily on moths.

[175] Oliver, G., K. Hersey, A. Kozlowski, K. Day, and K. Bunnell. 2009. Utah bat conservation plan. Utah Division of Wildlife Resources. Salt Lake City, Utah, USA.

- Townsend's big-eared bats use caves and mines year- round both for maternity colonies and hibernacula.
- Managed under the Utah Bat Conservation Plan.[176]

Abundance and Distribution

- NatureServe 2012; S4/N3N4
- Townsend's big-eared bats are generally rare, although they may be locally common near appropriate roosting habitat.
- The species is found throughout the state in a wide variety of habitats, but is closely tied to caves and abandoned mines for both hibernation and maternity roosts.

Utah Prairie Dog (*Cynomys parvidens*)

Description

- The Utah prairie dog is one of three species of white-tailed prairie dogs in the United States and is the western-most member of the genus *Cynomys*.
- The Utah prairie dog prefers arid grasslands, but can also be found in desert rangelands, sagebrush steppes and edges of Ponderosa pine stands, as well as agricultural fields and urban areas.
- ESA-listed as threatened since 1984. A 2014 court ruling restricted federal management authority to federally-owned lands.
- Managed according to the USFWS recovery plan[177] and Utah Division of Wildlife Resources Statewide Utah Prairie Dog Management Plan (2015).

Abundance and Distribution

- NatureServe 2013; S2/N2
- Spring counts from the past 30 years show considerable annual fluctuations, but stable to increasing long-term trends in adult Utah prairie dog numbers. Range-wide counts were as high as 11,349 in 2013. Spring counts and population estimates do not provide an accurate population census but are indicative of long-term trends.
- Utah prairie dogs are endemic to Utah and are limited to the central and southwestern quarter of the state in Beaver, Garfield, Iron, Kane, Piute, Sevier, and Wayne counties.

Western Red Bat (*Lasiurus blossevillii*)

[176] Oliver, G., K. Hersey, A. Kozlowski, K. Day, and K. Bunnell. 2009. Utah bat conservation plan. Utah Division of Wildlife Resources. Salt Lake City, Utah, USA.

[177] U.S. Fish and Wildlife Service. 2012. Utah Prairie Dog *(Cynomys parvidens)* Revised Recovery Plan. U.S. Fish and Wildlife Service, Denver, CO.

Description
- The red bat is a solitary species with distinctive reddish fur.
- The species roosts in the foliage of deciduous trees, with most records from riparian areas.
- Presumed migratory.
- Managed under the Utah Bat Conservation Plan.[178]

Abundance and Distribution
- NatureServe 2005; SU/N3
- An extremely rare species with less than 20 confirmed records from Utah.
- The western red bat can be found in western Canada, the western United States, western Mexico and Central America.
- The historical records in Utah occur in a north–south band from extreme north-central Utah to the extreme southwest. Recent acoustic records, and a capture, have expanded the known range.

White-tailed Prairie Dog (*Cynomys luecurus*)

Description
- A colonial species that uses a variety of grasslands and shrublands throughout its range.
- They spend much of their life underground and will enter hibernation during the winter and aestivation during summer when temperatures are high and/or food is limited.
- Found not warranted for ESA listing in 2010.
- Managed according to Utah Gunnison's prairie dog and white-tailed prairie dog conservation plan.[179]

Abundance and Distribution

- NatureServe 1996; S3/N4
- White-tailed prairie dogs are widely distributed and abundant within their range in Utah. Occupancy has remained relatively stable since 2008 survey efforts.
- White-tailed prairie dogs are found in eastern Utah, northwestern Colorado, Wyoming, and a small area in southern Montana. Though the species' current range is similar to its historic range, there is evidence that the species abundance has declined as a result of control efforts and plague.
- In Utah active colonies are found in Rich, Summit, Daggett, Uintah, Duchesne, Carbon, Emery, and Grand Counties with 473,843 ha considered suitable for prairie dogs.

Wolverine (*Gulo gulo*)

[178] Oliver, G., K. Hersey, A. Kozlowski, K. Day, and K. Bunnell. 2009. Utah bat conservation plan. Utah Division of Wildlife Resources. Salt Lake City, Utah, USA.
[179] Lupis, S. G., K. D. Bunnell, T. A. Black, and T. A. Messmer. 2007. Utah Gunnison's prairie dog and white-tailed prairie dog conservation plan: Draft #5. Utah Division of Wildlife Resources, Salt Lake City, Utah.

<u>Description</u>

- The wolverine is the largest terrestrial member of the weasel family. It has a dark stocky body with short legs, a rounded head, and whitish markings unique to each individual.
- In North America, wolverines traverse large home ranges within a wide variety of habitats, primarily boreal forests, tundra, and western mountains. Some research has tied wolverines to persistent spring snowpack.
- A proposal to ESA-list wolverines as threatened was withdrawn in 2014.

<u>Abundance and Distribution</u>

- NatureServe 2006; S2/N4
- Uncertain if they are resident. Regardless, wolverines are very rare in Utah; a photographic "capture" on the North Slope of the Uinta Mountains in 2014 was the first confirmed evidence in 30 years.
- In the contiguous United States, population estimates are 250-300 animals. Found primarily in the mountains of Montana, Idaho, and Wyoming.

Mollusks

Bear Lake Springsnail (*Pyrgulopsis pilsbryana*)

Description

- Small springsnail found in springs and streams.
- 3.5-4 mm in diameter with 5 whorls.

Abundance and Distribution

- NatureServe 2000; S1/N2
- Found only in springs and streams around Bear Lake.
- Surveys have been conducted at one of the three known Utah populations, and that population was still extant.

Bifid Duct Pyrg (*Pyrgulopsis peculiaris*)

Description

- Springsnail found in isolated desert springs.
- Less than 3 mm in diameter with 4.5-5 whorls.
- Petitioned for federal ESA listing 2009. Substantial 90-day finding in 2011. A status review is pending to determine if species will be federally listed.

Abundance and Distribution

- NatureServe 1999; S1/N2
- Recent surveys of five of the six Utah populations documented those populations were extant, and three were found to be abundant.

Black Canyon Pyrg (*Pyrgulopsis plicata*)

Description

- Springsnail endemic to one spring complex in Utah.
- Less than 3 mm in diameter with 4-4.5 whorls.

Abundance and Distribution

- NatureServe 1999; S1/N1
- Recent surveys have documented the single population is still extant.

Brian Head Mountainsnail (*Oreohelix parawanensis*)

Description

- Terrestrial snail, 5-10 mm in diameter.
- 2010 FWS 90-day finding determined that federal listing was not warranted.

Abundance and Distribution

- NatureServe 2004; S1/N1
- A Utah endemic species. Populations have not been recently verified.

California Floater (*Anodonta californiesis*)

Description

- Freshwater mussel. Greater than 70 mm in diameter. Larvae require gravel and rocky substrate in fast flowing water. Adults require mud, silt, or fine sand substrates in quiet areas.
- Limited mobility and thin shells result in sensitivity to habitat changes.
- Fish are needed as a host during a portion of the life cycle; however, the degree of host specificity is unknown.

Abundance and Distribution

- NatureServe 1998; S2/N3
- Surveys in the last 10 years have documented additional populations and no new losses of populations.

Carinate Glenwood Pyrg (*Pyrgulopsis inopinata*)

Description

- Only Utah springsnail with a carinate or angled shell.
- 3 mm in diameter and 5 whorls.

Abundance and Distribution

- NatureServe 1999; S1/N1
- Native only to two springs in Utah. Recent surveys of one of the populations documented it to be extant.

Cloaked Physa (*Physa megalochlamys*)

Description

- Freshwater snail. Best identified alive, when its gills extend from its shell. Physa species cannot be distinguished by their shells alone. Cone shaped shell with glossy appearance, up to 11 mm.

Abundance and Distribution

- NatureServe 2003; S1?/N3
- Found primarily in marshes and ponds with seasonally fluctuating water levels.

Coarse Rams-horn (*Planorbella binneyi*)

Description

- Large freshwater snail with wide whorls.
- Diameter up to 36 mm.

Abundance and Distribution

- NatureServe 2008; SH/N3N4
- 11 reported locations in Utah. Utah populations have not been recently verified.

Cross Snaggletooth (*Gastrocopta quadridens*)

Description

- Terrestrial snail.

Abundance and Distribution)

- NatureServe 2004; SH/N2N3
- Two records from Utah. Utah populations have not been recently verified.

Deseret Mountainsnail (*Oreohelix peripherica*)

Description

- Terrestrial snail. Shell appears wrinkled.
- 23-29 mm in diameter.
- Former subspecies *O.p. wasatchensis* was a candidate for listing. Removed from candidate list in 2008 when genetic analysis determined it was not a valid subspecies or other listable entity.

Abundance and Distribution

- NatureServe 2002; S2/N2
- Multiple locations primarily in northern Utah. Populations have not been recently verified.

Desert Springsnail (*Pyrgulopsis deserta*)

Description

- Spring obligate.
- 1.2-2.5 mm long with roughly 4 whorls.

Abundance and Distribution

- NatureServe 1999; SH/N2
- Surveys conducted in 2013 verified one extant population in Utah, on an urban golf course – Heritage rank needs to be updated to account for this.
- Native only to the Virgin River drainage.

Desert Tryonia (*Tryonia porrecta*)

Description

- Freshwater snail with disjunct range. Long shell 10 mm with 7-8 whorls.
- Shell often has ridges or ribs.

Abundance and Distribution

- NatureServe 2000; S2?/N2
- Reported from Bonneville Basin in Utah – Juab and Tooele Counties.

Eureka Mountainsnail (*Oreohelix eurekensis*)

Description

- Terrestrial snail. 9-10 mm in diameter with 4.5 whorls.

Abundance and Distribution

- NatureServe 2002; S1/N1
- A Utah endemic species. Populations have not been recently verified.

Fat-whorled Pondsnail (*Stagnicola bonnevillensis*)

Description

- Freshwater snail found in spring outflows. Requires warm and stable water temperatures.
- Less than 30 mm long with 4 whorls.
- Removed from ESA Candidate list in 2009.
- Draft Conservation Plan[180] developed to work with landowner to address the threats.

Abundance and Distribution

- NatureServe 2013; S3/N3
- Remnant species of ancient Lake Bonneville. Known from five locations in Utah.

[a species of] Fossaria (*Fossaria techella*)

Description

- Freshwater snail.
- Taxonomy is uncertain and distribution is disjunct. May be a subspecies of Prairie Fossaria.

Abundance and Distribution

- NatureServe 2000; SH/N3N4
- Three reported locations in Utah. Utah populations have not been recently verified.

[180] UDWR. 2005. Fat-Whorled Pondsnail Conservation Plan –Draft 3. Utah Division of Wildlife Resources. 2005.

Green River Pebblesnail (*Fluminicola coloradoensis*)

Description

- Freshwater snail. Larger than springsnails at 7-9 mm long with 4-5 whorls. Teardrop-shaped shell.

Abundance and Distribution

- NatureServe 2005; S2S3/N2N3
- Endemic to the upper Green River of Wyoming, Idaho, and Utah. Little is known about populations in Utah.

Hamlin Valley Pyrg (*Pyrgulopsis hamlinensis*)

Description

- Springsnail. Less than 2 mm long.
- Petitioned for federal ESA listing 2009. Substantial 90-day finding in 2011. A status review to determine if species will be federally listed is pending, as of March 2015.

Abundance and Distribution

- NatureServe 1999; S1/N1
- Endemic to one spring complex in Utah.
- Multiple surveys have documented a stable and locally abundant population.

Kanab Ambersnail (*Oxyloma haydeni kanabense*)

Description

- Semi-aquatic snail. 17-23 mm long.
- Fragile, translucent, amber-colored shell.

Abundance and Distribution

- NatureServe 2002; S1/N1
- Additional populations have been documented in Utah. Recent genetic work[181] indicates that Kanab ambersnail is not a distinct taxon.
- Federally listed as Endangered since 1991.
- Managed under federal recovery plan[182].

---

[181] Culver, M., Herrmann, H., Miller, M., Roth, B., and Sorenson, J. 2013. Anatomical and genetic variation of western *Oxyloma* (Pulmonata: Succineidae) concerning the endangered Kanab ambersnail (*Oxyloma haydeni kanabense*) in Arizona and Utah: U.S. Geological Survey Scientific Investigations Report, 2013–5164, 66 p., http://pubs.usgs.gov/sir/2013/5164/.

[182] U.S. Fish and Wildlife Service. 1995. Kanab ambersnail (*Oxyloma haydeni kanabensis*) recovery plan. U.S. Fish and Wildlife Service, Denver, Colorado.

Lamb Rams-horn (*Planorbella oregonensis*)

Description

- Aquatic snail.

Abundance and Distribution

- NatureServe 2005; SH/N1
- The sole Utah record is questionable, possibly based on a misidentification before 1947.
- No actions are planned to reintroduce this species to Utah. Not sure if it is native. One historic reported location in Utah, in Tooele County on the Nevada border.

Longitudinal Gland Pyrg (*Pyrgulopsis anguina*)

Description

- Springsnail. 2-3.5 mm long with 3-5 whorls.
- Petitioned for federal ESA listing 2009. Substantial 90-day finding in 2011. A status review to determine if species will be federally listed is pending as of March 2015.

Abundance and Distribution

- NatureServe 1999; S1/N1
- Known from only two locations. One in Utah, one in Nevada.
- Multiple surveys of the Utah population indicate that it is abundant and stable.

Lyrate Mountainsnail (*Oreohelix haydeni*)

Description

- Terrestrial snail with sharp, spiral ribs. 18-23 mm in diameter.

Abundance and Distribution

- NatureServe 2002; S2/N2N3
- Multiple locations primarily in northern Utah.

Mill Creek Mountainsnail (*Oreohelix howardi*)

Description

- Terrestrial snail.

Abundance and Distribution

- NatureServe 2002; SH/N1
- Utah endemic species. Populations have not been recently verified.

Mitered Vertigo (*Vertigo concinnula*)

Description

- Terrestrial snail. Chestnut brown, shiny appearance. 2 mm in diameter, 5 whorls.

Abundance and Distribution

- NatureServe 2010; SH/N4
- Seven historic records from Utah. Utah populations have not been recently verified.

Montane Snaggletooth (*Gastrocopta pilsbryana*)

Description

- Terrestrial snail. 2.1 mm in diameter, 5 whorls.

Abundance and Distribution

- NatureServe 2004; SH/N4N5
- Two historic records from southern Utah. Utah populations have not been recently verified.

Mountain Marshsnail (*Stagnicola montanensis*)

Description

- Freshwater snail. Requires pristine cold water springs.

Abundance and Distribution

- NatureServe 2008; SH/N3
- Utah populations have not been recently verified.

Ninemile Pyrg (*Pyrgulopsis nonaria*)

Description

- Springsnail. 2.5-2.9 mm long, 4.5-5 whorls

Abundance and Distribution

- NatureServe 1999; S1/N1
- Found in 2 locations in Utah. Recent surveys at 1 of the 2 populations have documented its continued presence.

Northwest Bonneville Pyrg (*Pyrgulopsis variegata*)

Description

- Springsnail. Primarily inhabits rheocrene springs that flow from a defined opening into a confined channel. 2.2-3 mm, 4.25-5 whorls.

Abundance and Distribution

- NatureServe 1999; S1/N2
- Occurs in eight locations in Utah. Surveys have been conducted at seven of the populations; six were documented to be extant and five were deemed to be in good condition.

Otter Creek Pyrg (*Pyrgulopsis fusca*)

Description

- Springsnail. 2.4-4.5 mm long, 4.25-5.25 whorls.

Abundance and Distribution

- NatureServe 2000; S1/N1
- Found in three springs in Utah. Recent surveys of one of the populations documented it to be extant.

Ribbed Dagger (*Pupoides hordacus*)

Description

- Terrestrial snail.

Abundance and Distribution

- NatureServe 2004; SH/N4
- Three historic records in Utah. Utah populations have not been recently verified.

Rocky Mountain Duskysnail (*Colligyrus greggi*)

Description

- Freshwater snail. Clear to white shell. 1.7-3.3 mm with 3.75-4.5 whorls.
- In Utah, inhabits spring brooks that flow from rheocrene springs. Elsewhere, a stream or river animal.

Abundance and Distribution

- NatureServe 2004; S1/N4
- Recent surveys have documented additional populations in Utah.

Rustic Ambersnail (*Succinea rusticana*)

Description

- Terrestrial snail with elongate shell.

Abundance and Distribution

- NatureServe 2003; SH/N2N3

- Multiple historic locations in northern Utah. Populations have not been recently verified.

Sierra Ambersnail (*Catinella stretchiana*)

Description
- Terrestrial snail.

Abundance and Distribution
- NatureServe 2002; SH/N3
- Historic locations primarily in northern Utah. Populations have not been recently verified.

Sluice Snaggletooth (*Gastrocopta ashmuni*)

Description
- Terrestrial snail.

Abundance and Distribution
- NatureServe 2005; SH/N4N5
- One record from Zion National Park in Utah. Utah populations have not been recently verified.

Southern Bonneville Springsnail (*Pyrgulopsis transversa*)

Description
- Freshwater springsnail. 2-3.1 mm long with 4.25-5.25 whorls.

Abundance and Distribution
- NatureServe 1999; S1/N2
- Found in six spring habitats in Utah. Recent surveys at three populations have documented extant populations.

Southern Tightcoil (*Ogaridiscus subrupicola*)

Description
- Terrestrial snail. 3-4 mm in diameter.

Abundance and Distribution
- NatureServe 2005; SH/N1
- Three widely disjunct locations nationally. Known from one cave in Utah, and likely extirpated by mining and quarrying.

Smooth Glenwood Pyrg (*Pyrgulopsis chamberlini*)

Description

- Freshwater springsnail. 2.3-4.3 mm long, 4.5-6 whorls.

Abundance and Distribution

- NatureServe 1999; S1/N1
- Found only in two springs in Utah.
- Surveys were conducted in 2013 and the population was found extant.

Striate Gem (*Hawaiia neomexicana*)

Description

- Terrestrial snail.

Abundance and Distribution

- NatureServe 2004; SH/N2
- Three reported locations in Utah. Utah populations have not been recently verified.

Sub-globose Snake Pyrg (*Pyrgulopsis saxatilis*)

Description

- Springsnail endemic to one warm spring.
- Petitioned for federal ESA listing 2009. Substantial 90-day finding in 2011. A status review to determine if species will be federally listed is pending, as of March 2015.

Abundance and Distribution

- NatureServe 1999; S1/N1
- Multiple surveys have documented stable population.

Thin-lip Vallonia (*Vallonia perspectiva*)

Description

- Terrestrial snail. White to colorless shell. 2 mm wide.

Abundance and Distribution

- NatureServe 2002; SH/N4N5
- Utah records from Washington and Garfield Counties. Utah populations have not been recently verified.

Top-heavy Column (*Pupilla syngenes*)

Description

- Terrestrial snail. Cylindrical shell wider at top than bottom. 8 whorls.

Abundance and Distribution

- NatureServe 2002; S3S4/N4
- Very little is known about historic and current occurrences in Utah.

Utah Physa (*Physella utahensis*)

Description

- Freshwater snail found in creeks, springs, and spring brooks. Glossy shell up to 14 mm long.
- Mostly inhabits rocky substrates.

Abundance and Distribution

- NatureServe 1999; S1/N2
- Two known locations in Utah. One population is monitored annually and an agreement is in place with the landowner to protect habitat.

Western Pearlshell (*Margaritifera falcata*)

Description

- Large (>80 mm) freshwater mussel inhabiting perennial rivers and streams at depths of 1.5 to 5 feet. Can live more than 100 years.
- Requires cold, clear, well-oxygenated habitat with coarse substrates. Larval stage requires a specific fish host, primarily native salmonids, especially cutthroat trout.

Abundance and Distribution

- NatureServe 1998; S1/N4
- Thought to have been extirpated from Utah, until its rediscovery in 2009. Since then, populations have been documented in five Utah locations.

Wet-rock Physa (*Physella zionis*)

Description

- Freshwater snail. Found only in seeps and hanging gardens in narrow sandstone canyons. Glossy egg-shaped shell. 4.5 mm long, 2.5 whorls.

Abundance and Distribution

- NatureServe 2002; S1/N1
- Restricted to about 3 miles of canyon, all within Zion National Park.

Widelip Pondsnail (*Stagnicola traski*)

Description

- Freshwater snail with short spire and rotund body whorl.

Abundance and Distribution

- NatureServe 2008; SH/N3
- Utah populations have not been recently verified.

[a race of the] Yavapai Mountainsnail (*Oreohelix yavapai cummingsi*)

Description

- Terrestrial snail. 12-14 mm in diameter.

Abundance and Distribution

- NatureServe 2004; S1/N3
- All Utah records are from the Navajo Nation.

.

Reptiles

Black-necked Gartersnake (*Thamnophis cyrtopsis*)

Description

- Paired black blotches on head. 16-46 inches total length.
- Primarily feeds on amphibians.

Abundance and Distribution

- NatureServe 2005; S1/N5
- All Utah records were considered historic, until rediscovery in 2009.
- In Utah, restricted to riparian situations in SE portion of the state. Uncertain if the species is merely cryptic, or truly rare in Utah.

Desert Night Lizard (*Xantusia vigilis*)

Description

- Olive, grey, or dark brown with black speckles. 1.5-2.75 inches total length.
- Mainly associated with Joshua trees. Long-lived, with a very low reproductive rate. Bears live young.

Abundance and Distribution

- NatureServe 1996; S2/N5
- Found in arid habitats in SW US. Patchy, very restricted distribution in southern Utah, more continuous elsewhere in the Mojave Desert.

Gila Monster (*Heloderma suspectum*)

Description

- Large venomous lizard with beadlike scales and contrasting pattern of orange and black. Total length 9-14 inches.
- Feed on eggs, nestling, or juveniles of small mammals, birds, and reptiles.
- In 2011, a petition to list the Utah population of Gila monster was found to be not warranted[183].

Abundance and Distribution

- NatureServe 1996; S2/N4
- In Utah, restricted to SW corner of the state.

Many-lined Skink (*Plestiodon multivirgatus*)

Description

- Short limbs with many dark and light lines on its body. 2.25-3 inches total length.

[183] http://www.gpo.gov/fdsys/pkg/FR-2011-06-21/pdf/2011-15399.pdf#page=1 accessed February 17, 2015.

- A relatively arid-adapted skink, but most readily detected near moist microhabitats. Often associated with burrow systems and surface cover (e.g., leaf litter, rocks, logs).

Abundance and Distribution
- NatureServe 1996; S1/N5
- In Utah, restricted to a few locations, all in San Juan County. Additional locations have been documented anecdotally, but need to be authenticated.

Midget Faded Rattlesnake (*Crotalus oreganus concolor*)

Description
- A dwarf subspecies of Western Rattlesnake, rarely exceeding 30 inches total length. Adults often have a reduced pattern, sometimes appearing unicolored.
- Very potent venom.

Abundance and Distribution
- NatureServe 2005; SNR/N4
- Restricted to Green River Basin of eastern Utah, western Colorado, and extreme SW Wyoming.

Mojave Desert Tortoise (*Gopherus agassizii*)

Description
- Long-lived species with high domed shell. 8-15 inches carapace length.
- Listed as federally threatened in 1990.
- Managed under Recovery Plan (2011[184]).

Abundance and Distribution
- NatureServe 1996; S2/NNR
- Restricted to Mojave Desert in Utah, found only in the SW corner of the state.
- Declines in tortoises have been reported in Utah.

Pyro Mountain Kingsnake (*Lampropeltis pyromelana*)

Description
- Red, black, and white banded. 18-42 inches total length.
- Occurs in rocky terrain, frequently in canyons at intermediate elevations.

Abundance and Distribution
- NatureServe 1996; S3/N5

[184] U.S. Fish and Wildlife Service. 2011. Revised recovery plan for the Mojave population of the desert tortoise (*Gopherus agassizii*). U.S. Fish and Wildlife Service, Pacific Southwest Region, Sacramento, California.

- Secretive species with patchy distribution. Recent discoveries are expanding the known range in isolated Great Basin mountain ranges of western Utah.

Smith's Black-headed Snake (*Tantilla hobartsmithi*)

Description
- Secretive nocturnal species that spends much of its time under cover. 5-15 inches total length.
- Most frequently found under rocks when soil moisture is adequate. Also occasionally found on roads at night.
- Primarily eats invertebrates.

Abundance and Distribution
- NatureServe 1996; S3/N5
- In Utah, mainly documented from the southern, low-elevation part of the state, thence northward up the Green / Colorado drainage. Recently discovered in lower Price River drainage, Emery County.

Spotted Leaf-nosed Snake (*Phyllorhynchus decurtatus*)

Description
- Small, exceptionally secretive, nocturnal species that spends much of its time underground. Specialized scale on nose aids burrowing in loose soils. 12-20 inches total length.
- Primarily eats lizards and their eggs.
- Before an adequate survey technique was discovered, was thought to be one of the rarest American snakes. Now believed to be widespread and abundant in warm deserts of the west.

Abundance and Distribution
- NatureServe 1996; S1/N5
- In Utah, known from only one record in the extreme SW corner of the state.

Utah Banded Gecko (*Coleonyx variegates utahensis*)

Description
- Inhabits rocky areas of desert shrubland and pinyon-juniper communities.
- Excellent climber that can consume larger invertebrate prey.

Abundance and Distribution
- NatureServe 2005; S3/N4
- In Utah, restricted to SW corner of the state.

Utah Milksnake (*Lampropeltis triangulum taylori*)

Description

- Bands or saddles of red or orange bordered by black and separated by narrower white or yellow spaces. 14-30 inches total length.
- Constricts prey – small terrestrial vertebrates.

Abundance and Distribution

- NatureServe 1996; S3/N4
- Occurs in a wide range of habitats in Utah.
- Recent surveys and data from public have documented many additional locations in Utah.
- Recent genetic work[185] lumps several formerly-recognized western milksnake subspecies into a distinct species, *Lampropeltis gentilis*. Utah milksnake may not be a distinct taxon.

Western Threadsnake (*Rena humilis*)

Description

- A tiny, secretive species which spends nearly all of its time underground. Occasionally found under surface objects when soil moisture is adequate. Also occasionally found on roads at night.
- Eats ants and termites, and their larvae.

Abundance and Distribution

- NatureServe 1996; S3/N5
- In Utah, restricted to SW corner of the state.

185 Ruane, S., R. Bryson, Jr., R.A. Pyron, & F.T. Burbrink. 2013. Coalescent species delimitation in Milksnakes (genus *Lampropeltis*) and impacts on phylogenetic comparative analyses. Systematic Biology DOI:10.1093/sysbio/syt099.

Creating the 2015 Utah Wildlife Action Plan Key Habitats List

Among the eight required elements of a State Wildlife Action Plan, the second element calls for describing the extent and condition of Key Habitats and community types essential to the conservation of Species of Greatest Conservation Need. The word "extent" here refers to location or geographic distribution within the state, along with amount of areal coverage – both of which can be represented via maps and associated tables.

A WAP Habitats Subteam was formed to undertake this task; this Subteam is referred to as "we" in the remainder of this Appendix. To meet the Element 2 requirement, we first needed to identify a full inclusive set of all Habitats for the whole state of Utah, from which we would then draw the subset of *Key* Habitats. Given low resources and short timeframe, we opted to evaluate several existing sets of Habitats, and select the one best suited to the purpose of describing both their extent and condition.

We evaluated four existing sets of habitats according to eight selection factors. Table 1 shows these existing habitat sets and selection factors, along with the evaluation results.

Table 1. Factors for selecting a full set of habitats to use as the basis for identifying 2015 WAP Key Habitats in Utah.

	Existing Habitat Sets			
Selection Factors	2005 Utah WAP	Southwest Re-GAP	LANDFIRE BpS+VegClass	NRCS Ecological Site
Habitat names and definitions (concepts) are consistent or standardized throughout Utah and beyond – at least throughout surrounding states, and (better yet) regionally or nationally.	↓	↑	↑	↑
Types of habitats (classification units) within the set are mutually-exclusive: they do not overlap in concept.	↑	↑	↑	↑
Types of habitats within the set are comprehensive: every acre in Utah can be assigned to a type of habitat (some will be non-natural, e.g., urban, agriculture, etc.).	↑	↑	↑	↓
The number of habitats within the set, which is related to how finely or coarsely they are defined, is considered appropriate for the whole-state scope of the WAP.	↑	↔	↔	↓
The habitats are definable, have broad support and utility (management-usefulness), and match or can be cross-walked with habitat schemes of major partners.	↑	↔	↔	↓
Habitat data for the set exist in spatial format: maps of habitat locations can be made.	↑	↑	↑	↔
Habitat spatial data for the set cover all of Utah border-to-border, and are consistent throughout that range.	↑	↑	↑	↓
Habitats and their spatial data allow for the assessment of the habitats' **condition**, both current and future, at all locations/ occurrences within Utah (without extensive fieldwork).	↓	↓	↑	↓

Key to Arrows: ↑ = Habitat set meets factor well. ↓ = Habitat set meets factor poorly or not at all.

↔ = Habitat set meets factor neither well nor poorly.

Included among the eight selection factors in Table 1 are concepts from the AFWA Best Practices for Wildlife Action Plans, such as multistate usage and consistent terminology. Then toward the bottom of Table 1 are specific factors related to:

- extent of habitats – their data must be in spatial format and cover Utah consistently border to border statewide; and
- condition of habitats – both current and future condition, the ability to detect change over time.

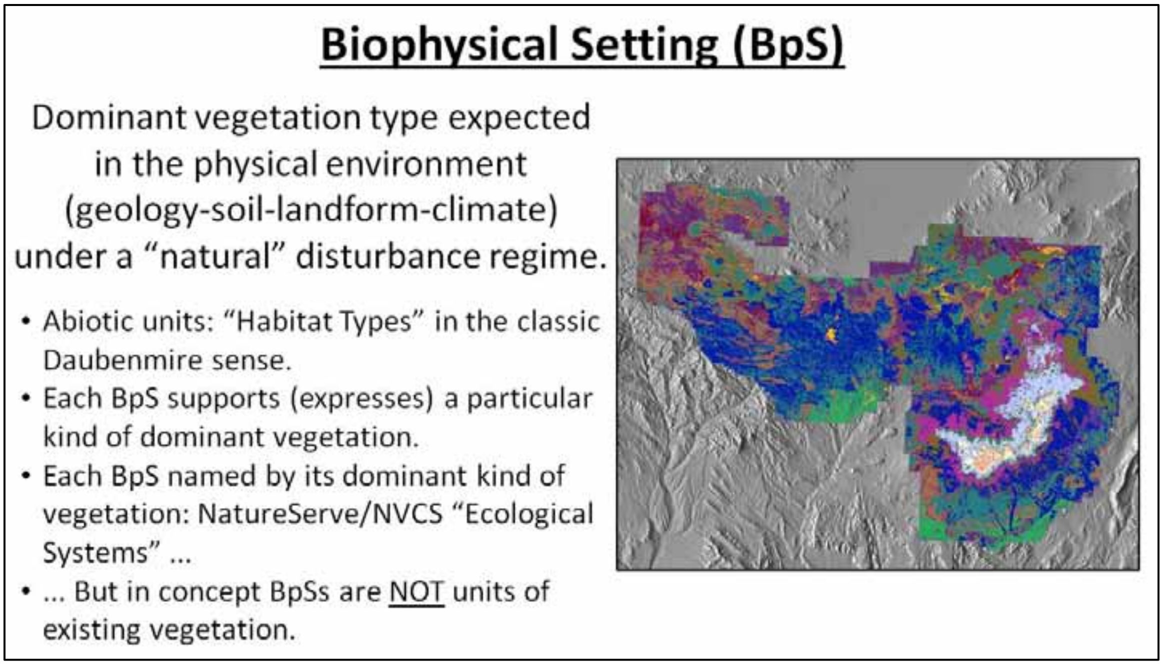
The arrows in Table 1 show the results of our evaluation: up-arrows mean the existing data set meets the factor well, down-arrows mean the set meets the factor poorly or not at all, and sideways arrows mean the set neither meets the factor well or poorly and would be considered somewhere in the middle. Among the four candidate existing habitat data sets, only LANDFIRE has all of the selection-factor arrows either up or sideways, i.e., it has no serious flaws from the perspective of our selection criteria. All other candidate data sets have at least one serious flaw (down-arrow). And for the selection factor that assesses condition of Habitats (bottom row in table), LANDFIRE is the only data set that was adequate, in our judgment, for the whole state and everywhere in the state.

Because LANDFIRE is the only existing set of habitat data that meets all selection factors well or neutrally, we decided to use LANDFIRE data as the basis for defining the full set of Habitats from among which the Key Habitats were later identified. From the LANDFIRE website (http://www.landfire.gov/), we downloaded certain data products for the entire state of Utah using the LF 2010 version (LF_1.2.0) of the data. Specifically, for determining both extent and condition of habitats, we obtained two LANDFIRE data products shown in the "LANDFIRE" column heading in Table 1:

- Biophysical Setting (abbreviated as BpS), and
- Vegetation Class (abbreviated as Veg Class), though LANDFIRE refers to it as Succession Class.

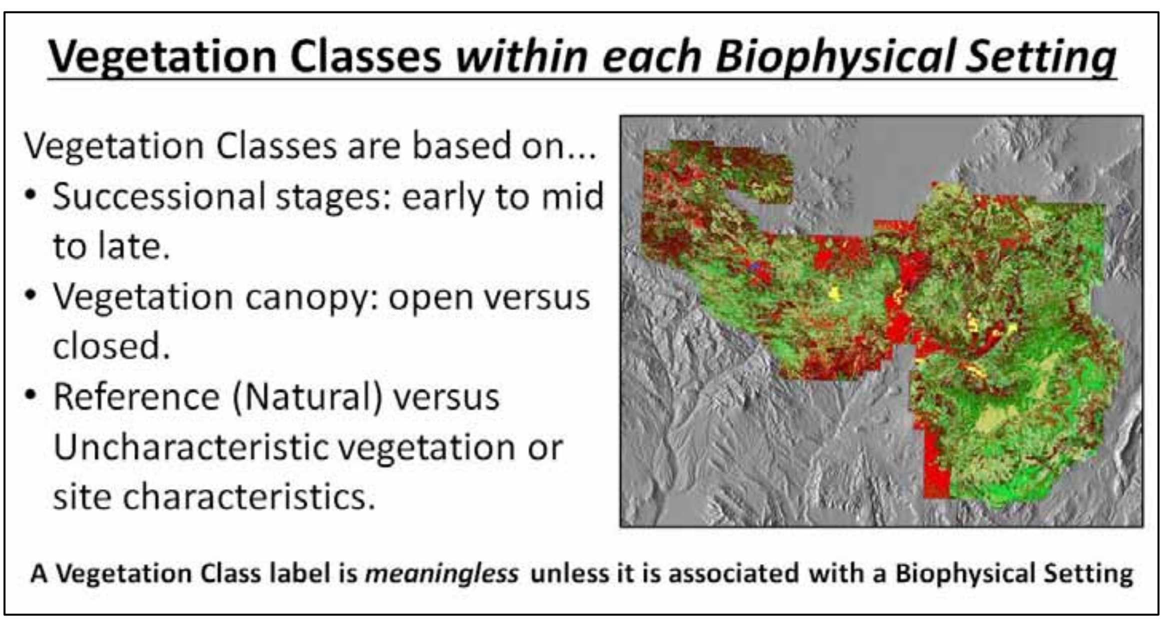
Definitions of these two data products – Biophysical Setting and Vegetation Class – appear below in Figures 1 and 2.

Figure 1. Definition of the LANDFIRE concept of Biophysical Setting (BpS).



The most important points in Figure 1 are that Biophysical Settings are physical, abiotic units; they each express a particular dominant type of vegetation, but inherently Biophysical Settings are NOT units of existing vegetation. The Map included in Figure 1, in this case of a National Forest Ranger District, demonstrates that the LANDFIRE BpS data are able to display "extent" or location of habitats.

Figure 2. Definition of the LANDFIRE concept of Vegetation Class (Veg Class).



The most important point in Figure 2 is that Vegetation Class is not an independent attribute. It has no meaning unless it is associated with a Biophysical Setting. Beyond this point, Veg Classes are usually defined by factors that include vegetation age (succession), structure, and "naturalness."

The “naturalness” factor broadly separates Veg Classes into two categories: (1) Reference (“natural”) conditions, and (2) Uncharacteristic conditions. Reference Classes generally reflect site/vegetation conditions as they were prior to European human settlement. Reference Classes are designated by the letters A, B, C, D, and E (though D/E are not always used), and generally correspond with advancing age or succession status, i.e., A→B→C→D→E = Young → Middle-Aged → Old = Early → Mid → Late Succession. Uncharacteristic Classes, designated by the letter U, reflect altered conditions resulting from post-settlement human activities, either “un-natural” disturbances or proactive management/restoration. The Uncharacteristic Class can include situations such as dominance of invasive annual grasses (e.g., cheatgrass), shrublands where the herbaceous understory is depleted, a former floodplain left high and dry because of stream-channel downcutting, or even a range/wildlife seeding with crested wheatgrass.

A Three-Step Process to Determine Extent and Condition of Key Habitats.

Using the large body of LANDFIRE data that we downloaded for the state of Utah – each 30-m pixel having both its BpS identity and its corresponding Veg Class – we followed this process:

1. Identify the Habitats in Utah that comprise the full set.

2. From among this full set, design and run a process to pick out the Key Habitats.

3. Determine the current condition of the Key Habitats.

Identifying the Habitats in Utah that Comprise the Full Set.

For Step 1, to define the full set of Habitats in Utah, we used only the Biophysical Setting data from LANDFIRE, clipped to the Utah boundary.

Table 2 presents the spreadsheet produced by having LANDFIRE export all of the Biophysical Settings and their acres within the state of Utah, with some re-formatting of the table for clarity and fit. The list in Table 2 contains 66 plausible-looking Biophysical Settings in Utah.

Table 2. LANDFIRE Biophysical Settings in Utah, including acreage and map zones of occurrence.

		BpS	LANDFIRE Map Zone						
Biophysical Setting Name — 66	**Acres**	**Code**	**13**	**15**	**16**	**17**	**22**	**23**	**24**
Barren-Rock/Sand/Clay	5,904,630	31							
Colorado Plateau Blackbrush-Mormon-tea Shrubland	2,588,191	10780			X			X	X
Colorado Plateau Mixed Low Sagebrush Shrubland	454,899	10640			X	X		X	X
Colorado Plateau Pinyon-Juniper Shrubland	86,561	11020	X		X			X	X
Colorado Plateau Pinyon-Juniper Woodland	4,505,986	10160	X	X	X	X	X	X	X
Columbia Plateau Low Sagebrush Steppe	61,533	11240				X			

Great Basin Pinyon-Juniper Woodland	802,915	10190	X	X	X	X			
Great Basin Semi-Desert Chaparral	164,316	11030	X		X	X		X	
Great Basin Xeric Mixed Sagebrush Shrubland	2,440,957	10790	X		X	X			
Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	48,298	10610	X			X	X		
Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland - High Elevation	1,197,004	10612			X			X	
Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland - Low Elevation	485,456	10611			X			X	X
Inter-Mountain Basins Big Sagebrush Shrubland	8,340,512	10800	X	X	X	X		X	X
Inter-Mountain Basins Big Sagebrush Shrubland - Basin Big Sagebrush	28,139	10801					X		
Inter-Mountain Basins Big Sagebrush Shrubland - Wyoming Big Sagebrush	265,794	10802					X		
Inter-Mountain Basins Big Sagebrush Steppe	151,006	11250	X		X	X		X	X
Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland	553,795	10620	X		X	X	X	X	
Inter-Mountain Basins Greasewood Flat	2,227,136	11530	X		X	X	X	X	X
Inter-Mountain Basins Juniper Savanna	55,012	11150	X		X	X	X	X	X
Inter-Mountain Basins Mat Saltbush Shrubland	857,734	10660					X	X	X
Inter-Mountain Basins Mixed Salt Desert Scrub	6,775,170	10810	X	X	X	X	X	X	X
Inter-Mountain Basins Montane Riparian Systems	301,965	11540	X		X	X			
Inter-Mountain Basins Montane Sagebrush Steppe	675,812	11260	X			X	X		
Inter-Mountain Basins Montane Sagebrush Steppe - Low Sagebrush	390,493	11262			X			X	
Inter-Mountain Basins Montane Sagebrush Steppe - Mountain Big Sagebrush	1,210,540	11261			X			X	
Inter-Mountain Basins Semi-Desert Grassland	331,185	11350	X	X	X	X	X	X	X
Inter-Mountain Basins Semi-Desert Shrub-Steppe	422,805	11270	X	X	X	X	X	X	X
Inter-Mountain Basins Sparsely Vegetated Systems	669,223	10010	X		X	X	X	X	X
Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland	6,067	10200				X			
Middle Rocky Mountain Montane Douglas-fir Forest and Woodland	848	11660					X		
Mogollon Chaparral	20,370	11040	X			X		X	X
Mojave Mid-Elevation Mixed Desert Scrub	365,732	10820	X	X		X		X	
North American Warm Desert Riparian Systems	9,036	11551	X						
North American Warm Desert Riparian Systems - Stringers	17,979	11552	X	X					
North American Warm Desert Sparsely Vegetated Systems	14,236	10040	X	X				X	X
Rocky Mountain Alpine Dwarf-Shrubland	20,969	10700			X				
Rocky Mountain Alpine Turf	56,963	11440			X				

Rocky Mountain Alpine/Montane Sparsely Vegetated Systems	115,164	10060			X			X	
Rocky Mountain Aspen Forest and Woodland	1,257,861	10110			X	X	X	X	X
Rocky Mountain Bigtooth Maple Ravine Woodland	481,240	10120			X	X			
Rocky Mountain Foothill Limber Pine-Juniper Woodland	12,484	10490			X		X	X	
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	564,279	11070				X		X	X
Rocky Mountain Gambel Oak-Mixed Montane Shrubland - Continuous	1,304,878	11071			X				
Rocky Mountain Gambel Oak-Mixed Montane Shrubland - Patchy	173,618	11072			X				
Rocky Mountain Lodgepole Pine Forest	170,209	10500			X		X		
Rocky Mountain Lower Montane-Foothill Shrubland	389,274	10860			X	X		X	
Rocky Mountain Lower Montane-Foothill Shrubland - No True Mountain Mahogany	8,680	10861					X		
Rocky Mountain Lower Montane-Foothill Shrubland - True Mountain Mahogany	3,158	10862					X		
Rocky Mountain Montane Riparian Systems	1,516,652	11590	X	X	X	X	X	X	X
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	1,094,839	10550			X	X	X	X	X
Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland	2,278	10560			X			X	
Rocky Mountain Subalpine/Upper Montane Riparian Systems	32,398	11600			X	X		X	
Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland	508	10570			X				
Rocky Mountain Subalpine-Montane Mesic Meadow	74,419	11450			X	X	X		
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	115,929	10870	X			X			
Sonora-Mojave Mixed Salt Desert Scrub	327	10880	X						
Sonora-Mojave Semi-Desert Chaparral	25,654	11080	X			X			
Sonoran Mid-Elevation Desert Scrub	289	10910	X						
Sonoran Paloverde-Mixed Cacti Desert Scrub	59	11090	X						
Southern Colorado Plateau Sand Shrubland	724,980	10930	X		X			X	X
Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	673,169	10510			X	X	X	X	X
Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	530,080	10520	X		X	X		X	X
Southern Rocky Mountain Montane-Subalpine Grassland	38,403	11460			X			X	
Southern Rocky Mountain Ponderosa Pine Savanna	50,015	11170			X			X	X
Southern Rocky Mountain Ponderosa Pine Woodland	769,216	10540	X		X	X	X	X	X
Wyoming Basins Dwarf Sagebrush Shrubland and Steppe	14,013	10720					X		

This list in Table 2, however, is not the full set of all habitats in Utah. These 66 Biophysical Settings are too finely-defined and numerous to be treated individually as discrete habitats for the state as a whole.

Some lumping or merging was needed. So, for simplicity and consistency, we took the habitats list from the previous 2005 Utah WAP as a starting point, made some refinements to it, and identified 23 broadly-defined, user-friendly-named units as our 2015 WAP Habitats. Table 3 presents the 23 new WAP Habitats alongside their old 2005 WAP counterparts.

Table 3. New 2015 WAP Habitats, with their counterparts from the old 2005 WAP.

New 2015 WAP Habitats	Old 2005 WAP Habitats	New 2015 WAP Habitats	Old 2005 WAP Habitats
Alpine	Alpine	Mountain Meadow	-None-
Aspen-Conifer	Aspen	Mountain Sagebrush	Shrubsteppe
Barren	Rock	Mountain Shrub	Mountain Shrub
Chaparral	Desert Oak	Pinyon-Juniper	Pinyon-Juniper
Colorado Plateau Desert Shrub	-None-	Ponderosa Pine	Ponderosa Pine
Desert Grassland	Grassland	Riparian	Lowland Riparian
Gambel Oak	Northern Oak		Mountain Riparian
Lodgepole Pine	Lodgepole Pine	Salt Desert Shrub	High Desert Scrub
Lowland Sagebrush	Shrubsteppe	Sparsely Vegetated	-None-
Mixed Conifer	Mixed Conifer	Subalpine Conifer	Sub-Alpine Conifer
Mojave Desert Shrub	Low Desert Scrub	Wet Meadow	Wet Meadow
Mountain Grassland	Grassland	Wetland	Wetland

The 23 **New 2015 WAP Habitats** in Table 3 are the full set of all habitats in Utah, but their names alone (in Table 3) are empty, without usable substance, without any possible way to determine their extent and condition, until we assign each of the narrowly-defined 66 LANDFIRE Biophysical Settings from Table 2 to its best match among the 23 broadly-defined WAP Habitats in Table 3. The resulting merger or cross-walk of Tables 2 and 3 is shown in Table 4: All 66 Biophysical Settings fit very well, or fairly well, into one of the 23 Habitats. Thus, Table 4 displays the full set of 2015 WAP Habitats (left column), with the finer-level LANDFIRE Biophysical Settings that comprise each one, along with their acreages in Utah.

Table 4. Full set of 23 Habitats in Utah, with the finer-level LANDFIRE BpSs that comprise each one.

2015 WAP Habitats — 23	Biophysical Setting Name — 66	Acres
Alpine	Rocky Mountain Alpine Dwarf-Shrubland	20,969
	Rocky Mountain Alpine Turf	56,963
Aspen-Conifer	Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	48,298
	Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland - High Elevation	1,197,004
	Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland - Low Elevation	485,456
	Rocky Mountain Aspen Forest and Woodland	1,257,861
Barren	Barren-Rock/Sand/Clay	5,904,630
Chaparral	Great Basin Semi-Desert Chaparral	164,316
	Mogollon Chaparral	20,370
	Sonora-Mojave Semi-Desert Chaparral	25,654
Colorado Plateau Desert Shrub	Colorado Plateau Blackbrush-Mormon-tea Shrubland	2,588,191
	Southern Colorado Plateau Sand Shrubland	724,980
Desert Grassland	Inter-Mountain Basins Semi-Desert Grassland	331,185
Gambel Oak	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	564,279
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland - Continuous	1,304,878
	Rocky Mountain Gambel Oak-Mixed Montane Shrubland - Patchy	173,618
Lodgepole Pine	Rocky Mountain Lodgepole Pine Forest	170,209
Lowland Sagebrush	Colorado Plateau Mixed Low Sagebrush Shrubland	454,899
	Great Basin Xeric Mixed Sagebrush Shrubland	2,440,957
	Inter-Mountain Basins Big Sagebrush Shrubland	8,340,512
	Inter-Mountain Basins Big Sagebrush Shrubland - Basin Big Sagebrush	28,139
	Inter-Mountain Basins Big Sagebrush Shrubland - Wyoming Big Sagebrush	265,794
	Inter-Mountain Basins Big Sagebrush Steppe	151,006
	Wyoming Basins Dwarf Sagebrush Shrubland and Steppe	14,013
Mixed Conifer	Middle Rocky Mountain Montane Douglas-fir Forest and Woodland	848
	Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	673,169
	Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	530,080
Mojave Desert Shrub	Mojave Mid-Elevation Mixed Desert Scrub	365,732
	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	115,929

	Sonoran Mid-Elevation Desert Scrub	289
	Sonoran Paloverde-Mixed Cacti Desert Scrub	59
Mountain Grassland	Southern Rocky Mountain Montane-Subalpine Grassland	38,403
Mountain Meadow	Rocky Mountain Subalpine-Montane Mesic Meadow	74,419
Mountain Sagebrush	Columbia Plateau Low Sagebrush Steppe	61,533
	Inter-Mountain Basins Montane Sagebrush Steppe	675,812
	Inter-Mountain Basins Montane Sagebrush Steppe - Low Sagebrush	390,493
	Inter-Mountain Basins Montane Sagebrush Steppe - Mountain Big Sagebrush	1,210,540
Mountain Shrub	Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland	553,795
	Rocky Mountain Bigtooth Maple Ravine Woodland	481,240
	Rocky Mountain Lower Montane-Foothill Shrubland	389,274
	Rocky Mountain Lower Montane-Foothill Shrubland - No True Mountain Mahogany	8,680
	Rocky Mountain Lower Montane-Foothill Shrubland - True Mountain Mahogany	3,158
Pinyon-Juniper	Colorado Plateau Pinyon-Juniper Shrubland	86,561
	Colorado Plateau Pinyon-Juniper Woodland	4,505,986
	Great Basin Pinyon-Juniper Woodland	802,915
	Inter-Mountain Basins Juniper Savanna	55,012
Ponderosa Pine	Southern Rocky Mountain Ponderosa Pine Savanna	50,015
	Southern Rocky Mountain Ponderosa Pine Woodland	769,216
Riparian	Inter-Mountain Basins Montane Riparian Systems	301,965
	North American Warm Desert Riparian Systems	9,036
	North American Warm Desert Riparian Systems - Stringers	17,979
	Rocky Mountain Montane Riparian Systems	1,516,652
	Rocky Mountain Subalpine/Upper Montane Riparian Systems	32,398
Salt Desert Shrub	Inter-Mountain Basins Greasewood Flat	2,227,136
	Inter-Mountain Basins Mat Saltbush Shrubland	857,734
	Inter-Mountain Basins Mixed Salt Desert Scrub	6,775,170
	Inter-Mountain Basins Semi-Desert Shrub-Steppe	422,805
	Sonora-Mojave Mixed Salt Desert Scrub	327
Sparsely Vegetated	Inter-Mountain Basins Sparsely Vegetated Systems	669,223
	North American Warm Desert Sparsely Vegetated Systems	14,236

	Rocky Mountain Alpine/Montane Sparsely Vegetated Systems	115,164
Subalpine Conifer	Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland	6,067
	Rocky Mountain Foothill Limber Pine-Juniper Woodland	12,484
	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	1,094,839
	Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland	2,278
	Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland	508
Wet Meadow	No corresponding LANDFIRE BpS in Utah; used acres from SW ReGAP equivalent system	117,616
Wetland	No corresponding LANDFIRE BpS in Utah; used acres from SW ReGAP equivalent system	118,803

Finally for Step 1, the full set of 23 WAP Habitats with their acreages appears in Table 5. This is how the LANDFIRE data were used to define a full set of WAP Habitats in Utah.

Table 5. New 2015 WAP Habitats, with their acreages in Utah.

2015 WAP Habitats	Acres
Alpine	77,932
Aspen-Conifer	2,988,620
Barren	5,904,630
Chaparral	210,339
Colorado Plateau Desert Shrub	3,313,171
Desert Grassland	331,185
Gambel Oak	2,042,775
Lodgepole Pine	170,209
Lowland Sagebrush	11,695,319
Mixed Conifer	1,204,098
Mojave Desert Shrub	482,009
Mountain Grassland	38,403

2015 WAP Habitats	Acres
Mountain Meadow	74,419
Mountain Sagebrush	2,338,378
Mountain Shrub	1,436,147
Pinyon-Juniper	5,450,474
Ponderosa Pine	819,231
Riparian	1,878,030
Salt Desert Shrub	10,283,171
Sparsely Vegetated	798,623
Subalpine Conifer	1,116,177
Wet Meadow	117,616
Wetland	118,803

Designing and Operating a Process to Select the Key Habitats.

Next, Step 2 of the 3-Step process was to design and run a procedure to pick out the Key Habitats from among the full set of 23 Habitats shown in Table 5. To do this, we built a multi-factor scoring "machine" or algorithm through which each of the 23 Habitats was run and received a score.

Table 6 shows five factors that were used to score each habitat, along with how score values were assigned for each factor. The five factors were purposely separated into two groups: one group with three factors based on geography and biology, on the left side of Table 6; and the second group with two factors based on possible adverse impacts, on the right side of Table 6.

Table 6. Factors in a scoring algorithm for defining Key Habitats from the full set of WAP Habitats.

"Left Side" – Based on Geography and Biology
Factors and values for scoring
I. Abundance in Utah (Quantitative)
1 – Habitat is Abundant, more than 15% of total land area
2 – Habitat is Common, between 10% and 14.9% of total land area
3 – Habitat is Uncommon, between 4% and 9.9% of total land area
4 – Habitat is Scarce, between 1% and 3.9% of total land area
5 – Habitat is Very Scarce, less than 1% of total land area
II. Number of SGCNs that Occur in the Habitat (Quantitative)
1 – 0-15 SGCNs
2 – 16-30 SGCNs
3 – 31-45 SGCNs
4 – 46-60 SGCNs
5 – 61-75 SGCNs
III. Wildlife Diversity (Qualitative, Subjective)
1 – Habitat is utilized by a small number of vertebrates and mollusks.
2 – Not used.
3 – Habitat is utilized by a moderate number of vertebrates and mollusks.
4 – Not used.
5 – Habitat is utilized by a large number of vertebrates and mollusks.

"Right Side" – Based on Possible Adverse Impacts
Factors and values for scoring
IV. Threats in Utah (Qualitative, Subjective)
1 – Habitat has low threat level.*
2 – Not used.
3 – Habitat has moderate threat level.
4 – Not used.
5 – Habitat has high threat level.
V. Value to Humans in Utah (Qualitative, Subjective)
1 – Habitat has low value to humans.
2 – Not used.
3 – Habitat has moderate value to humans.
4 – Not used.
5 – Habitat has high value to humans.

* Per estimation of scope and severity of all threat types

We then scored each of the 23 Habitats individually according to these five factors. Table 7 displays the resulting Factor scores, including summed scores for the left and right sides of the table, for each of the 23 Habitats.

Table 7. Summary table showing scores for all 23 Habitats for all 5 Factors.

	Left Side – 3 Factors				Right Side – 2 Factors		
Habitats – 23	**Factor I % of UT Area**	**Factor II # of SGCNs in Habitat**	**Factor III Wildlife Diversity**	**Sum Across I + II + III**	**Factor IV Threats in Utah**	**Factor V Value to Humans**	**Sum Across IV + V**
Alpine	5	1	1	7	1	5	6
Aspen-Conifer	3	3	5	11	5	5	10
Barren	2	4	1	7	1	1	2
Chaparral	5	1	3	9	1	1	2
Colorado Plateau Desert Shrub	3	3	3	9	3	3	6
Desert Grassland	5	2	3	10	5	3	8
Gambel Oak	4	3	3	10	1	3	4
Lodgepole Pine	5	1	1	7	1	3	4
Lowland Sagebrush	1	5	3	9	5	5	10
Mixed Conifer	4	2	3	9	3	3	6
Mojave Desert Shrub	5	2	5	12	5	1	6
Mountain Grassland	5	1	3	9	3	5	8
Mountain Meadow	5	1	3	9	5	5	10
Mountain Sagebrush	3	3	5	11	3	3	6
Mountain Shrub	4	3	3	10	1	3	4
Pinyon-Juniper	2	4	3	9	1	1	2
Ponderosa Pine	4	2	3	9	3	3	6
Riparian	4	5	5	14	5	5	10
Salt Desert Shrub	1	5	1	7	3	1	4
Sparsely Vegetated	4	2	1	7	1	1	2
Subalpine Conifer	4	2	1	7	1	3	4
Wet Meadow	5	1	5	11	5	5	10
Wetland	5	2	5	12	5	5	10

The habitat scores shown in Table 7 were the raw materials for operating the Key Habitats Algorithm: The 23 Habitats were sorted in descending order of their left-side scores – the column headed "**Sum Across I + II + III**" – and a simple two-part rule was then applied:

The 2015 Utah WAP <u>Key</u> Habitats are those that:

1. Have a Left-Side Sum-Across score of 10 or more,

   <u>OR</u>

2. Have a Left-Side Sum-Across score of 9 **<u>AND</u>** a Right-Side Sum-Across score of 10.

As shown in Table 8, the result of applying these two rules to the scores of the 23 Habitats was the selection of eleven Key Habitats. These Key Habitats appear above the bold line about mid-way down in Table 8, with yellow-highlighted cells showing the scores that met the two-part rule above.

Table 8. Operation of the algorithm to select Key Habitats from among the full set of 23 Habitats.

	Left Side				Right Side		
Habitat	**Factor I % of UT Area**	**Factor II # of SGCNs in Habitat**	**Factor III Wildlife Diversity**	**Sum Across I + II + III**	**Factor IV Threats in Utah**	**Factor V Value to Humans**	**Sum Across IV + V**
Riparian	4	5	5	14	5	5	10
Mojave Desert Shrub	5	2	5	12	5	1	6
Wetland	5	2	5	12	5	5	10
Aspen-Conifer	3	3	5	11	5	5	10
Mountain Sagebrush	3	3	5	11	3	3	6
Wet Meadow	5	1	5	11	5	5	10
Desert Grassland	5	2	3	10	5	3	8
Gambel Oak	4	3	3	10	1	3	4
Mountain Shrub	4	3	3	10	1	3	4
Lowland Sagebrush	1	5	3	9	5	5	10
Mountain Meadow	5	1	3	9	5	5	10
Mountain Grassland	5	1	3	9	3	5	8
Colorado Plateau Desert Shrub	3	3	3	9	3	3	6
Mixed Conifer	4	2	3	9	3	3	6
Ponderosa Pine	4	2	3	9	3	3	6
Chaparral	5	1	3	9	1	1	2
Pinyon-Juniper	2	4	3	9	1	1	2
Alpine	5	1	1	7	1	5	6
Barren	2	4	1	7	1	1	2
Lodgepole Pine	5	1	1	7	1	3	4
Salt Desert Shrub	1	5	1	7	3	1	4
Sparsely Vegetated	4	2	1	7	1	1	2
Subalpine Conifer	4	2	1	7	1	3	4

Finally for Step 2, Table 9 lists the eleven Key Habitats along with their acreages and their percentage of Utah land area. The two lists in Table 9 are the same, just ordered differently – by descending order of factor-scoring on the left (kind of a rough order of their "importance"), and in alphabetical order on the right.

Table 9. List of the eleven WAP Key Habitats, with acres and percents of Utah land area.

In descending order of Factor Scores		
Habitat	**Acres**	**% of Land Area**
Riparian	1,878,030	3.46%
Mojave Desert Shrub	482,009	0.89%
Wetland	118,803	0.22%
Aspen-Conifer	2,988,620	5.50%
Mountain Sagebrush	2,338,378	4.30%
Wet Meadow	117,616	0.22%
Desert Grassland	331,185	0.61%
Gambel Oak	2,042,775	3.76%
Mountain Shrub	1,436,147	2.64%
Lowland Sagebrush	11,695,319	21.52%
Mountain Meadow	74,419	0.14%
		43.26%

In alphabetical order		
Habitat	**Acres**	**% of Land Area**
Aspen-Conifer	2,988,620	5.50%
Desert Grassland	331,185	0.61%
Gambel Oak	2,042,775	3.76%
Lowland Sagebrush	11,695,319	21.52%
Mojave Desert Shrub	482,009	0.89%
Mountain Meadow	74,419	0.14%
Mountain Sagebrush	2,338,378	4.30%
Mountain Shrub	1,436,147	2.64%
Riparian	1,878,030	3.46%
Wet Meadow	117,616	0.22%
Wetland	118,803	0.22%
		43.26%

At this point in the process, we decided to separate Terrestrial Key Habitats from Aquatic Key Habitats, and treat the two types on separate, parallel tracks. The remainder of this section describes the rest of the process for Terrestrial Key Habitats. The next section of this Appendix describes the entire process for Aquatic Key Habitats.

This separation was done for four primary reasons:

1. The coarse-resolution 30m x 30m LANDFIRE pixels do not capture the common types of aquatic spatial features very well (i.e., lines, small polygons, long narrow polygons, etc.). One result of this is a systematic under-representation of pixels classified as these kinds of aquatic habitats. The pixels are instead classified as whatever their dominant feature is —typically, a terrestrial habitat.

2. Two of the "wet" Key Habitats in Table 9 above – Wet Meadow and Wetland – had no corresponding LANDFIRE-defined Biophysical Settings (see bottom two rows of Table 4). For purposes of showing extent of these two Key Habitats we could use their ReGAP-equivalent units, but this fallback approach ultimately was deemed to be unacceptable for technical GIS reasons.

3. The assessment of condition for the three "wet" Key Habitats in the table above, via a technique using LANDFIRE data described farther below, would have been either:

   - too inaccurate for the one (Riparian) where LANDFIRE data could have been used, or
   - impossible for the other two (Wet Meadow and Wetland), because no LANDFIRE data exist for them

4. LANDFIRE does not fully consider purely aquatic habitats (e.g., streams and rivers, ponds and lakes) at all. These habitats - which were called lotic and lentic, respectively, in the 2005 WAP - do not appear in Tables 1-9. See Table 15.

Terrestrial Key Habitats

The smaller list of the eight Terrestrial Key Habitats appears in Table 10, along with their acreages and their percentage of Utah land area. The two lists in Table 10 are the same, just ordered differently – by descending order of factor-scoring on the left (kind of a rough order of their “importance”), and in alphabetical order on the right.

Table 10. List of the eight WAP Terrestrial Key Habitats, with acres and percents of Utah land area.

In descending order of Factor Scores		
Habitat	**Acres**	**% of Land Area**
Mojave Desert Shrub	482,009	0.89%
Aspen-Conifer	2,988,620	5.50%
Mountain Sagebrush	2,338,378	4.30%
Desert Grassland	331,185	0.61%
Gambel Oak	2,042,775	3.76%
Mountain Shrub	1,436,147	2.64%
Lowland Sagebrush	11,695,319	21.52%
Mountain Meadow	74,419	0.14%
		39.36%

In alphabetical order		
Habitat	**Acres**	**% of Land Area**
Aspen-Conifer	2,988,620	5.50%
Desert Grassland	331,185	0.61%
Gambel Oak	2,042,775	3.76%
Lowland Sagebrush	11,695,319	21.52%
Mojave Desert Shrub	482,009	0.89%
Mountain Meadow	74,419	0.14%
Mountain Sagebrush	2,338,378	4.30%
Mountain Shrub	1,436,147	2.64%
		39.36%

A small-scale map showing the extent of each of these eight Terrestrial Key Habitats within Utah appears in the narrative write-up of each one that is contained in Chapter 2. More-detailed (“zoomed-in”) spatial extent of the Biophysical Settings that comprise each Terrestrial Key Habitat reside in the LANDFIRE data themselves, acquired and maintained by GIS staff of the Utah Division of Wildlife Resources.

Step 3: Determining the Current Condition of the Key Habitats.

The third and final step of the 3-Step process was to determine the current condition of the eight Terrestrial Key Habitats. To do this, we used the LANDFIRE data to calculate a measure of condition known as *Ecological Departure*. The calculation of Ecological Departure uses both the Biophysical Setting and its associated Vegetation Class assignment of pixels in the LANDFIRE data set.

Two definitions of Ecological Departure, using different words that attempt to describe the exact same concept, appear in the two text boxes below:

> The Ecological Departure of a Biophysical Setting is the dissimilarity between:
> (1) the amounts (percentage) of vegetation classes expected under reference conditions; and
> (2) the amounts (percentage) of vegetation classes that are currently present on the landscape.

> Ecological Departure summarizes, in a single number, how out-of-balance a Biophysical Setting is in terms of dissimilarity between:
> (1) the current amounts of its vegetation classes that are present in an area, and
> (2) the amounts of those classes that would be expected to occur under a reference baseline of natural disturbance regimes and climate.

It is essential to grasp that the concept of Ecological Departure has meaning ONLY in relation to a specific large geographic area or polygon within which it is calculated.

Figure 3 shows a real-life example of the Ecological Departure calculation for a Biophysical Setting known as “Intermountain Basins Big Sagebrush Shrubland” (basically a Wyoming Big Sagebrush site) within a National Forest Ranger District. In this case, the Ranger District is the specific large geographic area, known as a Summary Unit, within which Ecological Departure is calculated.

Wyoming Big Sagebrush

BpS = *Intermountain Basins Big Sagebrush Shrubland*

		In Summary Unit Polygon		
	Vegetation Class	**Reference Amount**	**Current Amount**	**Similarity (Minimum of Ref, Curr)**
Reference	A (baby)	16%	8%	8%
Reference	B (adolescent)	28%	1%	1%
Reference	C (middle aged)	41%	15%	15%
Reference	D (mature)	6%	23%	6%
Reference	E (conifer-encroached)	9%	42%	9%
	U (uncharacteristic)	0%	11%	0%
		100%	100%	39%

Ecological Departure $= 100\% - \sum_{i=1}^{n} \min\{Current_i, Reference_i\}$ → → → **61%** ← **Dis-Similarity**

Three Ecological Departure Classes:

Low (Good) | 0-33% | 34-66% | 67-100% | High (Bad)

Figure 3. Example of a calculation of Ecological Departure on a National Forest Ranger District.

The table within Figure 3 displays the BpS’s Vegetation Classes: A through E are the Reference (“natural”) succession classes, and a single combined Uncharacteristic (U) class is also shown. The light-blue column (labeled **Reference Amount**) shows the expected, reference proportions of the vegetation classes. These conceptual amounts are based on LANDFIRE vegetation models, developed in workshops by regional vegetation and fire ecology experts, with later peer review for model refinement. The models were then used as inputs to the spatial fire and succession simulation model LANDSUM, which generated the reference-class percentages. Note that reference percentage of the Uncharacteristic class is always zero. The light-purple column (labeled **Current Amount**) shows the actual proportions of the same vegetation classes on this Ranger District at the present time. These actual amounts come from GIS analysis of the LANDFIRE data of BpS-VegClass clipped to the boundary of the District.

The column on the right (labeled **Similarity**) contains the smaller, or minimum, of either the Reference or the Current percentage value in that Veg Class row (to its left). The sum of these minimum class values (39%) is the overall Similarity between the Reference and Current columns. Therefore, the Dissimilarity between the two columns, or the *Ecological Departure of Current from Reference*, is One (100%) minus the Similarity, in this case 61%. The mathematical formula for Ecological Departure, shown in Figure 3, is repeated here:

$$\textbf{Ecological Departure} = 100\% - \sum_{i=1}^{n} \min\{\mathit{Current}_i, \mathit{Reference}_i\}$$

The possible range of values of Ecological Departure is 0-100%. Lower values (smaller Departure) represent better condition, and higher values (greater or total Departure) represent worse condition. The 0-100% range is traditionally broken into three classes that can be color-coded like a stop light for purposes of visual display: Green/Yellow/Red respectively represent Good/Fair/Poor condition.

In the 2015 WAP, the large geographic areas (Summary Units) used for calculating Ecological Departure were the eight-digit Hydrologic Unit Code polygons ("HUC-8 polygons") that overlap the state of Utah. Figure 4 shows the locations of the 67 HUC-8 polygons that overlap Utah, and Table 11 shows their eight-digit codes, names, and acreages.

Figure 4. Locations of the HUC-8 polygons that overlap the state of Utah.

Table 11. Codes, names, and acreages of the HUC-8 polygons that overlap the state of Utah.

HUC-8 #	HUC-8 Name	Acres
14010005	Colorado Headwaters-Plateau	272,955
14030001	Westwater Canyon	931,162
14030002	Upper Dolores	388,854
14030004	Lower Dolores	357,662
14030005	Upper Colorado-Kane Springs	1,455,306
14040106	Upper Green-Flaming Gorge Rsrvr	1,599,676
14040107	Blacks Fork	1,754,756
14040108	Muddy (WY)	617,327
14050007	Lower White	1,135,667

HUC-8 #	HUC-8 Name	Acres
15010013	Meadow Valley Wash	1,625,125
16010101	Upper Bear	1,284,671
16010102	Central Bear	524,091
16010201	Bear Lake	277,135
16010202	Middle Bear	395,599
16010203	Little Bear-Logan	565,402
16010204	Lower Bear-Malad	516,866
16020101	Upper Weber	739,419
16020102	Lower Weber	849,843

14060001	Lower Green-Diamond	627,346	16020201	Utah Lake	860,111
14060002	Ashley-Brush	412,848	16020202	Spanish Fork	615,961
14060003	Duchesne	1,713,446	16020203	Provo	438,745
14060004	Strawberry	744,712	16020204	Jordan	520,507
14060005	Lower Green-Desolation Canyon	1,244,616	16020301	Hamlin-Snake Valleys	1,995,567
14060006	Willow	610,238	16020302	Pine Valley	468,999
14060007	Price	1,206,455	16020303	Tule Valley	608,558
14060008	Lower Green	1,194,430	16020304	Rush-Tooele Valleys	772,726
14060009	San Rafael	1,555,982	16020305	Skull Valley	520,438
14070001	Upper Lake Powell	1,828,832	16020306	Southern Great Salt Lake Desert	3,504,550
14070002	Muddy (UT)	991,796	16020307	Pilot-Thousand Springs, NV, UT	1,193,129
14070003	Fremont	1,250,140	16020308	Northern Great Salt Lake Desert	2,706,344
14070004	Dirty Devil	555,300	16020309	Curlew Valley	1,313,460
14070005	Escalante	1,295,710	16020310	Great Salt Lake	1,118,249
14070006	Lower Lake Powell	1,105,267	16030001	Upper Sevier	769,786
14070007	Paria	907,796	16030002	East Fork Sevier	794,442
14080201	Lower San Juan-Four Corners	1,275,526	16030003	Middle Sevier	1,184,621
14080202	McElmo	333,804	16030004	San Pitch	550,593
14080203	Montezuma	747,618	16030005	Lower Sevier	2,623,618
14080204	Chinle	298,621	16030006	Escalante Desert	2,106,719
14080205	Lower San Juan	1,560,126	16030007	Beaver Bottoms-Upper Beaver	1,105,046
15010003	Kanab	600,046	16030008	Lower Beaver	513,582
15010008	Upper Virgin	1,397,438	16030009	Sevier Lake	893,180
15010009	Fort Pearce Wash	899,102	17040210	Raft	473,356
15010010	Lower Virgin	856,088	17040211	Goose	455,457

With Summary Unit polygons thus defined, we used the LANDFIRE data to calculate Ecological Departure for: (1) every Biophysical Setting associated with the eight Terrestrial Key Habitats, in (2) every HUC-8 polygon where it occurred. The result was a large body of tabular data, from which a small but typical fragment of the Lowland Sagebrush Key Habitat was extracted and copied as Table 12.

All of the necessary ingredients for calculating Ecological Departure are present in Table 12: The Key Habitat and Biophysical Setting names are in Columns B & C; the HUC-8 polygon Summary Units are in Columns G & H; and the Veg Classes with their Reference and Current percentages are in Columns L through O – with the same light blue and purple cell-shadings as the example in Figure 3. And at the right side of the table (when turned sideways) in Columns P & Q are the values for Ecological Departure and Ecological Departure Class – the current condition of these Biophysical Settings.

Table 12. Fragment from LANDFIRE data, with Ecological Departure calculations in HUC-8 polygons.

	B	C	D	G	H	K	L	M	N	O	P	Q
1	Key Habitat	Biophysical Setting Name	BpS Code	HUC-8 Name	HUC-8 #	Acres of BpS in HUC-8	Veg Class	Ref %	Current %	Min of Ref % and Curr %	Ecological Departure	Ecol Dep Class
4298	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Pine Valley	16020302	80640.1	A	15	0	0.0	40.0	2
4299	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Pine Valley	16020302	80640.1	B	50	62.5	50.0		
4300	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Pine Valley	16020302	80640.1	C	25	0	0.0		
4301	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Pine Valley	16020302	80640.1	D	5	11.3	5.0		
4302	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Pine Valley	16020302	80640.1	E	5	25.5	5.0		
4303	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Pine Valley	16020302	80640.1	U	0	0.7	0.0		
4304	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Rush-Tooele Valleys	16020304	177108.1	A	15	2.2	2.2	43.2	2
4305	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Rush-Tooele Valleys	16020304	177108.1	B	50	77.7	50.0		
4306	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Rush-Tooele Valleys	16020304	177108.1	C	25	0.3	0.3		
4307	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Rush-Tooele Valleys	16020304	177108.1	D	5	1.9	1.9		
4308	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Rush-Tooele Valleys	16020304	177108.1	E	5	2.4	2.4		
4309	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Rush-Tooele Valleys	16020304	177108.1	U	0	15.5	0.0		
4310	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	San Pitch	16030004	32629.3	A	15	1.9	1.9	26.2	1
4311	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	San Pitch	16030004	32629.3	B	50	36.9	36.9		
4312	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	San Pitch	16030004	32629.3	C	25	30.8	25.0		
4313	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	San Pitch	16030004	32629.3	D	5	6.9	5.0		
4314	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	San Pitch	16030004	32629.3	E	5	7.6	5.0		
4315	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	San Pitch	16030004	32629.3	U	0	15.9	0.0		
4328	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Sevier Lake	16030009	39603.0	A	15	0.1	0.1	39.9	2
4329	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Sevier Lake	16030009	39603.0	B	50	83.1	50.0		
4330	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Sevier Lake	16030009	39603.0	C	25	0	0.0		
4331	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Sevier Lake	16030009	39603.0	D	5	6	5.0		
4332	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Sevier Lake	16030009	39603.0	E	5	9.9	5.0		
4333	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Sevier Lake	16030009	39603.0	U	0	0.9	0.0		
4334	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Skull Valley	16020305	113802.5	A	15	2.1	2.1	41.5	2
4335	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Skull Valley	16020305	113802.5	B	50	46.4	46.4		
4336	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Skull Valley	16020305	113802.5	C	25	0	0.0		
4337	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Skull Valley	16020305	113802.5	D	5	8.2	5.0		
4338	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Skull Valley	16020305	113802.5	E	5	8.7	5.0		
4339	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Skull Valley	16020305	113802.5	U	0	34.6	0.0		
4340	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Southern Great Salt Lake Desert	16020306	114935.0	A	15	0.2	0.2	39.8	2
4341	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Southern Great Salt Lake Desert	16020306	114935.0	B	50	76.7	50.0		
4342	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Southern Great Salt Lake Desert	16020306	114935.0	C	25	0	0.0		
4343	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Southern Great Salt Lake Desert	16020306	114935.0	D	5	5.2	5.0		
4344	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Southern Great Salt Lake Desert	16020306	114935.0	E	5	5.7	5.0		
4345	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1710800	Southern Great Salt Lake Desert	16020306	114935.0	U	0	12.2	0.0		

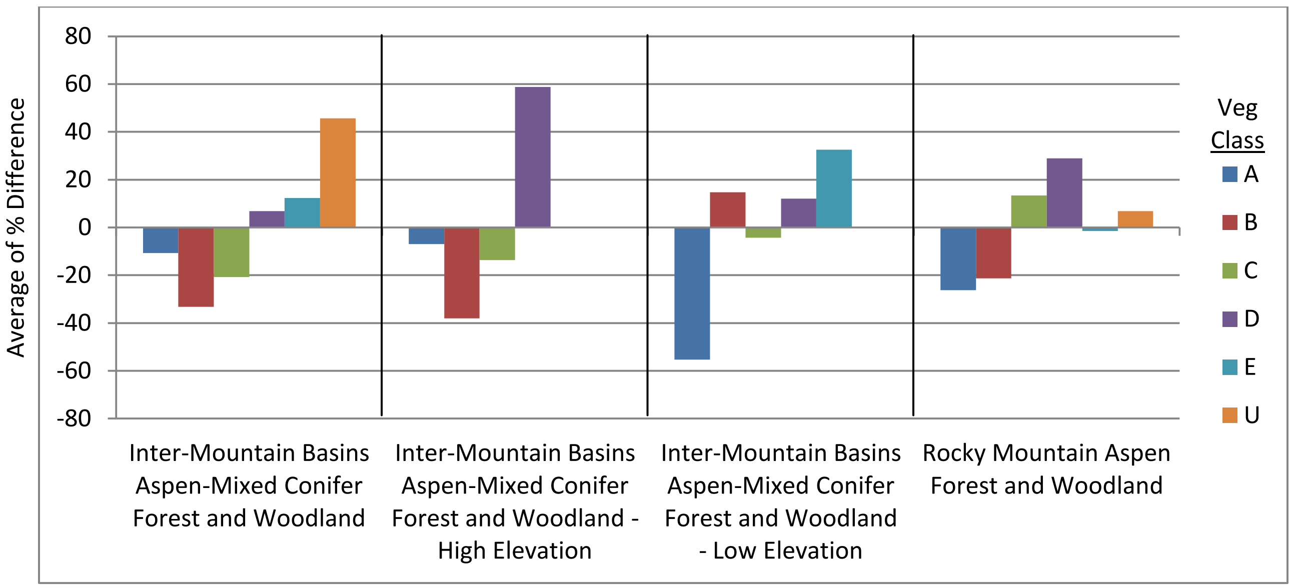
The Ecological Departure values in Table 12 apply only to each unique six-row block of a particular Biophysical Setting within a particular HUC-8 polygon. In order for Ecological Departure to be assessed at larger scales than HUC-8 polygons, the underlying LANDFIRE spatial data would need to be clipped and analyzed using fewer, larger Summary Units, such as DWR Regions, big game management units, BLM Field Office boundaries, or even Counties. This can be done, but the resulting sets of Ecological Departure values (for Biophysical Settings) would be relevant only within their associated Summary Units; they would not be readily comparable across Summary-Unit types. In the end, any such reconfiguring of the Summary Units would still yield Ecological Departure values for discrete individual polygons one at a time.

Another feature of Ecological Departure as a measure of habitat condition is that its single number is an integrated measure that reveals little about why the Departure is high or low without further investigation. Of course, one can readily look at the LANDFIRE data (as in Table 12) and infer the reasons for Ecological Departure from the discrepancies between the **Current %** and **Ref %** of the component Vegetation Classes – but this finer inference can be done only in each unique BpS-by-HUC combination, one polygon at a time.

Because the basic LANDFIRE data exist in Excel format, however, they can be manipulated to yield products that summarize habitat (BpS) condition across Summary Units (HUC-8 polygons), but at the level of individual Vegetation Classes, not integrated Ecological Departure. Two examples may help to illustrate this concept.

Figure 5 is a pivot chart derived from the LANDFIRE data. It shows summary information for Vegetation Classes of the four Biophysical Settings that comprise the Aspen-Conifer Terrestrial Key Habitat, for the entire state across all HUC-8 polygons.

Figure 5 . Average of % Difference (Current % minus Reference %) in each Vegetation Class of Biophysical Settings that comprise the Aspen-Conifer Key Habitat, across all HUC8 Units.



The Y-axis in Figure 5 is a measure of the difference between the **Current %** and the **Reference %** of each component Vegetation Class, averaged across every HUC-8 polygon in which the Biophysical Setting occurs. Bars above the X-axis indicate the average amount of surplus of that Class statewide, whereas bars below the X-axis indicate the average amount of deficit of that Class statewide. All bars at the zero level, nothing displayed, would indicate no surplus or deficit (Departure) of any Classes – i.e., perfect Reference conditions for that Biophysical Setting in the state as a whole.

For the left-most BpS in Figure 5, Aspen-Mixed Conifer Forest and Woodland, the bars show:

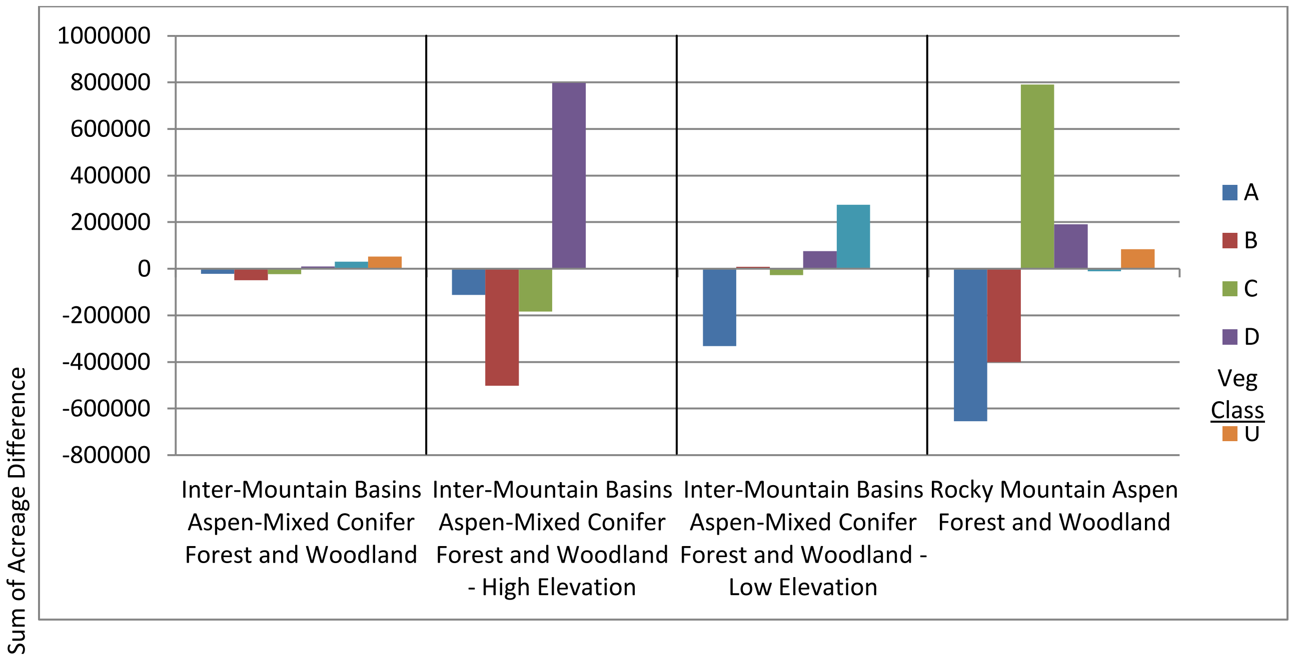
- average statewide deficits on the order of 10% to 30% for the young and mid age classes (A,B,C);
- average statewide surpluses of up to 10% for the old conifer-encroached classes (D,E); and

- large average statewide surplus (>40%) of the uncharacteristic class, which probably represents aspen clones that are at or beyond the point of extirpation.

These summary statistics confirm the general knowledge that coverage of aspen in Utah has been in decline for many decades.

Figure 6 is another pivot chart from the LANDFIRE data, again showing summary information for Vegetation Classes of the four Biophysical Settings that comprise the Aspen-Conifer Terrestrial Key Habitat, for the entire state across all HUC-8 polygons.

Figure 6. Sum of Acreage Difference (Current Acres minus Reference Acres) in each Vegetation Class of Biophysical Settings that comprise the Aspen-Conifer Key Habitat, across all HUC8 Units.



The Y-axis in Figure 6 is a measure of the difference between the **Current Acres** and the **Reference Acres** of each component Vegetation Class, summed across every HUC-8 polygon in which the Biophysical Setting occurs. Bars above the X-axis indicate the cumulative surplus acreage of that Class statewide, whereas bars below the X-axis indicate the cumulative deficit acreage of that Class statewide. All bars at the zero level would again indicate perfect Reference conditions for that Biophysical Setting in the state as a whole. However, all bars near the zero level, as for the left-most BpS in Figure 6, probably indicate small overall acreage of that BpS, rather than near-Reference conditions.

For the second-from-left BpS in Figure 6, Aspen-Mixed Conifer Forest and Woodland – High Elevation, the bars show:

- cumulative statewide deficits on the order of 100,000 to 500,000 acres for each of the young and mid age classes (A,B,C); and

- cumulative statewide surplus of 800,000 acres for the old conifer-encroached class (D).

The substantial excess acreage of the old conifer-encroached class would be a good target for further investigation of potential locations for treatment projects to convert these acres back to young aspen-dominated classes.

One constraint of WAP habitat condition assessment using LANDFIRE data, is that calculation of Ecological Departure, and summary bar graphs of Vegetation Classes, can be produced only at the finer level of the Biophysical Setting. Neither of these metrics can be generated reliably at the broader level of the Terrestrial Key Habitats that are aggregations of Biophysical Settings, for reasons that involve the assignment of conceptual Reference % values to the Vegetation Classes.

In summary, we believe that the 3-Step process described above does satisfy the WAP Element 2 language for describing the extent and condition of the 2015 WAP's Terrestrial Key Habitats.

Using the LANDFIRE Data for Purposes Beyond Extent and Condition of Key Habitats.

The LANDFIRE data in Table 12 – or actually in the large Excel file behind it – may be even more useful in the long run than just meeting the letter of the law for WAP revision. A revised WAP is useless unless it guides partners to take action – to *do things* – toward the specific objectives of the WAP itself.

Digging deeper into the LANDFIRE data can yield not only the reasons for any particular Ecological Departure number (i.e., exactly which Vegetation Classes are currently out-of-balance), but also ingredients for prioritizing actions to reduce Departure and improve habitat condition. One example of digging deeper into the data, among many, is described below.

Referring back to Figure 3 (the example of Ecological Departure calculation), note that Vegetation Class E is described as "conifer-encroached." Figure 7 shows what this looks like – a scene probably familiar to many readers.

Such conifer encroachment is not inherently unnatural or uncharacteristic – Class E is a Reference (natural) class. However, in sagebrush landscapes where such encroachment is common and widespread, i.e., where it is greatly in excess relative to its expected Reference amount, it creates large Ecological Departure and is one indicator of poor sagebrush-habitat condition.

Figure 7. Sagebrush shrubland encroached by juniper and pinyon pine.

Further, these encroaching conifers reduce the overall quality and use of this important habitat by many species of wildlife including Greater sage-grouse, which is a high-profile and potentially contentious species in much of the interior western U.S. at this date. So taking actions to reduce juniper and pinyon pine encroachment into the sagebrush habitats of sage-grouse is a priority for a number of WAP-implementation partners. How might the LANDFIRE data help in this regard?

Table 13 is another fragment of the Lowland Sagebrush Key Habitat data extracted from the underlying large Excel file of LANDFIRE data. Its Column format is like that of Table 12, though without the Ecological Departure and Departure Class columns that are irrelevant to this example.

Table 13. Fragment from LANDFIRE data for the Lowland Sagebrush Key Habitat.

	A	B	C	D	E	F	G	H	I
1	Key Habitat	Biophysical Setting Name	BpS Code	HUC-8 Name	HUC-8 #	Acres of BpS in HUC-8	Veg Class	Ref %	Current %
42	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1610800	Beaver Bottoms-Upper Beaver	16030007	355395.6	E	5	17.0
84	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1610800	East Fork Sevier	16030002	139799.2	E	5	31.4
90	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1610800	Escalante	14070005	116186.8	E	5	17.3
96	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1610800	Escalante Desert	16030006	676773.8	E	5	19.1
126	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1610800	Hamlin-Snake Valleys	16020301	220728.4	E	5	24.4
138	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1610800	Kanab	15010003	236246.0	E	5	15.2
192	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1610800	Lower San Juan	14080205	136366.9	E	5	24.8
198	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1610800	Lower San Juan-Four Corners	14080201	164970.0	E	5	28.2
210	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1610800	Lower Virgin	15010010	5326.4	E	5	43.8
234	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1610800	Meadow Valley Wash	15010013	309920.7	E	5	31.7
246	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1610800	Middle Sevier	16030003	225728.7	E	5	19.0
288	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1610800	Pine Valley	16020302	109203.6	E	5	21.4
336	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1610800	Skull Valley	16020305	110121.2	E	5	17.5
378	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1610800	Upper Dolores	14030002	124607.4	E	5	19.8
384	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1610800	Upper Green-Flaming Gorge Rsrvr	14040106	37556.9	E	5	30.8
390	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1610800	Upper Lake Powell	14070001	81543.5	E	5	24.0
396	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1610800	Upper Sevier	16030001	157303.0	E	5	42.7
402	Lowland Sagebrush	Inter-Mountain Basins Big Sagebrush Shrubland	1610800	Upper Virgin	15010008	105599.7	E	5	24.1

The Excel filter function was used on Column G to display only Veg Class **E** – the "conifer-encroached" Class – for the HUC-8 polygons where this Biophysical Setting occurs. Further, from among the many HUC-8 polygons where this Biophysical Setting occurs, eighteen were selected (the table rows) in which the **Current %** of Class E (in Column I) is *more than triple* the expected **Ref %** of Class E (in Column H).

In practical terms, these eighteen watersheds in Utah now contain a large over-abundance (surplus) of conifer-encroached Wyoming big sagebrush habitat. And most of these eighteen watersheds contain substantial acreage of this habitat (large values in Column F), meaning that these high surpluses reflect large actual acreage amounts of conifer-encroached sagebrush on the ground. These eighteen watersheds would thus be good initial locations for WAP-implementation partners to explore further for potential treatment projects to reduce conifer encroachment in sagebrush.

At the species level, the HUC-8 polygon named Hamlin-Snake Valleys (row 126 in Table 13) is a Greater Sage-grouse Management Area in Utah's Greater Sage-grouse Management Plan. The table data show that it now has roughly a quarter (24.4%) of its Wyoming big sagebrush site acreage in the conifer-encroached Class E, about five times the expected reference amount of 5%. Given the total amount of sagebrush habitat in this watershed (220,000+ acres), in absolute terms this ~20% <u>surplus</u> of Class E translates to over 40,000 <u>excess</u> acres of conifer-encroached sagebrush that could be treated to improve habitat for Greater Sage-grouse (and sagebrush).

As a note of caution, one must be careful not to use the broad-scope/coarse-scale LANDFIRE data inappropriately for planning and implementing actions at too fine a scale – at scales beyond the capacity of the LANDFIRE data to support. To reiterate generally what was stated above, these LANDFIRE data are best used to identify initial locations for further investigation at the finer project scale for possible habitat-improvement or restoration projects.

Aquatic Key Habitats

Given limited resources, it was decided that it would be prudent to adopt a preexisting data set addressing extent of aquatic habitat instead of attempting to develop a new version. Six existing aquatic data sets were evaluated based upon eight selection factors (Table 14). They include the wetland habitats identified in the 2005 Utah Comprehensive Wildlife Conservation Strategy (2005 Utah WAP), Southwest Regional Gap Analysis Project (SW ReGAP), National Wetlands Inventory (NWI), National Wetlands Inventory data utilizing a Utah Geologic Society functional crosswalk (NWI with UGS Crosswalk), Landscape Fire and Resource Management Planning Tools Project (LANDFIRE), and the National Hydrography Data set (NHD). Included among the eight selection factors in Table 14 are concepts from the AFWA Best Practices for Wildlife Action Plans (2012), such as broader, beyond-state consistency.

Table 14. Factors for selecting a full set of habitats to use as the basis for identifying 2015 WAP Aquatic Key Habitats in Utah.

	Existing Habitat Sets					
Selection Factors	2005 Utah WAP	SW ReGAP	NWI	NWI w/ UGS Crosswalk	LANDFIRE	NHD
Habitat names and definitions (concepts) are consistent or standardized throughout Utah and beyond – at least throughout surrounding states, and (better yet) regionally or nationally.	↓	↑	↑	↑	↑	↑
Types of habitats (classification units) within the set are mutually-exclusive: they do not overlap in concept.	↑	↑	↑	↑	↑	↔
Types of habitats within the set are comprehensive: every acre in Utah can be assigned to a type of habitat (some will be non-natural, e.g., urban, agriculture, etc.).	↑	↑	↑	↑	↑	↓
The number of habitats within the set, which is related to how finely or coarsely they are defined, is considered appropriate for the whole-state scope of the WAP.	↑	↔	↓	↑	↔	↔
The habitats are definable, have broad support and utility (management-usefulness), and match or can be cross-walked with habitat schemes of major partners.	↑	↔	↑	↑	↔	↑
Habitat data for the set exist in spatial format: maps of habitat locations can be made.	↑	↑	↑	↑	↑	↑
Habitat spatial data for the set cover all of Utah border-to-border, and are consistent throughout that range.	↑	↑	↑	↑	↑	↑
Habitats and their spatial data allow for the assessment of the habitats' <u>condition</u>, both current and future, at all locations/ occurrences within Utah (without extensive fieldwork).	↓	↓	↓	↓	↓*	↓

Key to Arrows: ↑ = Habitat set meets factor well. ↓ = Habitat set meets factor poorly or not at all.

↔ = Habitat set meets factor neither well nor poorly.

---

* Although LANDFIRE does provide some condition data (departure values) for some habitat types, it provides incomplete data for a majority of the aquatic habitat designations. In addition, the coarse resolution (30 x 30m) of LANDFIRE pixels does a poor job of capturing common aquatic habitat spatial features.

Table 14 illustrates the selection process utilized to determine which spatial data set to use for delineating the extent of aquatic habitats within Utah. Up arrows indicate data sets that meet the selection factor, down arrows indicate a poor fit, and sideways arrows indicate an intermediate fit (neither well nor poorly). No data set met all of the eight selection criteria. Wetland condition data for habitats within Utah is incomplete and geographically limited to a very small minority of watersheds. Although LANDFIRE does provide condition data (departure values) for some habitat types, it provides incomplete data for a majority of the aquatic habitat designations. In addition, the coarse resolution of LANDFIRE pixels (30 x 30m) does a poor job of capturing common aquatic habitat spatial features. Given these limitations and weaknesses, it was determined that LANDFIRE data do not meet the eighth selection criteria regarding condition. The Utah Geological Survey (a Wildlife Action Plan partner) is currently finalizing both a rapid assessment protocol and landscape scale wetland stressor model to determine wetland condition in Utah. More information regarding these condition assessments can be found in the Monitoring chapter of the 2015 WAP and in other supporting documents (Emerson and Menuz 2014; Menuz, Sempler, and Jones 2014; UGS 2014).

Despite the fact that no aquatic habitat data set met all our criteria, the NWI data crosswalked into functional categories using UGS methodology met seven of the eight selection factors and was determined to be best suited – despite its lack of condition data – to meeting the goals of the Wildlife Action Plan. Detailed methods regarding the functional classification employed by the Utah Geological Survey can be reviewed in the Utah Wetland Functional Classification report (Emerson 2014). A review of a preliminary protocol is also available (Emerson and Hooker 2011). A brief summary of the current methodology is included below.

Utah Wetland Functional Classification Summary

The most comprehensive wetland classification system for the state of Utah is the National Wetland Inventory (NWI). While the NWI is the most complete and accessible classification system, the 366 unique wetland type identifiers in the state are often difficult to interpret and have little relevance to natural resource managers. Consequently, NWI data are often overlooked as a viable wetland data source, which often restricts opportunity for interagency cooperation as many agencies develop their own wetland GIS data sets and workflows. To address these concerns, the Utah Geological Survey reclassified the state's wetlands to provide GIS data users a universal data set for consistent use. The goal of the exercise is to reclassify, or "crosswalk" current NWI data into a functional system that is more easily utilized by the state's resource managers to help guide management decisions. The project also supports the Utah Wetland Program planning initiative to develop a comprehensive mapping strategy for the state (Hooker and Gardberg[186] 2011).

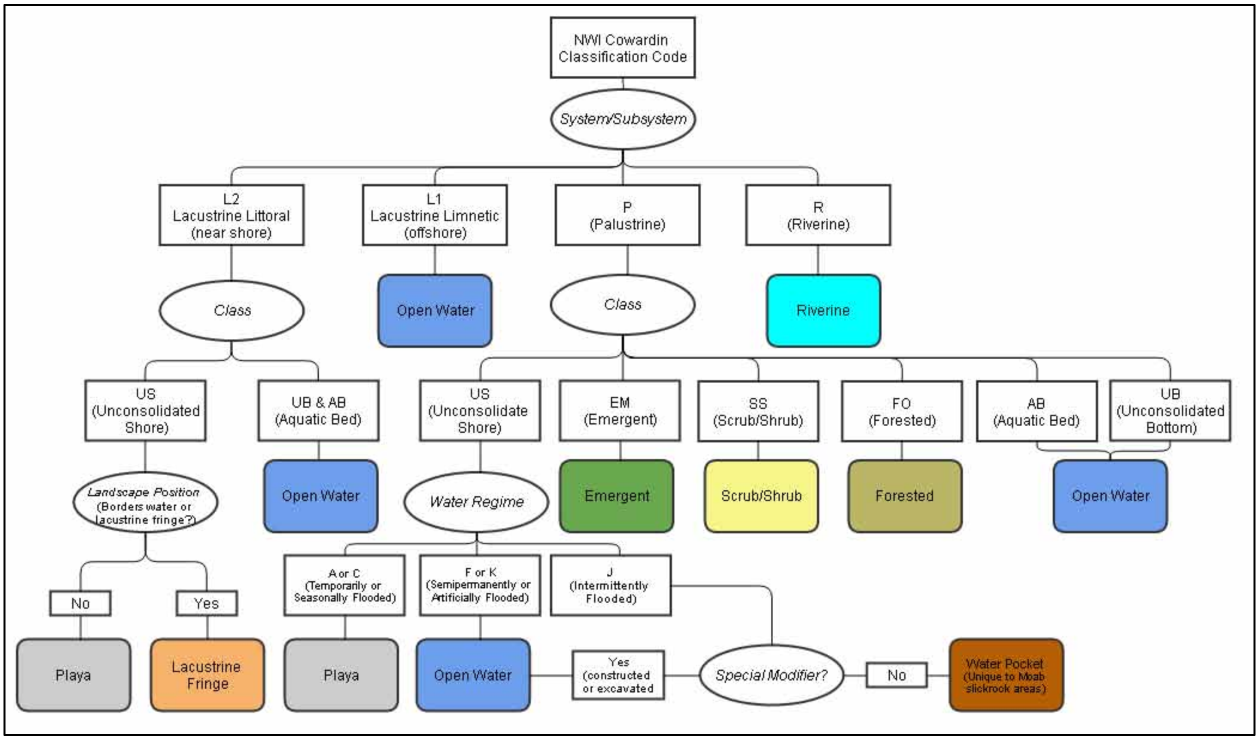
Eight functional classifications – Open Water, Mudflat Fringe, Emergent, Playa, Riverine, Forested, Scrub/Shrub, and Water Pocket – were created to provide classifications that are general enough to be applied across Utah's various ecosystems, yet specific enough to provide useful analysis at a variety of scales (Table 15). Over 300 NWI Cowardin wetland classification codes were crosswalked into eight UGS functional classifications using a defined set of rules based upon Cowardin system/subsystem and class designations (Figure 8).

Table 15. UGS Functional wetland type descriptions (adapted from Emerson 2014).

Utah Type	Description
Open Water	Perennial water bodies.
Mudflat Fringe	Mostly non-vegetated wetlands near the shoreline of lakes and reservoirs where water availability is controlled by lake levels and where the primary movement of water is sheet-flow – often expansive mudflats or barren ground during low water-level periods around the fringes of reservoirs and endorheic lakes.
Emergent	Palustrine wetland with emergent vegetation often associated with groundwater discharge or shallow surface flow.
Playa	Ephemeral ponds, depressional features, or expansive mineral flats where evapotranspiration exceeds water supply or through-flow; a mineral soil must be present.
Riverine	Perennial stream constrained to a channel (includes canals and ditches).
Aquatic - Forested	Associated with woody vegetation greater than 6 meters in height, commonly found around the margins of rivers, montane lakes, or springs.
Aquatic - Scrub/Shrub	Associated with woody vegetation less than 6 meters in height.
Water Pocket	Bedrock pothole where little to no soil is present and water is supplied only by precipitation.

Figure 8. UGS crosswalk flowchart of NWI data (adapted from Emerson 2014).

[186] Hooker, T. and J. Gardberg. 2011. Utah's Wetland Program Plan. Utah Geological Society. Available from UGS online library, http://geodata.geology.utah.gov/pages/themes.php?header=Wetlands



Special modifiers were also designated to denote unique wetlands such as those that have been artificially constructed or drained. In addition, land use descriptors were developed to identify special wetland use. A full list of modifiers and land use descriptors can be found in Emerson (2014). In an effort to improve accurate mapping of the extent of riparian wetlands, NHD data were modified to enhance the Riverine functional classification by successively iterating a spatial selection of wetlands within a 40-meter buffer of selected wetlands. Wetlands connected to lacustrine and mudflat fringe were then removed from the selection to avoid misclassifying these wetlands as riparian (Emerson 2014).

Utilizing the NWI data set crosswalked into the UGS functional classification, we were able to reclassify over 135,000 NWI wetland polygons within Utah into one of eight aquatic types. The accuracy of the reclassification was determined by aerial photo interpretation of over 900 randomly distributed points and corresponding polygons. The adjusted accuracy was 74.1% excluding NHD-buffered Riverine polygons (Emerson 2014).

Extent of Aquatic Habitats.

Utilizing the NWI data crosswalked into the UGS functional classifications, we were able to identify the extent of each of the eight functional aquatic types (Open Water, Mudflat Fringe, Emergent, Playa, Riverine, Forested, Scrub/Shrub, and Water Pocket) within Utah. These eight classes are considered the full set of all aquatic habitats in Utah (Table 16).

Table 16. Full Set of Aquatic Habitats in Utah

Habitat	Acres	% of Utah's Land Area
Emergent	375,399	0.69%
Aquatic - Forested	4,460	0.01%
Lacustrine Fringe (Mudflat Fringe)	419,319	0.77%
Open Water	882,641	1.62%
Playa	86,187	0.16%
Riverine	120,256	0.22%
Aquatic - Scrub/Shrub	54,428	0.10%
Water Pocket	32	0.000058%
TOTAL	**1,942,722**	**3.57%**

Designing and Operating a Process to select Aquatic Key Habitats.

The next step of the process was to design and run a procedure to select Key Aquatic Habitats from among the full set of eight aquatic habitats shown in Table 16. To facilitate this goal, a five-factor prioritization model was created through which each of the eight aquatic habitats was evaluated and scored. Table 17 illustrates the five factors that were used to score each habitat and how score values were assigned for each factor. The five factors were purposely separated into two groups: one group with three factors based on geography and biology, on the left side of the table; and the second group with two factors based on possible adverse impacts, on the right side of the table.

Table 17. Factors in a scoring algorithm for defining Key Habitats from the full set of WAP Habitats.

"Left Side" – Based on Geography and Biology
Factors and values for scoring
I. Abundance in Utah (Quantitative)
1 – Habitat is Abundant, more than 15% of total land area
2 – Habitat is Common, between 10% and 14.9% of total land area
3 – Habitat is Uncommon, between 4% and 9.9% of total land area
4 – Habitat is Scarce, between 1% and 3.9% of total land area
5 – Habitat is Very Scarce, less than 1% of total land area
II. Number of SGCNs that Occur in the Habitat (Quantitative)
1 – 0-15 SGCNs
2 – 16-30 SGCNs
3 – 31-45 SGCNs
4 – 46-60 SGCNs
5 – 61-75 SGCNs
III. Wildlife Diversity (Qualitative, Subjective)
1 – Habitat is utilized by a small number of vertebrates and mollusks.
2 – Not used.
3 – Habitat is utilized by a moderate number of vertebrates and mollusks.
4 – Not used.
5 – Habitat is utilized by a large number of vertebrates and mollusks.

"Right Side" – Based on Possible Adverse Impacts
Factors and values for scoring
IV. Threats in Utah (Qualitative, Subjective)
1 – Habitat has low threat level.*
2 – Not used.
3 – Habitat has moderate threat level.
4 – Not used.
5 – Habitat has high threat level.
V. Value to Humans in Utah (Qualitative, Subjective)
1 – Habitat has low value to humans.
2 – Not used.
3 – Habitat has moderate value to humans.
4 – Not used.
5 – Habitat has high value to humans.

* Per estimation of scope and severity of all threat types

Each of the eight aquatic habitats were scored individually according to these five factors. Table 18 displays the resulting Factor scores, including summed scores for the left and right sides of the table, for each of the eight aquatic habitats.

Table 18. Summary table of scores for eight Aquatic Habitats and their corresponding five factor prioritization scores.

	Left Side – 3 Factors				Right Side – 2 Factors		
Habitats – 8	**Factor I % of UT Area**	**Factor II # of SGCNs in Habitat**	**Factor III Wildlife Diversity**	**Sum Across I + II + III**	**Factor IV Threat**	**Factor V Value to Humans**	**Sum Across IV + V**
Emergent	5	4	5	14	5	5	10
Open Water	4	4	5	13	5	5	10
Riverine	5	3	5	13	5	5	10
Aquatic - Forested	5	1	5	11	5	5	10
Aquatic - Scrub/Shrub	5	2	3	10	5	5	10
Mudflat Fringe	5	1	3	9	3	3	6
Water Pocket	5	1	3	9	3	3	6
Playa	5	2	1	8	3	3	6

The habitat scores shown in Table 18 were the raw materials for operating the Key Habitats Algorithm: The eight Aquatic Habitats were sorted in descending order of their left-side scores – the column headed "**Sum Across I + II + III**" – and a simple two-part rule was then applied to identify Aquatic Key Habitats for the 2015 Wildlife Action Plan:

The 2015 Utah WAP Aquatic <u>Key</u> Habitats are those that:

1. Have a Left-Side Sum-Across score of 10 or more,

   <u>OR</u>

2. Have a Left-Side Sum-Across score of 9 **<u>AND</u>** a Right-Side Sum-Across score of 10.

As shown in Table 19, the result of applying these two rules to the scores of the eight aquatic habitats was the selection of five Aquatic Key Habitats. These Aquatic Key Habitats appear as yellow-highlighted cells showing the scores that met the two-part rule above.

Table 19. Operation of the algorithm to select Key Habitats from among the full set of 8 Aquatic Habitats.

	Left Side-3 Factors				Right Side-2 Factors		
Habitats – 8	Factor I % of UT Area	Factor II # of SGCNs in Habitat	Factor III Wildlife Diversity	Sum Across I + II + III	Factor IV Threat	Factor V Value to Humans	Sum Across IV + V
Emergent	5	4	5	14	5	5	10
Open Water	4	4	5	13	5	5	10
Riverine	5	3	5	13	5	5	10
Aquatic - Forested	5	1	5	11	5	5	10
Aquatic - Scrub/Shrub	5	2	3	10	5	5	10
Mudflat Fringe	5	1	3	9	3	3	6
Water Pocket	5	1	3	9	3	3	6
Playa	5	2	1	8	3	3	6

Table 20 lists the five Aquatic Key Habitats along with their acreages and their percentage of Utah land area. The two lists in Table 20 are the same, just ordered differently – by descending order of factor-scoring on the left (kind of a rough order of their "importance"), and in alphabetical order on the right.

Table 20. List of the five WAP Aquatic Key Habitats, with acres and percents of Utah land area.

In descending order of Factor Scores		
Aquatic Key Habitat	Acres	% of Land Area
Emergent	375,399	0.69%
Open Water	882,641	1.62%
Riverine	120,256	0.22%
Aquatic - Forested	4,460	0.01%

In alphabetical order		
Aquatic Key Habitat	Acres	% of Land Area
Emergent	375,399	0.69%
Aquatic - Forested	4,460	0.01%
Open Water	882,641	1.62%
Riverine	120,256	0.22%

Aquatic - Scrub/Shrub	54,428	0.10%
	1,437,184	2.64%

Aquatic - Scrub/Shrub	54,428	0.10%
	1,437,184	2.64%

A coarse-scale map showing the extent of each of these five Aquatic Key Habitats within Utah appears in the narrative write-up of each one that is contained in the Key Habitats chapter of the 2015 WAP. High-resolution spatial extent of each Aquatic Key Habitat is maintained by and available from GIS staff of the Utah Division of Wildlife Resources.

Determining the Current Condition of the Aquatic Key Habitats.

Detailed condition data for Aquatic Key Habitats are limited to a few localized areas, such as the wetlands associated with the Great Salt Lake (Menuz, Sempler, Jones 2014). No comprehensive, statewide condition assessment has been completed. Nonetheless, significant progress toward the development, implementation, and ground-truthing of both a landscape scale and rapid assessment procedure was accomplished from 2011 to 2015 (Emerson and Menuz 2014; Emerson and Hooker 2011; UGS 2014). Substantial additional information regarding Utah's plan to implement aquatic habitat condition assessment and monitoring is provided in the Key Habitats and Monitoring chapters of the 2015 WAP.

Creating the 2015 Utah Wildlife Action Plan Threat Assessment

The approach the WAP Joint Team took to identify, measure, and prioritize the threats facing Utah's conservation targets grew from its shared experience of implementing the 2005 WAP, which propelled it toward a set of commonly-held ideals. These ideals were more descriptive than prescriptive, such as the widely understood need for a transparent and well-documented process. As such, the final process evolved into its final form by trial and error, leadership and compromise, rather than by dogma and decree.

The flexibility of the group tasked with developing this process had much to do with our recent and difficult - but illuminating - experience of jointly selecting conservation targets. That effort facilitated the development of the trust and resolve within the group to clearly articulate the purpose and qualities of the end product, before attempting to develop a process to create it. And a deadline-driven sense of urgency encouraged us to employ and extend existing approaches as much as practical, instead of attempting to create something completely novel.

Informally, our ideal process had five desired qualities:

- Uniformity – It would be sensibly applicable to all taxa and habitats without resorting to contortions.
- Unitary – A single approach would be the fairest process to all constituencies and to all targets; it would not propagate a legacy of unequal investment and progress.
- Universal – Any process would enable meaningful summary 'rollups' required by funders, agency leads, and program administrators.
- Ubiquitous - To the degree allowed by interstate cooperation, the ideal process would facilitate joint priorities between taxa and targets, and across administrative boundaries by using a common language and measurement scale.
- Utility – We sought to use existing procedures to better connect our results to existing programs and protocols, and where appropriate, to imbue these procedures with this broader purpose.

Any one-size-fits-all approach has shortcomings. There are a number of corollary issues and collateral shortfalls that result from these ideals. The group was aware of these flaws; they were debated, and ultimately none were found to be fatal. For example, dependence on a single set of published threat categories made our product dependent on its relative merits, and the 'pick-list' approach to unifying language limits nuance and eliminates narrative. There were also several acknowledged sources of bias. Our selection of an equality-based approach enforced a lowest common denominator bar for data inclusion versus an equitable approach where the best data for each taxa might be used. Similarly, vote-counting approaches such as this are subject to potentially undue weighting due to an exceptionally well-researched species, or well-documented or highly-salient threats. And finally, as in most human endeavors, the quality and value of our initial outputs were probably as reflective of who showed up and who spoke up, as much as the data we had to work with *per se*.

In a conscious effort to mitigate these sources of bias, we convened moderated groups of experts to assess the relative importance of each threat to each conservation target, using a customized threats 'calculator[187]' to capture these assessments, participants, citations, and data sources used in a standardized format ready for merging and summarization. Every effort was made to include *bona fide* experts armed with real data, GIS support, and all relevant documents. These groupings varied from large workshop format events with coordinated data calls and staff support, to distributed small groups where needed experts iteratively came to consensus when unable to be simultaneously present. While the ultimate assessment format varied somewhat, we consistently sought a process that efficiently maximized consensus and buy-in from participants. Every group used the same threats 'calculator', enforcing the use of the same language, definitions, and ranking criteria.

Our process rationale and rubric follows:

- Using the Salafsky et al. Level 1 and Level 2 Threats language, we created a threats 'calculator' to capture results of the species and habitat status assessments, the participants, the data employed, and the process used to arrive at the conclusions in a consistent semi-automated format that also allowed for immediate data merging and summarization. This was largely based on the NatureServe Conservation Rank Calculator. See the Monitoring and Adapting chapter for more detail on the rank calculator, its factor categories (one of which is "threats"), and their scoring.

- A third Level of detail was built into the threats calculator to allow users to incorporate additional details and specificity nested within the formalized first two levels. As each threat assessment group derived these categories independently, Level 3 categories also underwent a conforming process to eliminate duplication while preserving relevant difference.

- In order to deal with the pervasive, often stymieing uncertainty encountered in many conservation prioritization efforts, a twelfth Level 2 Threat was created for 'Crucial Data Gaps'. By doing so, we formally acknowledged that the lack of actionable information can itself be a paralyzing threat to effective conservation, and we elevated it as such. It is worth expanding upon our approach and rationale:

    - Each species and habitat has an endless suite of unanswered and unanswerable questions. To avoid bogging down in fruitless discussions, we created a means of assessing the state of knowledge for each conservation target in the areas needed to effect conservation action. In essence, we sought to catalogue our "known and unknown unknowns" in a consistent format, and on a level playing field.

    - Data gaps were categorized and summarized by the current state of knowledge for WAP conservation targets on two hierarchical 8-point scales, one for species and one for habitats.

[187] Implemented in Microsoft Excel, the "threats calculator" is a macro-enabled spreadsheet of several linked worksheets. It is the data-entry interface where threats are assessed for individual targets. The contents of its data summary sheet are copied over to another database, where the entire data set of threat assessments resides.

This scale was based on similar work done for the Florida WAP[188]. Each of the eight areas corresponds to areas of knowledge we considered essential for effective and efficient conservation (See Table DG1). This was done as a fair means of summarizing the current state of affairs across taxa and targets, and also provides a means of monitoring WAP progress toward meeting goals and objectives for reducing crucial data gaps.

- Categorizing and summarizing the state of knowledge for each WAP target and across all targets clarifies which data gaps, across the vast range of unknowns, are impediments to action and which are not. Just as for threats, the ability to 'roll-up' data gaps allows managers, researchers, and other conservationists to 1) better guide project actions, 2) develop more relevant research proposals, and 3) assess progress toward identified and ranked conservation goals and objectives by target, threat, or action at the species, habitat, or WAP scale.

The assessment and data gaps summaries were tabulated, ranked, and used to establish priorities as described and presented in the main text. As seen in this presentation, there are a number of real issues glossed over by this approach that impact diverse targets differently:

- All assessments suffered from a serious lack of reliable current data.
- Data layers describing the distributions of species and of threats, and the condition of aquatic habitats, were most notably of poor quality or missing entirely.
- Certain intersections of threats and targets were categorically difficult to assess: diffuse threats, ephemeral species, spatial heterogeneity, and probabilistic events – all proved challenging for participants to grapple with.

Yet while we acknowledge that no process is perfect, we understand the compromises inherent in our process well enough to be comfortable with these results. The threat assessments are credible enough to meet our near-term needs, and the process used to generate these results is transparent enough to be replicated and easily revised. In fact, revising these results with better data from targeted work (see the Monitoring and Adapting chapter for more detail) is the intent of many newly galvanized participants. The current state of knowledge for many species and habitats was not unknown to us as individual content experts, but it is both sobering and motivating in the aggregate. Encouragingly, there are many commonalities that point to cross-taxa efficiencies, common threat-mitigation approaches yielding benefits to many conservation targets, and a means to assess progress on what can too often seem an endless trek.

[188] http://myfwc.com/conservation/special-initiatives/fwli/taking-action/data-gaps/ accessed November 4, 2014.

Table 1. List of Threats for Utah[189]

IUCN-CMP L1 Code	IUCN-CMP L2 Code	UTAH L3 Code	Level 1 IUCN-CMP Threat / Level 2 IUCN-CMP Threat / Level 3 Utah-Specific Threat
1			**Residential and Commercial Development** Threats from human settlements or other non-agricultural land uses with a substantial footprint.
	1.1		**<u>Housing and Urban Areas</u>:** human cities, towns and settlements including non-housing development typically integrated with housing (e.g., *urban areas, suburbs, villages, vacation homes, shopping areas, offices, schools, hospitals*).
		1.1.1	Cabin Communities / Development
	1.2		**<u>Commercial and Industrial Areas</u>:** factories and other commercial centers (e.g., *manufacturing plants, shopping centers, office parks, military bases, power plants, train and ship yards, airports*).
		1.2.1	Expansion of Military Installations
		1.2.2	Landfill Operation
		1.2.3	Power Generation
	1.3		**<u>Tourism and Recreation Areas</u>:** tourism and recreation sites with a substantial footprint (e.g., *ski areas, golf courses, beach resorts, cricket fields,county parks, campgrounds*).
		1.3.1	Riparian Campground Development
		1.3.2	Trailhead and Staging Area Development
		1.3.3	Ski Area Development
2			**Improper Agriculture and Aquaculture** Threats from farming and ranching as a result of agricultural expansion and intensification, including silviculture, mariculture and aquaculture.
	2.1		**<u>Annual and Perennial Non-timber Crops</u>:** crops planted for food, fodder, fiber, fuel, or other uses (e.g., *farms, household swidden plots, plantations,orchards, vineyards, mixed agroforestry systems*).
		2.1.1	Conversion from Flood to Sprinkler Irrigation
		2.1.2	Conversion to Cropland or Pasture

[189] <u>Level 1 and 2 threats</u> are taken from: Salafsky, N., D. et al. 2008. A standard lexicon for biodiversity conservation: Unified classifications of threats and actions. Conservation Biology 22:897-911.

<u>Level 3 threats</u> were all drafted by local subject matter experts during the threat assessment exercise described in this appendix. The draft Level 3 threats were then reconciled and standardized by the Threats Committee of the WAP Joint Team. It is conceivable that more threats could be added, or that some of these existing ones could be consolidated (e.g., the plethora of nonmotorized recreational activities could be collapsed into a few, based on the kinds of remedial actions that could be undertaken). Such consolidation might possibly "change the arithmetic" of our threat prioritization exercise.

	2.2		**<u>Wood and Pulp Plantations</u>:** stands of trees planted for timber or fiber outside of natural forests, often with non-native species (e.g., *teak or eucalyptus plantations, silviculture, christmas tree farms*).
	2.3		**<u>Improper Livestock Farming and Ranching</u>:** domestic terrestrial animals raised in one location on farmed or nonlocal resources (farming); also domestic or semidomesticated animals allowed to roam in the wild and supported by natural habitats (ranching) (e.g., *cattle feed lots, dairy farms, cattle ranching, chicken farms, goat, camel, or yak herding*).
		2.3.1	Improper Grazing (current)
		2.3.2	Livestock Feedlot
		2.3.3	Water Developments for Livestock
		2.3.4	Improper Grazing (historic)
	2.4		**<u>Marine and Freshwater Aquaculture</u>:** aquatic animals raised in one location on farmed or nonlocal resources; also hatchery fish allowed to roam in the wild (e.g., *shrimp or fin fish aquaculture, fish ponds on farms, hatchery salmon, seeded shellfish beds, artificial algal beds*).
		2.4.1	Unintentional Spread of Non-native Species

3			**Energy Production and Mining** Threats from production of non-biological resources.
	3.1		**<u>Oil and Gas Drilling</u>:** exploring for, developing, and producing petroleum and other liquid hydrocarbons (e.g., *oil wells, deep sea natural gas drilling*).
		3.1.1	Well Pad Development
		3.1.2	Spills and Production Water
	3.2		**<u>Mining and quarrying</u>:** exploring for, developing, and producing minerals and rocks (e.g., *coal mines, alluvial gold panning, gold mines, rock quarries, coral mining, deep sea nodules, guano harvesting*).
		3.2.1	Hardrock Minerals
		3.2.2	Sand and Gravel
		3.2.3	Oil Shale
		3.2.4	Tar Sands
	3.3		**<u>Renewable Energy</u>:** exploring, developing, and producing renewable energy (e.g., *geothermal power production, solar farms, wind farms (including birds flying into windmills), tidal farms*).
		3.3.1	Geothermal Power Facilities
		3.3.2	Solar Power Facilities
		3.3.3	Wind Power Facilities
		3.3.4	Hydro Power Facilities
		3.3.5	Nuclear Power Facilities

4			**Transportation and Service Corridors** Threats from long narrow transport corridors and the vehicles that use them, including associated wildlife mortality.
	4.1		**<u>Roads and Railroads</u>:** surface transport on roadways and dedicated tracks (e.g., *highways, secondary roads, logging roads, bridges and causeways, road kill, fencing associated with roads, railroads*).

		4.1.1	Roads – Transportation Network
		4.1.2	Roads – Energy Development
		4.1.3	Railroads
	4.2		**Utility and Service Lines:** transport of ewnergy and resources (e.g., *electrical and phone wires, aqueducts, oil and gas pipelines, electrocution of wildlife*).
		4.2.1	Utility Lines / Towers - Power and Communication
		4.2.2	Pipelines / Powerlines - Energy Development
	4.3		**Shipping Lanes:** transport on and in freshwater and ocean waterways (e.g., *dredging, canals, shipping lanes, ships running into whales, wakes from cargo ships*).
	4.4		**Flight Paths:** air and space transport (e.g., *flight paths, jets impacting birds*).

5			**Biological Resource Use** Threats from consumptive use of "wild" biological resources including deliberate and unintentional harvesting effects; also persecution or control of specific species.
	5.1		**Hunting and Collecting Terrestrial Animals:** killing or trapping terrestrial wild animals or animal products for commercial, recreation, subsistence, research or cultural purposes, or for control/persecution reasons; includes accidental mortality/bycatch (e.g., *bushmeat hunting, trophy hunting, fur trapping, insect collecting, honey or bird nest hunting, predator control, pest control, persecution*).
		5.1.1	Excessive Harvest – Unregulated / Illegal
		5.1.2	Excessive Harvest – Regulated / Legal
		5.1.3	Incidental Poisoning
	5.2		**Gathering Terrestrial Plants:** harvesting plants, fungi, and other nontimber/nonanimal products for commercial, recreation, subsistence, research or cultural purposes, or for control reasons (e.g., *wild mushrooms, forage for stall fed animals, orchids, rattan, control of host plants to combat timber diseases*).
		5.2.1	Excessive Harvest – Unregulated / Illegal
		5.2.2	Excessive Harvest – Regulated / Legal
	5.3		**Logging and Wood Harvesting:** harvesting trees and other woody vegetation for timber, fiber, or fuel (e.g., *clear cutting of hardwoods, selective commercial logging of ironwood, pulp operations, fuel wood collection, charcoal production*).
		5.3.1	Improper Forest Management
		5.3.2	Woodcutting for Fuel / Posts
	5.4		**Fishing and Harvesting Aquatic Resources:** harvesting aquatic wild animals or plants for commercial, recreation, subsistence, research, or cultural purposes, or for control/persecution reasons; includes accidental mortality/bycatch (e.g., *trawling, blast fishing, spear fishing, shellfish harvesting, whaling, seal hunting, turtle egg collection, live coral collection, seaweed collection*).

6			**Human Intrusions and Disturbance** Threats from human activities that alter, destroy and disturb habitats and species associated with non-consumptive uses of biological resources.

	6.1		**Recreational Activities:** people spending time in nature or traveling in vehicles outside of established transport corridors, usually for recreational reasons (e.g., *off-road vehicles, motorboats, jet-skis, snowmobiles, ultralight planes, dive boats, whale watching, mountain bikes, hikers, birdwatchers, skiers, pets in rec areas, temporary campsites, caving, rock-climbing*).
		6.1.1	OHV Motorized Recreation
		6.1.2	Camping (Dispersed)
		6.1.3	Cave / Mine Exploration
		6.1.4	Hiking / Foot travel
		6.1.5	Low-level Aircraft Flights (tourism and recreation)
		6.1.6	Mountain Biking
		6.1.7	Pack / Saddle Stock
		6.1.8	River Rafting
		6.1.9	Rock Climbing
		6.1.10	Skiing
		6.1.11	Snowmobiling
		6.1.12	Unauthorized Species Introductions
		6.1.13	Skimboarding
		6.1.14	Swimming / Bathing
	6.2		**War, Civil Unrest and Military Exercises:** actions by formal or paramilitary forces without a permanent footprint (e.g., *armed conflict, mine fields, tanks and other military vehicles, training exercises and ranges, defoliation, munitions testing*).
		6.2.1	Military Testing and Training Activities
	6.3		**Work and Other Activities:** people spending time in or traveling in natural environments for reasons other than recreation or military activities (e.g., *law enforcement, drug smugglers, illegal immigrants, species research, vandalism*).
		6.3.1	Low-level aircraft flights (Law Enforcement, Medical, Etc)
		6.3.2	Motorized Travel
		6.3.3	Research and Monitoring

7			**Natural System Modifications** Threats from actions that convert or degrade habitat in service of "managing" natural or semi-natural systems, often to improve human welfare.
	7.1		**Fire and Fire Suppression:** suppression or increase in fire frequency and/or intensity outside of its natural range of variation (e.g., *fire suppression to protect homes, inappropriate fire management, escaped agricultural fires, arson, campfires, fires for hunting*).
		7.1.1	Inappropriate Fire Frequency and Intensity
		7.1.2	Fire Suppression Tactics
		7.1.3	Canal Burning
		7.1.4	Prescribed Fire

	7.2		**Dams and Water Management / Use:** changing water flow patterns from their natural range of variation either deliberately or as a result of other activities (e.g., *dam construction, dam operations, sediment control, change in salt regime, wetland filling for mosquito control, levees and dikes, surface water diversion, groundwater pumping, channelization, artificial lakes*).
		7.2.1	Presence of Dams
		7.2.2	Presence of Diversions
		7.2.3	Dam / Reservoir Operation
		7.2.4	Dam Safety
		7.2.5	Channelization / Bank Alteration (direct,intentional)
		7.2.6	Groundwater Pumping
		7.2.7	Spring Development / Capping
		7.2.8	Agricultural / Municipal / Industrial Water Usage
		7.2.9	Water Allocation Policies
		7.2.10	Salinity Alteration (of water)
		7.2.11	Sediment Transport Imbalance
		7.2.12	Diking / Pumping (specific to Great Salt Lake)
	7.3		**Other Ecosystem Modifications:** other actions that convert or degrade habitat in service of "managing" natural systems to improve human welfare (e.g., *land reclamation projects, abandonment of managed lands, rip-rap along shoreline, mowing grass, tree thinning in parks, beach construction, removal of snags from streams*).
		7.3.1	Brush Eradication / Vegetation Treatments
		7.3.2	Seeding Non-native Plants
		7.3.3	Channel Downcutting (indirect, unintentional)
		7.3.4	Water Developments for Wildlife
		7.3.5	Mine Shaft / Adit Closures
		7.3.6	Rotenone Treatments for Fish Control

8			**Invasive and Other Problematic Species and Genes** Threats from non-native and native plants, animals, pathogens/microbes, or genetic materials that have or are predicted to have harmful effects on biodiversity following their introduction, spread and/or increase in abundance.
	8.1		**Invasive Non-native / Alien Species:** harmful plants, animals, pathogens and other microbes not originally found within the ecosystem(s) in question and directly or indirectly introduced and spread into it by human activities (e.g., *feral cattle, household pets, zebra mussels, Dutch elm disease or chestnut blight, Miconia tree, introduction of species for biocontrol, Chytrid fungus affecting amphibians outside of Africa*).
		8.1.1	Invasive Wildlife Species – Non-native
		8.1.2	Invasive Plant Species – Non-native
		8.1.3	Feral Domesticated Animals
		8.1.4	Insects – Alien Organisms
		8.1.5	Disease – Alien Organisms

	8.2		**Problematic Native Species:** harmful plants, animals, or pathogens and other microbes that are originally found within the ecosystem(s) in question, but have become "out of balance" or released" directly or indirectly due to human activities (e.g., *overabundant native deer, overabundant algae due to loss of native grazing fish, native plants that hybridize with other plants, plague affecting rodents*).
		8.2.1	Problematic Wildlife Species – Native
		8.2.2	Problematic Insects – Native
		8.2.3	Problematic Plant Species – Native Upland
		8.2.4	Problematic Plant Species – Native Wetland
		8.2.5	Disease – Endemic Organisms
		8.2.6	Loss of Genetic Exchange / Inbreeding
		8.2.7	Natural Rarity
		8.2.8	Small Isolated Populations
	8.3		**Introduced Genetic Material:** human-altered or transported organisms or genes (e.g., *pesticide resistant crops, hatchery salmon, restoration projects using nonlocal seed stock, genetically modified insects for biocontrol, genetically modified trees, genetically modified salmon*).

9			**Pollution** Threats from introduction of exotic and/or excess materials or energy from point and nonpoint sources.
	9.1		**Household Sewage and Urban Waste Water:** water-borne sewage and nonpoint runoff from housing and urban areas that include nutrients, toxic chemicals and/or sediments (e.g., d*ischarge from municipal waste treatment plants, leaking septic systems, untreated sewage, outhouses, oil or sediment from roads, fertilizers and pesticides from lawns and golf-courses, road salt*).
		9.1.1	Stormwater Runoff
		9.1.2	Lack of Comprehensive Watershed Planning to Improve Water Quality (TMDL)
		9.1.3	Wastewater Treatment Plant Effluent - Excess Nutrients
	9.2		**Industrial and Military Effluents:** water-borne pollutants from industrial and military sources including mining, energy production, and other resource extraction industries that include nutrients, toxic chemicals and/or sediments (e.g., *toxic chemicals from factories, illegal dumping of chemicals, mine tailings, arsenic from gold mining, leakage from fuel tanks, PCBs in river sediments*).
		9.2.1	Heavy Metal Deposition
		9.2.2	Acid Mine Drainage
	9.3		**Agricultural and Forestry Effluents:** water-borne pollutants from agricultural, silivicultural, and aquaculture systems that include nutrients, toxic chemicals and/or sediments including the effects of these pollutants on the site where they are applied (e.g., *nutrient loading from fertilizer runoff, herbicide runoff, manure from feedlots, nutrients from aquaculture, soil erosion*).
		9.3.1	Agricultural Pollution
		9.3.2	Soil Erosion / Loss

	9.4		**Garbage and Solid Waste:** rubbish and other solid materials including those that entangle wildlife (e.g., *municipal waste, litter from cars, flotsam and jetsam from recreational boats, waste that entangles wildlife, construction debris*).
	9.5		**Air-borne Pollutants:** atmospheric pollutants from point and nonpoint sources (e.g., *acid rain, smog from vehicle emissions, excess nitrogen deposition, radioactive fallout, wind dispersion of pollutants or sediments, smoke from forest fires or wood stoves*).
		9.5.1	Atmospheric Deposition
		9.5.2	Soil Movement/Deposition
	9.6		**Excess Energy:** inputs of heat, sound, or light that disturb wildlife or ecosystems (e.g., *noise from highways or airplanes, sonar from submarines that disturbs whales, heated water from power plants, lamps attracting insects, beach lights disorienting turtles, atmospheric radiation from ozone holes*).
		9.6.1	Noise Pollution
		9.6.2	Thermal Alteration of Water (e.g., by power plant)
		9.6.3	Light Pollution

10			**Geological Events** Threats from catastrophic geological events.
	10.1		**Volcanoes:** volcanic events (e.g., *eruptions, emissions of volcanic gasses*).
	10.2		**Earthquakes / Tsunamis:** earthquakes and associated events (e.g., *earthquakes, tsunamis*).
	10.3		**Avalanches / Landslides:** avalanches or landslides (e.g., *avalanches, landslides, mudslides*).

11			**Climate Change and Severe Weather** Threats from long-term climatic changes that may be linked to global warming and other severe climatic or weather events outside the natural range of variation that could wipe out a vulnerable species or habitat.
	11.1		**Habitat Shifting and Alteration:** major changes in habitat composition and location (e.g., *sea-level rise, desertification, tundra thawing, coral bleaching*).
		11.1.1	Increasing Stream Temperatures
	11.2		**Droughts:** periods in which rainfall falls below the normal range of variation (e.g., *severe lack of rain, loss of surface water sources*).
	11.3		**Temperature Extremes:** periods in which temperatures exceed or go below the normal range of variation (e.g., *heat waves, cold spells, oceanic temperature changes, disappearance of glaciers/sea ice*).
	11.4		**Storms and Flooding:** extreme precipitation and/or wind events or major shifts in seasonality of storms (e.g., *cyclones, tornados, hailstorms, ice storms or blizzards, dust storms, erosion of beaches during storms*).

12			**Crucial Data Gaps** Gaps in our knowledge or understanding that severely impede our ability to detect, diagnose, and abate threats to species and habitats.
	12.1		**Inadequate Understanding of Ecology and Life History:** poor knowledge of the target and its relationship to its environment complicates or retards effective conservation

		12.1.1	Cheatgrass Impacts
		12.1.2	Importance and Contribution of Fluvial Populations
		12.1.3	Interaction with Non-native Species Unknown
		12.1.4	Vulnerability to Chytrid
		12.1.5	Relative Impacts of Fragmentation
		12.1.6	Persistent Declines in Prey Species
		12.1.7	Impacts on Migrating Birds
		12.1.8	Unknown Population Status
		12.1.9	Wind Power Impacts
	12.2		**Imperfect Understanding of Distribution or Range:** poor knowledge of location, extent, timing, and/or seasonal variation of occurrence complicates or retards effective conservation
	12.3		**Inadequate Inventory and Assessment Methods:** inability to sample or characterize condition of individuals or population complicates or retards effective conservation
		12.3.1	No Morphological Key or Other Means to Identify
		12.3.2	Inventory Techniques Poorly Developed
		12.3.3	No Standardized Condition Assessment Method
	12.4		**Taxonomic Debate:** uncertain identity complicates or retards effective conservation
		12.4.1	Uncertain Management / Conservation Unit
	12.5		**Abiotic Conditions and Processes:** uncertainty concerning specific physical or chemical processes complicates or retards effective conservation
		12.5.1	Atmospheric Deposition / Snowmelt Chemistry
		12.5.2	Relationship Between Groundwater and Surface Water
		12.5.3	Scope and Severity of Mercury Deposition
	12.6		**Climate Change:** uncertain climatic parameters and/or target tolerance and needs complicates or retards effective conservation
		12.6.1	Future Effects of Greater Temperature Variability under Climate Change
		12.6.2	Future Effects of Greater Precipitation Variability under Climate Change
	12.7		**Inadequate Restoration Tools:** lack of adequate restoration materials or methods complicates or retards effective conservation
		12.7.1	Plant Material Development

Contents and Intended Usage

The following tables present the results of the WAP Threat Assessment, from a single-species perspective. These tables are included here to assist those who may be working on individual species, to determine which priority threats are impacting those species. Threats are presented here at the L2 (intermediate detail) level, mainly by major taxonomic grouping. The exception is with mollusks and crustaceans, which are first lumped together as "invertebrates" and then split by key habitat group - aquatic or terrestrial. Numbers in the table refer to how many priority L3 threats affect each species.

The best way to locate the WAP text relating to these threats, is to use the WAP Table of Contents to find the page numbers where the relevant threat accounts begin.

Amphibians

Species Common Name		**Threat Impact**		
Level 2 Threat Name	**Very High**	**High**	**Medium**	**Grand Total**
Arizona Toad	**1**	**3**		**4**
Invasive Non-native Species		2		2
Dams and Water Management / Use		1		1
Droughts	1			1
Columbia Spotted Frog	**1**		**3**	**4**
Invasive Non-native Species			1	1
Housing and Urban Areas			1	1
Dams and Water Management / Use			1	1
Droughts	1			1
Great Plains Toad		**3**	**5**	**8**
Dams and Water Management / Use			3	3
Roads and Railroads		1		1
Recreational Activities		1		1
Droughts		1		1
Improper Livestock Farming and Ranching			1	1
Housing and Urban Areas			1	1
Mexican Spadefoot		**1**	**2**	**3**
Droughts			1	1
Improper Livestock Farming and Ranching			1	1
Recreational Activities		1		1
Northern Leopard Frog		**2**	**7**	**9**
Dams and Water Management / Use			4	4
Invasive Non-native Species		1	2	3
Other Ecosystem Modifications			1	1
Droughts		1		1
Plains Spadefoot		**1**	**2**	**3**
Droughts			1	1

Improper Livestock Farming and Ranching			1	1
Recreational Activities		1		1
Relict Leopard Frog	**2**	**3**	**2**	**7**
Invasive Non-native Species		2		2
Dams and Water Management / Use		1	1	2
Problematic Native Species	1			1
Droughts	1			1
Habitat Shifting and Alteration			1	1
Western Toad	**1**	**3**	**1**	**5**
Problematic Native Species		1		1
Droughts	1			1
Improper Livestock Farming and Ranching		1		1
Fire and Fire Suppression			1	1
Invasive Non-native Species		1		1
Grand Total	**5**	**16**	**22**	**43**

Aquatic Invertebrates

Species Common Name	Threat Impact			
Level 2 Threat Name	Very High	High	Medium	Grand Total
Bear Lake Springsnail		**1**	**2**	**3**
Dams and Water Management / Use			1	1
Improper Livestock Farming and Ranching			1	1
Problematic Native Species		1		1
Bifid Duct Pyrg		**3**	**2**	**5**
Roads and Railroads		1		1
Dams and Water Management / Use			1	1
Improper Livestock Farming and Ranching		1		1
Droughts		1		1
Problematic Native Species			1	1
Black Canyon Pyrg	**1**			**1**
Problematic Native Species	1			1
California Floater		**1**	**5**	**6**
Dams and Water Management / Use		1	2	3
Other Ecosystem Modifications			1	1
Problematic Native Species			1	1
Invasive Non-native Species			1	1
Carinate Glenwood Pyrg		**2**	**2**	**4**
Problematic Native Species		2		2
Recreational Activities			1	1
Invasive Non-native Species			1	1
Cloaked Physa	**1**			**1**
Problematic Native Species	1			1
Desert Springsnail		**4**	**3**	**7**
Dams and Water Management / Use		2	2	4
Invasive Non-native Species			1	1
Problematic Native Species		1		1
Housing and Urban Areas		1		1
Fat-whorled Pondsnail		**2**		**2**
Problematic Native Species		1		1
Invasive Non-native Species		1		1
Hamlin Valley Pyrg	**1**			**1**
Problematic Native Species	1			1
Kanab Ambersnail		**1**		**1**
Problematic Native Species		1		1
Lamb Rams-horn	**1**			**1**
Problematic Native Species	1			1
Longitudinal Gland Pyrg		**3**		**3**
Dams and Water Management / Use		1		1
Problematic Native Species		1		1
Droughts		1		1
Ninemile Pyrg		**1**		**1**

Problematic Native Species		1		1
Northwest Bonneville Pyrg		**1**		**1**
Problematic Native Species		1		1
Otter Creek Pyrg		**2**		**2**
Problematic Native Species		1		1
Invasive Non-native Species		1		1
Pilose Crayfish		**2**	**1**	**3**
Dams and Water Management / Use			1	1
Invasive Non-native Species		1		1
Droughts		1		1
Rocky Mountain Duskysnail			**1**	**1**
Problematic Native Species			1	1
Sierra Ambersnail	**1**			**1**
Problematic Native Species	1			1
Smooth Glenwood Pyrg	**1**	**1**		**2**
Recreational Activities		1		1
Problematic Native Species	1			1
Southern Bonneville Springsnail		**1**	**1**	**2**
Improper Livestock Farming and Ranching			1	1
Problematic Native Species		1		1
Sub-globose Snake Pyrg	**1**	**1**	**1**	**3**
Invasive Non-native Species		1	1	2
Problematic Native Species	1			1
Utah Amphipod	**1**	**1**	**1**	**3**
Droughts		1		1
Recreational Activities			1	1
Problematic Native Species	1			1
Utah Physa		**1**	**1**	**2**
Problematic Native Species		1		1
Invasive Non-native Species			1	1
Western Pearlshell	**1**	**2**	**2**	**5**
Problematic Native Species		1		1
Dams and Water Management / Use			1	1
Improper Livestock Farming and Ranching		1		1
Fire and Fire Suppression	1			1
Other Ecosystem Modifications			1	1
Wet-rock Physa		**1**		**1**
Problematic Native Species		1		1
Grand Total	**9**	**31**	**22**	**62**

Birds

Species Common Name Level 2 Threat Name	Threat Impact Very High	High	Medium	Grand Total
American Bittern			**1**	**1**
Invasive Non-native Species			1	1
American White Pelican		**1**		**1**
Problematic Native Species		1		1
Bald Eagle			**1**	**1**
Roads and Railroads			1	1
Black Rosy-finch			**2**	**2**
Habitat Shifting and Alteration			1	1
Droughts			1	1
Black Swift			**2**	**2**
Recreational Activities			1	1
Droughts			1	1
Boreal Owl			**2**	**2**
Problematic Native Species			1	1
Fire and Fire Suppression			1	1
Burrowing Owl			**1**	**1**
Invasive Non-native Species			1	1
California Condor		**2**	**2**	**4**
Problematic Native Species		2		2
Droughts			1	1
Fire and Fire Suppression			1	1
Caspian Tern	**1**	**1**		**2**
Problematic Native Species	1			1
Dams and Water Management / Use		1		1
Ferruginous Hawk		**1**	**4**	**5**
Problematic Native Species			1	1
Droughts		1		1
Recreational Activities			1	1
Fire and Fire Suppression			1	1
Invasive Non-native Species			1	1
Golden Eagle			**3**	**3**
Fire and Fire Suppression			1	1
Recreational Activities			1	1
Invasive Non-native Species			1	1
Greater Sage-grouse	**1**	**4**	**8**	**13**
Problematic Native Species		1	2	3
Other Ecosystem Modifications		1	2	3
Fire and Fire Suppression	1		1	2
Roads and Railroads			1	1

Droughts			1	1
Invasive Non-native Species		1		1
Dams and Water Management / Use		1		1
Housing and Urban Areas			1	1
Gunnison Sage-grouse	**1**	**4**	**8**	**13**
Problematic Native Species		1	3	4
Other Ecosystem Modifications		1	2	3
Fire and Fire Suppression	1		1	2
Dams and Water Management / Use		1		1
Droughts			1	1
Invasive Non-native Species		1		1
Housing and Urban Areas			1	1
Lewis's Woodpecker		**1**		**1**
Fire and Fire Suppression		1		1
Mexican Spotted Owl	**1**	**2**	**7**	**10**
Recreational Activities		1	3	4
Problematic Native Species			2	2
Invasive Non-native Species			1	1
Fire and Fire Suppression	1			1
Dams and Water Management / Use		1		1
Habitat Shifting and Alteration			1	1
Olive-sided Flycatcher		**1**	**1**	**2**
Fire and Fire Suppression		1		1
Droughts			1	1
Peregrine Falcon			**1**	**1**
Invasive Non-native Species			1	1
Sharp-tailed Grouse		**3**	**4**	**7**
Problematic Native Species			2	2
Invasive Non-native Species		1		1
Other Ecosystem Modifications		1		1
Fire and Fire Suppression		1		1
Droughts			1	1
Housing and Urban Areas			1	1
Snowy Plover			**2**	**2**
Problematic Native Species			1	1
Invasive Non-native Species			1	1
Southwestern Willow Flycatcher	**1**	**3**	**10**	**14**
Recreational Activities		1	1	2
Problematic Native Species	1		1	2
Dams and Water Management / Use			2	2
Invasive Non-native Species		1	1	2
Housing and Urban Areas			1	1
Improper Livestock Farming and Ranching			1	1
Roads and Railroads			1	1

Other Ecosystem Modifications			1	1
Droughts		1		1
Fire and Fire Suppression			1	1
White-faced Ibis		**2**	**4**	**6**
Invasive Non-native Species			2	2
Dams and Water Management / Use		1		1
Problematic Native Species			1	1
Droughts		1		1
Housing and Urban Areas			1	1
Yellow-billed Cuckoo		**5**	**6**	**11**
Other Ecosystem Modifications		2		2
Recreational Activities			2	2
Dams and Water Management / Use		1	1	2
Fire and Fire Suppression			1	1
Problematic Native Species		1		1
Improper Livestock Farming and Ranching		1		1
Droughts			1	1
Habitat Shifting and Alteration			1	1
Grand Total	**5**	**30**	**69**	**104**

Fishes

Species Common Name	Threat Impact			
Level 2 Threat Name	**Very High**	**High**	**Medium**	**Grand Total**
Bear Lake Sculpin	**2**	**2**	**1**	**5**
Dams and Water Management / Use	2	1		3
Recreational Activities		1		1
Invasive Non-native Species			1	1
Bear Lake Whitefish	**2**	**2**	**1**	**5**
Dams and Water Management / Use	2	1		3
Recreational Activities		1		1
Invasive Non-native Species			1	1
Bluehead Sucker	**5**	**4**	**3**	**12**
Dams and Water Management / Use	3	3	1	7
Invasive Non-native Species	1		1	2
Habitat Shifting and Alteration			1	1
Droughts	1			1
Fire and Fire Suppression		1		1
Bonneville Cisco	**2**	**2**	**1**	**5**
Dams and Water Management / Use	2	1		3
Recreational Activities		1		1
Invasive Non-native Species			1	1
Bonneville Cutthroat Trout	**1**	**12**	**2**	**15**
Dams and Water Management / Use		5	1	6
Invasive Non-native Species		2		2
Fire and Fire Suppression	1			1
Roads and Railroads		1		1
Recreational Activities			1	1
Habitat Shifting and Alteration		1		1
Improper Livestock Farming and Ranching		1		1
Droughts		1		1
Other Ecosystem Modifications		1		1
Bonneville Whitefish	**2**	**2**	**1**	**5**
Dams and Water Management / Use	2	1		3
Recreational Activities		1		1
Invasive Non-native Species			1	1
Bonytail	**2**	**5**	**7**	**14**
Dams and Water Management / Use		2	4	6
Problematic Native Species		2	1	3
Invasive Non-native Species	1		1	2
Droughts	1			1
Habitat Shifting and Alteration			1	1
Fire and Fire Suppression		1		1
Colorado Pikeminnow	**2**	**4**	**6**	**12**

Dams and Water Management / Use		3	4	7
Invasive Non-native Species	1		1	2
Habitat Shifting and Alteration			1	1
Droughts	1			1
Fire and Fire Suppression		1		1
Colorado River Cutthroat Trout	**1**	**11**	**2**	**14**
Dams and Water Management / Use		3		3
Roads and Railroads		2		2
Invasive Non-native Species		2		2
Habitat Shifting and Alteration		1		1
Fire and Fire Suppression	1			1
Recreational Activities			1	1
Droughts		1		1
Improper Livestock Farming and Ranching		1		1
Other Ecosystem Modifications		1		1
Problematic Native Species			1	1
Desert Sucker	**4**	**8**	**5**	**17**
Dams and Water Management / Use	1	3	2	6
Problematic Native Species			2	2
Invasive Non-native Species	1	1		2
Roads and Railroads		1		1
Fire and Fire Suppression		1		1
Recreational Activities			1	1
Habitat Shifting and Alteration	1			1
Droughts	1			1
Improper Livestock Farming and Ranching		1		1
Housing and Urban Areas		1		1
Flannelmouth Sucker	**5**	**4**	**3**	**12**
Dams and Water Management / Use	3	3	1	7
Invasive Non-native Species	1		1	2
Habitat Shifting and Alteration			1	1
Droughts	1			1
Fire and Fire Suppression		1		1
Humpback Chub	**2**	**4**	**5**	**11**
Dams and Water Management / Use		2	3	5
Problematic Native Species		1	1	2
Droughts	1			1
Invasive Non-native Species	1			1
Habitat Shifting and Alteration			1	1
Fire and Fire Suppression		1		1
June Sucker		**6**	**4**	**10**
Dams and Water Management / Use		3	1	4
Recreational Activities			1	1
Problematic Native Species		1		1

Droughts		1		1
Roads and Railroads			1	1
Habitat Shifting and Alteration			1	1
Invasive Non-native Species		1		1
Least Chub	**2**	**3**	**2**	**7**
Invasive Non-native Species	1		1	2
Recreational Activities		1		1
Droughts	1			1
Improper Livestock Farming and Ranching			1	1
Dams and Water Management / Use		1		1
Problematic Native Species		1		1
Northern Leatherside Chub	**1**	**3**	**2**	**6**
Dams and Water Management / Use		2	1	3
Housing and Urban Areas			1	1
Problematic Native Species		1		1
Droughts	1			1
Razorback Sucker	**2**	**4**	**8**	**14**
Dams and Water Management / Use		3	4	7
Invasive Non-native Species	1		1	2
Problematic Native Species			2	2
Droughts	1			1
Habitat Shifting and Alteration			1	1
Fire and Fire Suppression		1		1
Roundtail Chub	**5**	**5**	**3**	**13**
Dams and Water Management / Use	3	3	1	7
Invasive Non-native Species	1		1	2
Habitat Shifting and Alteration			1	1
Droughts	1			1
Problematic Native Species		1		1
Fire and Fire Suppression		1		1
Southern Leatherside Chub		**6**	**8**	**14**
Dams and Water Management / Use		5		5
Invasive Non-native Species		1	1	2
Roads and Railroads			1	1
Droughts			1	1
Other Ecosystem Modifications			1	1
Fire and Fire Suppression			1	1
Improper Livestock Farming and Ranching			1	1
Habitat Shifting and Alteration			1	1
Housing and Urban Areas			1	1
Virgin Chub	**5**	**9**	**3**	**17**
Dams and Water Management / Use	2	4	1	7
Invasive Non-native Species	1	1		2
Problematic Native Species		1	1	2

Droughts	1			1
Recreational Activities			1	1
Fire and Fire Suppression		1		1
Roads and Railroads		1		1
Habitat Shifting and Alteration	1			1
Housing and Urban Areas		1		1
Virgin Spinedace	**4**	**8**	**5**	**17**
Dams and Water Management / Use	1	3	2	6
Problematic Native Species			2	2
Invasive Non-native Species	1	1		2
Roads and Railroads		1		1
Fire and Fire Suppression		1		1
Recreational Activities			1	1
Habitat Shifting and Alteration	1			1
Droughts	1			1
Improper Livestock Farming and Ranching		1		1
Housing and Urban Areas		1		1
Woundfin	**5**	**9**	**3**	**17**
Dams and Water Management / Use	2	4	1	7
Invasive Non-native Species	1	1		2
Problematic Native Species		1	1	2
Droughts	1			1
Recreational Activities			1	1
Fire and Fire Suppression		1		1
Roads and Railroads		1		1
Habitat Shifting and Alteration	1			1
Housing and Urban Areas		1		1
Yellowstone Cutthroat Trout	**1**	**8**	**2**	**11**
Dams and Water Management / Use		2	1	3
Problematic Native Species		1		1
Roads and Railroads		1		1
Droughts		1		1
Recreational Activities			1	1
Fire and Fire Suppression	1			1
Improper Livestock Farming and Ranching		1		1
Habitat Shifting and Alteration		1		1
Invasive Non-native Species		1		1
Grand Total	**55**	**121**	**77**	**253**

Mammals

Species Common Name	**Threat Impact**			
Level 2 Threat Name	**Very High**	**High**	**Medium**	**Grand Total**
[a Race of the] Chisel-toothed Kangaroo Rat		**1**	**3**	**4**
Improper Livestock Farming and Ranching			1	1
Invasive Non-native Species			1	1
Fire and Fire Suppression		1		1
Housing and Urban Areas			1	1
[a Race of the] Montane Vole	**1**		**1**	**2**
Invasive Non-native Species			1	1
Housing and Urban Areas	1			1
[a Race of] Botta's Pocket Gopher			**1**	**1**
Invasive Non-native Species			1	1
Allen's Big-eared Bat			**4**	**4**
Roads and Railroads			1	1
Recreational Activities			1	1
Invasive Non-native Species			1	1
Other Ecosystem Modifications			1	1
American Bison		**2**		**2**
Improper Livestock Farming and Ranching		1		1
Housing and Urban Areas		1		1
Big Free-tailed Bat		**2**	**3**	**5**
Invasive Non-native Species		1	1	2
Improper Livestock Farming and Ranching			1	1
Droughts		1		1
Habitat Shifting and Alteration			1	1
Bighorn Sheep	**1**	**2**	**1**	**4**
Invasive Non-native Species	1	1		2
Improper Livestock Farming and Ranching		1		1
Problematic Native Species			1	1
Black-footed Ferret	**1**	**1**	**1**	**3**
Invasive Non-native Species	1			1
Roads and Railroads			1	1
Problematic Native Species		1		1
Dark Kangaroo Mouse		**2**	**2**	**4**
Recreational Activities			1	1
Problematic Native Species			1	1
Fire and Fire Suppression		1		1
Invasive Non-native Species		1		1
Dwarf Shrew			**2**	**2**
Habitat Shifting and Alteration			1	1
Droughts			1	1

Fringed Myotis	**1**		**1**	**2**
Other Ecosystem Modifications			1	1
Invasive Non-native Species	1			1
Gunnison's Prairie Dog		**1**	**2**	**3**
Droughts			1	1
Problematic Native Species			1	1
Invasive Non-native Species		1		1
Idaho Pocket Gopher		**1**	**1**	**2**
Problematic Native Species		1		1
Droughts			1	1
Kit Fox		**3**	**2**	**5**
Problematic Native Species		1		1
Droughts			1	1
Recreational Activities			1	1
Fire and Fire Suppression		1		1
Invasive Non-native Species		1		1
Little Brown Myotis	**1**		**2**	**3**
Habitat Shifting and Alteration			1	1
Improper Livestock Farming and Ranching			1	1
Invasive Non-native Species	1			1
Preble's Shrew		**3**		**3**
Improper Livestock Farming and Ranching		2		2
Droughts		1		1
Pygmy Rabbit		**4**		**4**
Improper Livestock Farming and Ranching		1		1
Other Ecosystem Modifications		1		1
Fire and Fire Suppression		1		1
Invasive Non-native Species		1		1
Spotted Bat		**1**	**4**	**5**
Invasive Non-native Species		1	1	2
Improper Livestock Farming and Ranching			1	1
Droughts			1	1
Habitat Shifting and Alteration			1	1
Townsend's Big-eared Bat		**1**	**1**	**2**
Recreational Activities		1		1
Other Ecosystem Modifications			1	1
Utah Prairie Dog	**1**	**3**	**2**	**6**
Invasive Non-native Species	1		1	2
Droughts		1		1
Problematic Native Species			1	1
Habitat Shifting and Alteration		1		1
Housing and Urban Areas		1		1
Western Red Bat			**2**	**2**
Other Ecosystem Modifications			1	1

Droughts			1	1
White-tailed Prairie Dog			**2**	**2**
Invasive Non-native Species			1	1
Droughts			1	1
Wolverine		**1**	**2**	**3**
Problematic Native Species		1	1	2
Habitat Shifting and Alteration			1	1
Grand Total	**6**	**28**	**39**	**73**

Reptiles

Species Common Name	Threat Impact			
Level 2 Threat Name	**Very High**	**High**	**Medium**	**Grand Total**
Black-necked Gartersnake			**3**	**3**
Roads and Railroads			2	2
Invasive Non-native Species			1	1
Desert Night Lizard	**1**		**2**	**3**
Droughts	1			1
Improper Livestock Farming and Ranching			1	1
Fire and Fire Suppression			1	1
Gila Monster	**3**	**3**		**6**
Invasive Non-native Species	1			1
Improper Livestock Farming and Ranching		1		1
Roads and Railroads		1		1
Fire and Fire Suppression	1			1
Droughts	1			1
Housing and Urban Areas		1		1
Many-lined Skink		**2**	**2**	**4**
Improper Livestock Farming and Ranching			1	1
Recreational Activities		1		1
Droughts		1		1
Problematic Native Species			1	1
Midget Faded Rattlesnake		**1**	**1**	**2**
Roads and Railroads		1	1	2
Mohave Desert Tortoise	**3**	**4**		**7**
Invasive Non-native Species	1	1		2
Improper Livestock Farming and Ranching		1		1
Roads and Railroads		1		1
Fire and Fire Suppression	1			1
Droughts	1			1
Housing and Urban Areas		1		1
Smith's Black-headed Snake			**3**	**3**
Droughts			1	1
Housing and Urban Areas			1	1
Fire and Fire Suppression			1	1
Spotted Leaf-nosed Snake	**2**			**2**
Problematic Native Species	1			1
Droughts	1			1
Utah Banded Gecko	**2**	**1**	**1**	**4**
Roads and Railroads		1		1
Housing and Urban Areas			1	1
Droughts	1			1

Fire and Fire Suppression	1			1
Utah Milksnake			**1**	**1**
Housing and Urban Areas			1	1
Western Threadsnake	**2**	**4**	**1**	**7**
Droughts			1	1
Roads and Railroads		1		1
Problematic Native Species		1		1
Fire and Fire Suppression	1			1
Improper Livestock Farming and Ranching		1		1
Housing and Urban Areas		1		1
Invasive Non-native Species	1			1
Grand Total	**13**	**15**	**14**	**42**

Terrestrial Invertebrates

Species Common Name	**Threat Impact**	
Level 2 Threat Name	**Very High**	**Grand Total**
Brian Head Mountainsnail	**1**	**1**
Problematic Native Species	1	1
Eureka Mountainsnail	**1**	**1**
Problematic Native Species	1	1
Mill Creek Mountainsnail	**1**	**1**
Problematic Native Species	1	1
Montane Snaggletooth	**1**	**1**
Problematic Native Species	1	1
Sluice Snaggletooth	**1**	**1**
Problematic Native Species	1	1
Southern Tightcoil	**1**	**1**
Problematic Native Species	1	1
Grand Total	**6**	**6**

Contents and Intended Usage

The following tables present the results of the WAP Threat Assessment, from a single-species perspective. These tables are included here to assist those who may be working on individual species, to determine which priority data gaps are impacting those species. Data gaps are presented here at the L2 level, mainly by major taxonomic grouping. The exception is with mollusks and crustaceans, which are first lumped together as "invertebrates" and then split by key habitat group - aquatic or terrestrial. Numbers in the table refer to how many L3 data gaps affect each species.

The best way to locate the WAP text relating to these data gaps, is to use the WAP Table of Contents to find the page numbers where the relevant data gap accounts begin.

Amphibians

Species Common Name	**Threat Impact**	
Level 2 Data Gap Name	**NA**	**Grand Total**
Mexican Spadefoot	**6**	**6**
Inadequate Understanding of Distribution or Range	1	1
Taxonomic Debate	1	1
Inadequate Understanding of Ecology and Life History	1	1
Climate Change	1	1
Abiotic Conditions and Processes	1	1
Inadequate Inventory and Assessment Methods	1	1
Northern Leopard Frog	**2**	**2**
Inadequate Understanding of Ecology and Life History	1	1
Abiotic Conditions and Processes	1	1
Plains Spadefoot	**6**	**6**
Inadequate Understanding of Distribution or Range	1	1
Taxonomic Debate	1	1
Inadequate Understanding of Ecology and Life History	1	1
Climate Change	1	1
Abiotic Conditions and Processes	1	1
Inadequate Inventory and Assessment Methods	1	1
Western Toad	**3**	**3**
Abiotic Conditions and Processes	1	1
Taxonomic Debate	1	1
Inadequate Understanding of Ecology and Life History	1	1
Grand Total	**17**	**17**

Aquatic Invertebrates

Species Common Name	Threat Impact	
Level 2 Data Gap Name	NA	Grand Total
[a Species of] Fossaria	**4**	**4**
Taxonomic Debate	1	1
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Inventory and Assessment Methods	1	1
Inadequate Understanding of Distribution or Range	1	1
Bear Lake Springsnail	**1**	**1**
Taxonomic Debate	1	1
Bifid Duct Pyrg	**2**	**2**
Inadequate Understanding of Distribution or Range	1	1
Inadequate Inventory and Assessment Methods	1	1
Black Canyon Pyrg	**2**	**2**
Inadequate Understanding of Distribution or Range	1	1
Inadequate Inventory and Assessment Methods	1	1
California Floater	**3**	**3**
Inadequate Inventory and Assessment Methods	1	1
Taxonomic Debate	1	1
Inadequate Understanding of Distribution or Range	1	1
Carinate Glenwood Pyrg	**2**	**2**
Inadequate Understanding of Distribution or Range	1	1
Inadequate Inventory and Assessment Methods	1	1
Cloaked Physa	**3**	**3**
Inadequate Inventory and Assessment Methods	1	1
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Coarse Rams-horn	**3**	**3**
Inadequate Inventory and Assessment Methods	1	1
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Desert Springsnail	**2**	**2**
Inadequate Understanding of Distribution or Range	1	1
Inadequate Inventory and Assessment Methods	1	1
Desert Tryonia	**3**	**3**
Inadequate Inventory and Assessment Methods	1	1
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Fat-whorled Pondsnail	**2**	**2**
Taxonomic Debate	1	1
Inadequate Understanding of Distribution or Range	1	1
Green River Pebblesnail	**4**	**4**

Taxonomic Debate	1	1
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Inventory and Assessment Methods	1	1
Inadequate Understanding of Distribution or Range	1	1
Hamlin Valley Pyrg	**2**	**2**
Inadequate Understanding of Distribution or Range	1	1
Inadequate Inventory and Assessment Methods	1	1
Kanab Ambersnail	**3**	**3**
Inadequate Inventory and Assessment Methods	1	1
Taxonomic Debate	1	1
Inadequate Understanding of Distribution or Range	1	1
Lamb Rams-horn	**2**	**2**
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Longitudinal Gland Pyrg	**2**	**2**
Inadequate Understanding of Distribution or Range	1	1
Inadequate Inventory and Assessment Methods	1	1
Mountain Marshsnail	**3**	**3**
Inadequate Inventory and Assessment Methods	1	1
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Ninemile Pyrg	**2**	**2**
Inadequate Understanding of Distribution or Range	1	1
Inadequate Inventory and Assessment Methods	1	1
Northwest Bonneville Pyrg	**2**	**2**
Inadequate Understanding of Distribution or Range	1	1
Inadequate Inventory and Assessment Methods	1	1
Otter Creek Pyrg	**2**	**2**
Inadequate Understanding of Distribution or Range	1	1
Inadequate Inventory and Assessment Methods	1	1
Pilose Crayfish	**3**	**3**
Inadequate Understanding of Ecology and Life History	2	2
Inadequate Inventory and Assessment Methods	1	1
Rocky Mountain Duskysnail	**1**	**1**
Inadequate Understanding of Distribution or Range	1	1
Rustic Ambersnail	**3**	**3**
Inadequate Inventory and Assessment Methods	1	1
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Sierra Ambersnail	**3**	**3**
Inadequate Inventory and Assessment Methods	1	1
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1

Smooth Glenwood Pyrg	**2**	**2**
Inadequate Understanding of Distribution or Range	1	1
Inadequate Inventory and Assessment Methods	1	1
Southern Bonneville Springsnail	**2**	**2**
Inadequate Understanding of Distribution or Range	1	1
Inadequate Inventory and Assessment Methods	1	1
Sub-globose Snake Pyrg	**2**	**2**
Inadequate Understanding of Distribution or Range	1	1
Inadequate Inventory and Assessment Methods	1	1
Top-heavy Column	**2**	**2**
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Utah Amphipod	**2**	**2**
Inadequate Understanding of Ecology and Life History	2	2
Utah Physa	**2**	**2**
Inadequate Understanding of Distribution or Range	1	1
Inadequate Inventory and Assessment Methods	1	1
Western Pearlshell	**1**	**1**
Inadequate Understanding of Distribution or Range	1	1
Wet-rock Physa	**1**	**1**
Inadequate Understanding of Distribution or Range	1	1
Widelip Pondsnail	**2**	**2**
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Grand Total	**75**	**75**

Birds

Species Common Name / Level 2 Data Gap Name	Threat Impact NA	Grand Total
American Bittern	**3**	**3**
Inadequate Inventory and Assessment Methods	2	2
Inadequate Understanding of Distribution or Range	1	1
American White Pelican	**1**	**1**
Inadequate Understanding of Distribution or Range	1	1
Band-tailed Pigeon	**2**	**2**
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Inventory and Assessment Methods	1	1
Bendire's Thrasher	**2**	**2**
Inadequate Understanding of Distribution or Range	1	1
Inadequate Inventory and Assessment Methods	1	1
Black Rosy-finch	**2**	**2**
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Black Swift	**1**	**1**
Inadequate Understanding of Distribution or Range	1	1
Boreal Owl	**2**	**2**
Inadequate Understanding of Distribution or Range	1	1
Inadequate Inventory and Assessment Methods	1	1
Burrowing Owl	**2**	**2**
Inadequate Understanding of Distribution or Range	1	1
Inadequate Inventory and Assessment Methods	1	1
Flammulated Owl	**2**	**2**
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Golden Eagle	**2**	**2**
Inadequate Understanding of Ecology and Life History	2	2
Greater Sage-grouse	**2**	**2**
Inadequate Understanding of Ecology and Life History	1	1
Climate Change	1	1
Gunnison Sage-grouse	**2**	**2**
Inadequate Understanding of Ecology and Life History	1	1
Climate Change	1	1
Lewis's Woodpecker	**1**	**1**
Inadequate Understanding of Distribution or Range	1	1
Mexican Spotted Owl	**4**	**4**
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Restoration Tools or Methods	1	1
Abiotic Conditions and Processes	1	1

Climate Change	1	1
Northern Pygmy-owl	**1**	**1**
Inadequate Understanding of Distribution or Range	1	1
Olive-sided Flycatcher	**1**	**1**
Inadequate Inventory and Assessment Methods	1	1
Peregrine Falcon	**1**	**1**
Inadequate Inventory and Assessment Methods	1	1
Snowy Plover	**1**	**1**
Inadequate Understanding of Ecology and Life History	1	1
Southwestern Willow Flycatcher	**1**	**1**
Inadequate Understanding of Distribution or Range	1	1
Yellow-billed Cuckoo	**5**	**5**
Inadequate Inventory and Assessment Methods	2	2
Inadequate Understanding of Ecology and Life History	1	1
Taxonomic Debate	1	1
Inadequate Understanding of Distribution or Range	1	1
Grand Total	**38**	**38**

Fishes

Species Common Name	Threat Impact	
Level 2 Data Gap Name	**NA**	**Grand Total**
Bluehead Sucker	**2**	**2**
Taxonomic Debate	1	1
Inadequate Understanding of Ecology and Life History	1	1
Bonneville Cutthroat Trout	**1**	**1**
Inadequate Understanding of Ecology and Life History	1	1
Bonytail	**4**	**4**
Inadequate Understanding of Ecology and Life History	2	2
Inadequate Inventory and Assessment Methods	1	1
Inadequate Understanding of Distribution or Range	1	1
Colorado Pikeminnow	**2**	**2**
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Colorado River Cutthroat Trout	**1**	**1**
Taxonomic Debate	1	1
Flannelmouth Sucker	**1**	**1**
Inadequate Understanding of Ecology and Life History	1	1
Humpback Chub	**3**	**3**
Inadequate Inventory and Assessment Methods	1	1
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Northern Leatherside Chub	**2**	**2**
Inadequate Understanding of Ecology and Life History	2	2
Razorback Sucker	**4**	**4**
Inadequate Understanding of Ecology and Life History	3	3
Inadequate Understanding of Distribution or Range	1	1
Roundtail Chub	**4**	**4**
Inadequate Inventory and Assessment Methods	2	2
Taxonomic Debate	1	1
Inadequate Understanding of Ecology and Life History	1	1
Grand Total	**24**	**24**

Mammals

Species Common Name	Threat Impact	
Level 2 Data Gap Name	NA	Grand Total
[a Race of the] Chisel-toothed Kangaroo Rat	**1**	**1**
Inadequate Understanding of Ecology and Life History	1	1
[a Race of the] Montane Vole	**3**	**3**
Inadequate Inventory and Assessment Methods	1	1
Taxonomic Debate	1	1
Inadequate Understanding of Distribution or Range	1	1
[a Race of] Botta's Pocket Gopher	**3**	**3**
Inadequate Inventory and Assessment Methods	1	1
Taxonomic Debate	1	1
Inadequate Understanding of Ecology and Life History	1	1
Allen's Big-eared Bat	**2**	**2**
Inadequate Understanding of Distribution or Range	1	1
Inadequate Inventory and Assessment Methods	1	1
Big Free-tailed Bat	**1**	**1**
Inadequate Inventory and Assessment Methods	1	1
Canada Lynx	**1**	**1**
Inadequate Understanding of Distribution or Range	1	1
Dark Kangaroo Mouse	**2**	**2**
Taxonomic Debate	1	1
Inadequate Understanding of Distribution or Range	1	1
Dwarf Shrew	**3**	**3**
Inadequate Inventory and Assessment Methods	1	1
Taxonomic Debate	1	1
Inadequate Understanding of Distribution or Range	1	1
Fringed Myotis	**1**	**1**
Inadequate Understanding of Distribution or Range	1	1
Idaho Pocket Gopher	**5**	**5**
Inadequate Inventory and Assessment Methods	3	3
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Little Brown Myotis	**4**	**4**
Taxonomic Debate	1	1
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Inventory and Assessment Methods	1	1
Inadequate Understanding of Distribution or Range	1	1
Preble's Shrew	**4**	**4**
Taxonomic Debate	1	1
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Inventory and Assessment Methods	1	1

Inadequate Understanding of Distribution or Range	1	1
Spotted Bat	**1**	**1**
Inadequate Inventory and Assessment Methods	1	1
Townsend's Big-eared Bat	**3**	**3**
Inadequate Understanding of Ecology and Life History	2	2
Inadequate Understanding of Distribution or Range	1	1
Western Red Bat	**2**	**2**
Taxonomic Debate	1	1
Inadequate Understanding of Distribution or Range	1	1
Wolverine	**1**	**1**
Inadequate Understanding of Distribution or Range	1	1
Grand Total	**37**	**37**

Reptiles

Species Common Name Level 2 Data Gap Name	Threat Impact NA	 Grand Total
Black-necked Gartersnake	**3**	**3**
Inadequate Understanding of Ecology and Life History	2	2
Climate Change	1	1
Desert Night Lizard	**1**	**1**
Inadequate Understanding of Distribution or Range	1	1
Many-lined Skink	**3**	**3**
Climate Change	1	1
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Midget Faded Rattlesnake	**7**	**7**
Inadequate Understanding of Ecology and Life History	3	3
Climate Change	1	1
Taxonomic Debate	1	1
Inadequate Inventory and Assessment Methods	1	1
Inadequate Understanding of Distribution or Range	1	1
Pyro Mountain Kingsnake	**4**	**4**
Taxonomic Debate	1	1
Inadequate Understanding of Distribution or Range	1	1
Climate Change	1	1
Inadequate Inventory and Assessment Methods	1	1
Smith's Black-headed Snake	**1**	**1**
Inadequate Understanding of Distribution or Range	1	1
Spotted Leaf-nosed Snake	**1**	**1**
Inadequate Understanding of Distribution or Range	1	1
Utah Milksnake	**4**	**4**
Taxonomic Debate	1	1
Inadequate Understanding of Distribution or Range	1	1
Climate Change	1	1
Inadequate Inventory and Assessment Methods	1	1
Western Threadsnake	**2**	**2**
Inadequate Understanding of Distribution or Range	1	1
Inadequate Inventory and Assessment Methods	1	1
Grand Total	**26**	**26**

Terrestrial Invertebrates

Species Common Name	Threat Impact	
Level 2 Data Gap Name	NA	Grand Total
[a Race of the] Yavapai Mountainsnail	**3**	**3**
Inadequate Inventory and Assessment Methods	1	1
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Brian Head Mountainsnail	**2**	**2**
Inadequate Understanding of Distribution or Range	1	1
Inadequate Inventory and Assessment Methods	1	1
Cross Snaggletooth	**3**	**3**
Inadequate Inventory and Assessment Methods	1	1
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Deseret Mountainsnail	**4**	**4**
Taxonomic Debate	1	1
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Inventory and Assessment Methods	1	1
Inadequate Understanding of Distribution or Range	1	1
Eureka Mountainsnail	**3**	**3**
Inadequate Inventory and Assessment Methods	1	1
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Lyrate Mountainsnail	**3**	**3**
Inadequate Inventory and Assessment Methods	1	1
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Mill Creek Mountainsnail	**4**	**4**
Taxonomic Debate	1	1
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Inventory and Assessment Methods	1	1
Inadequate Understanding of Distribution or Range	1	1
Mitered Vertigo	**3**	**3**
Inadequate Inventory and Assessment Methods	1	1
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Montane Snaggletooth	**3**	**3**
Inadequate Inventory and Assessment Methods	1	1
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Ribbed Dagger	**3**	**3**
Inadequate Inventory and Assessment Methods	1	1

Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Sluice Snaggletooth	**3**	**3**
Inadequate Inventory and Assessment Methods	1	1
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Southern Tightcoil	**2**	**2**
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Striate Gem	**2**	**2**
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Thin-lip Vallonia	**2**	**2**
Inadequate Understanding of Ecology and Life History	1	1
Inadequate Understanding of Distribution or Range	1	1
Grand Total	**40**	**40**

Appendix - Threats By Habitats Look-up Tables

The following tables present the results of the WAP Threat Assessment, from a single-habitat perspective. These tables are included here to assist those who may be working on individual habitats, to determine which priority threats are impacting those habitats. Threats are presented here at the L2 (intermediate detail) level, by aquatic and terrestrial habitats. Numbers in the table refer to how many priority L3 threats affect each habitat.

The best way to locate the WAP text relating to these threats, is to use the WAP Table of Contents to find the page numbers where the relevant threat accounts begin.

Aquatic Key Habitats

Key Habitat Name Level 2 Threat Name	**Threat Impact**			
	Very High	**High**	**Medium**	**Grand Total**
Aquatic-Forested	**3**	**4**	**7**	**14**
Dams and Water Management / Use	3	2	3	8
Roads and Railroads			1	1
Other Ecosystem Modifications		1		1
Droughts		1		1
Improper Livestock Farming and Ranching			1	1
Housing and Urban Areas			1	1
Invasive Non-native Species			1	1
Aquatic-Scrub/Shrub	**3**	**4**	**8**	**15**
Dams and Water Management / Use	3	1	3	7
Other Ecosystem Modifications		1	1	2
Roads and Railroads			1	1
Invasive Non-native Species			1	1
Fire and Fire Suppression			1	1
Droughts		1		1
Improper Livestock Farming and Ranching		1		1
Housing and Urban Areas			1	1
Emergent		**2**	**5**	**7**
Dams and Water Management / Use		1	3	4
Invasive Non-native Species			1	1
Other Ecosystem Modifications			1	1
Droughts		1		1
Open Water	**2**	**2**	**6**	**10**
Dams and Water Management / Use	2	1	2	5
Roads and Railroads			1	1
Invasive Non-native Species			1	1
Droughts		1		1
Improper Livestock Farming and Ranching			1	1
Housing and Urban Areas			1	1
Riverine	**3**	**5**	**8**	**16**

Dams and Water Management / Use	3	2	3	8
Other Ecosystem Modifications		1	1	2
Roads and Railroads			1	1
Invasive Non-native Species			1	1
Fire and Fire Suppression			1	1
Droughts		1		1
Improper Livestock Farming and Ranching		1		1
Housing and Urban Areas			1	1
Grand Total	**11**	**17**	**34**	**62**

Terrestrial Key Habitats

Key Habitat Name Level 2 Threat Name	Threat Impact Very High	 High	 Medium	 Grand Total
Aspen-conifer	**3**	**3**	**4**	**10**
Problematic Native Species	1	1	1	3
Improper Livestock Farming and Ranching	1	1		2
Fire and Fire Suppression	1			1
Other Ecosystem Modifications		1		1
Droughts			1	1
Habitat Shifting and Alteration			1	1
Housing and Urban Areas			1	1
Desert Grassland		**3**	**3**	**6**
Improper Livestock Farming and Ranching		1	1	2
Fire and Fire Suppression		1		1
Recreational Activities			1	1
Housing and Urban Areas			1	1
Invasive Non-native Species		1		1
Gambel Oak		**1**	**2**	**3**
Fire and Fire Suppression		1		1
Invasive Non-native Species			1	1
Housing and Urban Areas			1	1
Lowland Sagebrush	**2**	**4**	**3**	**9**
Other Ecosystem Modifications		1	1	2
Improper Livestock Farming and Ranching		1		1
Invasive Non-native Species	1			1
Fire and Fire Suppression	1			1
Problematic Native Species			1	1
Habitat Shifting and Alteration		1		1
Droughts		1		1
Housing and Urban Areas			1	1
Mojave Desert Shrub	**2**	**1**	**1**	**4**
Improper Livestock Farming and Ranching		1		1
Invasive Non-native Species	1			1
Fire and Fire Suppression	1			1
Housing and Urban Areas			1	1
Mountain Sagebrush	**2**	**2**	**7**	**11**
Other Ecosystem Modifications			2	2
Improper Livestock Farming and Ranching	1	1		2
Fire and Fire Suppression			1	1
Habitat Shifting and Alteration			1	1
Problematic Native Species	1			1
Roads and Railroads			1	1

Droughts		1		1
Housing and Urban Areas			1	1
Invasive Non-native Species			1	1
Mountain Shrub			**2**	**2**
Other Ecosystem Modifications			1	1
Invasive Non-native Species			1	1
Grand Total	**9**	**14**	**22**	**45**

The following tables present the results of the WAP Threat Assessment, from a single-habitat perspective. These tables are included here to assist those who may be working on individual habitats, to determine which data gaps are impacting those habitats. Data gaps are presented here at the L2 (intermediate detail) level, by aquatic and terrestrial habitats. Numbers in the table refer to how many L3 data gaps affect each habitat.

The best way to locate the WAP text relating to these data gaps, is to use the WAP Table of Contents to find the page numbers where the relevant data gap accounts begin.

Aquatic Key Habitats

Key Habitat Name	**Threat Impact**	
Level 2 Data Gap Name	**NA**	**Grand Total**
Aquatic Habitats	**14**	**14**
Aquatic-Forested	**2**	**2**
Inadequate Inventory and Assessment Methods	1	1
Abiotic Conditions and Processes	1	1
Aquatic-Scrub/Shrub	**3**	**3**
Abiotic Conditions and Processes	1	1
Inadequate Understanding of Distribution or Range	1	1
Inadequate Inventory and Assessment Methods	1	1
Emergent	**4**	**4**
Inadequate Inventory and Assessment Methods	2	2
Inadequate Understanding of Distribution or Range	1	1
Abiotic Conditions and Processes	1	1
Open Water	**2**	**2**
Inadequate Inventory and Assessment Methods	1	1
Abiotic Conditions and Processes	1	1
Riverine	**3**	**3**
Abiotic Conditions and Processes	1	1
Inadequate Understanding of Distribution or Range	1	1
Inadequate Inventory and Assessment Methods	1	1
Grand Total	**14**	**14**

Terrestrial Key Habitats

Key Habitat Name	Threat Impact	
Level 2 Data Gap Name	**NA**	**Grand Total**
Terrestrial Habitats	**7**	**7**
Lowland Sagebrush	**2**	**2**
Inadequate Restoration Tools or Methods	2	2
Mojave Desert Shrub	**3**	**3**
Inadequate Restoration Tools or Methods	2	2
Climate Change	1	1
Mountain Meadow	**1**	**1**
Inadequate Restoration Tools or Methods	1	1
Mountain Sagebrush	**1**	**1**
Inadequate Restoration Tools or Methods	1	1
Grand Total	**7**	**7**