

EXECUTIVE SUMMARY

Congress passed the State Wildlife Grants program (SWG) in 2001 in recognition of the need for funding of wildlife diversity programs. Congress mandated each state and territory to develop a Comprehensive Wildlife Conservation Strategy (now named Wildlife Action Plans) by 2005 in order to continue to receive federal funds through the SWG program. Nevada's Wildlife Action Plan (WAP) was completed and approved by the U.S. Fish and Wildlife Service (USFWS) in 2005. Nevada's WAP has served as a plan of action for state wildlife conservation and funding by targeting the species of greatest conservation need and the key habitats on which they depend. To date, NDOW has received over \$11 million in federal dollars through the SWG program.

NDOW has been coordinating and leading a conservation partner planning team to revise Nevada's Wildlife Action Plan to incorporate the potential impacts of emerging and expanding stressors including climate change, accelerated energy development, invasive species, and disease on Nevada's fish, wildlife, and habitats. NDOW partnered with the original Wildlife Action Plan team: The Nevada Natural Heritage Program, The Lahontan Audubon Society, The Nature Conservancy, and also The Great Basin Bird Observatory to develop this revision to the plan.

Among the 50 states, Nevada ranks eleventh in overall biological diversity and is unfortunately ranked fifth in the number of species extinctions. Nevada's diversity of life is derived from its geography; the many mountain ranges are effectively isolated from one another by arid and treeless basins. Nevada's borders encompass about 71 million acres, making it the seventh largest state. The federal government administers 86% of the land base.

Nevada is uniquely challenged in approaching effective wildlife conservation in part because of its arid climate, geography and limited water resources, which has created a unique endemic biota easily subject to threats and stressors. Throughout Nevada, water is a scarce and valuable resource essential for both human needs and maintenance of wildlife and their habitats, thus the alteration of hydrologic resources is a significant source of stress to wildlife resources. Invasive, exotic and feral species are critical problems facing both terrestrial and aquatic species and habitats in Nevada.

NDOW has been coordinating with state, federal, and local agencies, and conservation organizations to gather pertinent information for the plan revision. Public scoping meetings were held the winter of 2012 in Elko, Las Vegas, and Reno. We have been working with multiple stakeholders to assess key habitats and species most likely to be affected by these stressors and have developed effective strategies for managing and mitigating impacts. By identifying key conservation actions, we will be in a stronger position to ensure ecosystem resiliency across the changing landscape for key habitats and species. A major project theme will be "keeping common species common" through the constant assessment of the status and needs of wildlife and their habitat and the initiation of responsive action before critical thresholds are crossed.

This Nevada Wildlife Action Plan Revision (2012) is organized into 11 major sections:

- Introduction
- An Overview of Nevada
- Approach & Methods
- Nevada's Wildlife Heritage
- Challenges in Wildlife Management
- Identification of Species of Conservation Priority
- Defining Nevada's Landscape for Wildlife
- The Conservation Strategies for Nevada's 22 Key Habitats and Their Associated Wildlife

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- Key Partnerships and Implementation Mechanisms
- Conservation Education and Watchable Wildlife
- Species Accounts

The sections are intended to complement each other and work together to describe the overwhelming task of comprehensive wildlife conservation in Nevada, the partners expected to participate in its ultimate achievement, and the expectations and methods of implementation.

With the help of experts from all taxonomic fields, the WAP Team identified a total of 256 Species of Conservation Priority. The various ecological systems of the state were organized into 22 key habitat types. Multi-level strategies were devised for these 22 key habitats that integrate conservation needs for species assemblages as well as individual species. Each strategy describes the habitats, their values to wildlife, land uses within the habitat and problems facing the species and habitats. This information provides support to the goals, objectives and actions that follow. The objectives and actions are derived from existing conservation plans, where available, and feedback from multiple meetings with species experts and conservation partners during the revision of the WAP. Each strategy includes a list of key conservation partners, programs, and projects likely to fulfill the objectives for each key habitat, and identifies preliminary focal areas for action through a process that involved coordination with partners and concurrent planning processes.

As in the 2005 plan, it will be the task of Nevada's wildlife conservation partnership to evaluate the 22 strategies, set priorities, design implementation plans, monitor progress and evaluate the results. The WAP describes work prioritization and quantifiable objectives, key partnerships and implementation mechanisms, including several proposed examples to achieve successful implementation of the WAP. During implementation of Nevada's WAP, it is critical to recognize the importance of monitoring success and adjusting priorities and actions (adaptive management).

HOW TO USE THIS PLAN

Use of this Plan

The Nevada Wildlife Action Plan (WAP) serves as a comprehensive, landscape level plan, identifying the species of greatest conservation need and the key habitats on which they depend, with the intent to prevent wildlife species from becoming threatened or endangered. The WAP contains conservation actions to provide guidance to successfully conserve Nevada's key habitats and priority species. Many of the conservation actions within the WAP are strategies identified in other existing conservation plans. The WAP's recommended conservation actions in no way represent a mandate or expectation for a given party to carry out or implement these actions. During WAP implementation, conservation actions developed at the state or local level would be used to provide guidance to address site-specific conditions as appropriate. Some of these actions may be applicable at the land use plan level, and some more appropriately applied at an activity plan or site-specific plan level.

The next step in the ongoing implementation phase will be to tier down possible actions identified in the WAP that will form the basis for prioritized work plans, site-specific decisions, and planned actions. Wildlife conservation partners and stakeholders will be encouraged to contribute to and review these implementation processes.

Guiding Principles

Conservation partners from the Governor's Sage-Grouse Conservation Team convened in May 2005 to develop a set of "guiding principles" for the WAP writing team while preparing the Draft Plan. The guiding principles decided upon included:

- the WAP is a guidance document for enhanced conservation, not a de facto regulatory document
- the WAP will function as a usable document incorporating adaptive management theory
- the WAP is a road map linking existing plans into common effort
- the WAP is primarily focused on the conservation of wildlife
- the WAP operates under a collaborative process
- the WAP recognizes all authorities, jurisdictions, and citizen's rights, including property rights
- the WAP is primarily designed to address the needs of species before they become imperiled through the creation and implementation of incentives, services, and benefits
- Regulation is recognized as a sometimes necessary mechanism when voluntary processes fail; regulation should be developed as an open, collaborative, citizen based process.

These guiding principles continue to hold true in this 2012 revision of the Wildlife Action Plan.

2012 Nevada Wildlife Action Plan Revision Structure

The Nevada Wildlife Action Plan Revision (2012) is organized into 11 major sections that are intended to complement each other and work together to describe the overwhelming task of comprehensive wildlife conservation in Nevada, the partners expected to participate in its ultimate achievement, and the expectations and methods of implementation.

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- **Introduction** describes the purpose and intent of the WAP, its legislative mandate, and the major guidance provided by Congress.
- **An Overview of Nevada** describes the nature of Nevada’s ecological setting, its socioeconomic history, and the land ownership mosaic.
- **Approach & Methods** describes the methodologies that were utilized during the analyses of species of conservation priority, key habitats, climate change effects on wildlife, and developing conservation strategies.
- **Nevada’s Wildlife Heritage** describes the state’s current wildlife resources as influenced by geological and historical processes – why Nevada has the species it has, and why and how species develop conservation risk. The process for determining the Species of Conservation Priority to be featured in this strategy is described in general terms in this section, with a detailed description of the species prioritization processes used occurring in Appendix D.
- **Challenges in Wildlife Management** describes the issues influencing wildlife conservation, anthropogenic, and natural in origin. Issues ranging from climate change to invasive species to development are discussed.
- **Identification of Species of Conservation Priority** describes the methodologies that we utilized during the analysis of species of conservation priority. The process for determining the Species of Conservation Priority to be featured in this strategy is described in general terms in this section, with a detailed description of the species prioritization processes used occurring in Appendix D.
- **Defining Nevada’s Landscape for Wildlife** discusses the development of the ecological framework for strategy development. Here, the reader can find the process for developing the 22 Key Habitats from Southwest ReGAP habitat type inventory to provide the basic strategy units (the Key Habitats), the process by which we linked Species of Conservation Priority to the 22 Key Habitats to interlock species conservation strategy development with habitat types, and the process by which we identified potential focus areas where conservation strategy for the species and key habitats was likely to be applied. In addition, the reader will find the various landscape scale conservation-based efforts, initiatives, and/or cooperatives that have been developed in recent years to streamline land management efforts throughout Nevada.
- **The Conservation Strategies for Nevada’s 22 Key Habitats and Their Associated Wildlife** provides the main description of the conservation task at hand in Nevada. Here the reader will find descriptions of the 22 major habitat groups that occur in the state along with each key habitat’s particular importance to wildlife, each key habitat’s associated Species of Conservation Priority organized by the important features of the habitat type that most influence the presence of the species (“key habitat elements important to wildlife”). Included in this section are the predicted effects of climate change and wildlife responses to those effects, each key habitat’s current condition, current land uses, and current problems in meeting its full contribution to statewide comprehensive wildlife conservation. A Conservation Strategy has been designed for each key habitat, consisting of goals written in terms of desired landscape conditions, directional objectives (increase, decrease, maintain) that are measurable with respect to their overall trend by the end of the planning period, and suggested management actions that could significantly contribute toward the movement of the objectives into the desired

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direction. While most management actions are habitat-based, working under the assumption that the most effective method for maintaining healthy, diverse wildlife populations is through responsible habitat management, some management actions are non-habitat-based and refer to a single species or sometimes groups of species. While species-based actions could occur across a variety of habitat types, we attempted to present actions in the habitat type that is key to their implementation to avoid redundancy in the text.

- The **Key Partnerships and Implementation Mechanisms** section describes how the conservation strategies from the Key Habitats section will be prioritized, compiled, and integrated into the appropriate planning processes, distributed for local working group implementation, monitored for effectiveness, collectively analyzed and adjusted to meet new perceptions of need. Methods of partnership development of WAP services and products and partnership guidance of overall implementation are discussed in this section.
- The **Conservation Education and Watchable Wildlife** section describes Wildlife Education objectives, Watchable Wildlife objectives, and also implementation mechanisms and effectiveness methodologies for Conservation Education in the WAP.
- For readers with a species-based focus, we have provided a separate section of **Species Accounts** that not only provide status, distribution, and natural history information for each Species of Conservation Priority, but also attempt to capture the conservation strategies from the Key Habitat discussions relevant to a particular species and consolidate them in one place for quick review.

INTRODUCTION

Purpose and Scope of the Nevada Wildlife Action Plan

The Nevada Department of Wildlife (NDOW) was charged with the development of a statewide Comprehensive Wildlife Conservation Plan, now called Nevada's Wildlife Action Plan (WAP). This planning process was required of each state to continue to receive federal funds through the State Wildlife Grants program. Nevada's original Wildlife Action Plan was completed and approved by the U.S. Fish and Wildlife Service (USFWS) in December, 2005. To date, NDOW has received over \$11 million in federal dollars through the State Wildlife Grants program.

NDOW has been coordinating and leading a conservation partner planning team to revise Nevada's WAP to incorporate the potential impacts of emerging and expanding stressors including climate change, accelerated energy development, and invasive species on Nevada's fish, wildlife, and habitats. NDOW partnered with the original Wildlife Action Plan team: The Nevada Natural Heritage Program, The Lahontan Audubon Society, The Nature Conservancy, and also The Great Basin Bird Observatory to develop this revision to the plan. This partnership team was awarded a State Lands Question 1 Bond Habitat Conservation Planning grant in order to help fund these efforts.

We have been working with multiple stakeholders to assess key habitats and species most likely to be affected by these stressors and are developing effective strategies for managing and mitigating impacts. By identifying key conservation actions, we will be in a stronger position to ensure ecosystem resiliency across the changing landscape for key habitats and species. The benefit will be healthy and diverse wildlife populations across the state of Nevada. Primary focus will center on proactively preventing species from being listed as threatened or endangered as well as the restoration of species already listed. A major project theme will be "keeping common species common" through the constant assessment of the status and needs of wildlife and their habitat and the initiation of responsive action before critical thresholds are crossed.

The Original Eight Required Elements Addressed in the Nevada Wildlife Action Plan

This WAP sets a strategic vision for wildlife conservation in Nevada. To further clarify the vision, Congress requires addressing these eight elements in the WAP:

1. Information about wildlife species numbers and distribution,
2. Descriptions of key habitats and locations,
3. Descriptions of problems that may affect identified species and research needed to improve the situations,
4. Descriptions of proposed actions for conservation of the identified wildlife and their habitats,
5. Descriptions of how the species and results of the actions will be monitored,
6. Descriptions of how the strategy will be reviewed and updated on a periodic basis,
7. Coordination with federal, state, local agencies and Indian tribes if the plan impacts land managed by these groups, and,
8. Public participation to identify their priorities.

In 2009, the Association of Fish & Wildlife Agencies (AFWA) and U.S. Fish & Wildlife Service produced a series of guidelines for the states and territories with recommendations on how to incorporate climate change during a

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major revision of the Wildlife Action Plan. All revisions must continue to address the required eight elements as mandated by Congress, hence the guidance document, *“Voluntary Guidance for States to Incorporate Climate Change into State Wildlife Action Plans & Other Management Plans”* (Appendix A). The recommendations on how to incorporate climate change under each required element in this document provided important guidance to the revision of Nevada’s Wildlife Action Plan. The Wildlife Action Plan Team also reviewed the *“Preliminary Draft State Wildlife Action Plan Best Practices”* document being developed by the AFWA Teaming with Wildlife Committee State Wildlife Action Plan Best Practices Working Group, and have incorporated many of the proposed best practices into this plan revision.

NDOW and the Revision Team have been coordinating with state, federal, and local agencies, and conservation organizations to gather pertinent information for the plan revision. An overview of the revision process was provided to the Board of Wildlife Commissioners in December 2011. Public scoping meetings were held the winter of 2012 in Elko, Las Vegas, and Reno. The revised plan is expected to be completed and submitted to the USFWS for approval by summer of 2012.

AN OVERVIEW OF NEVADA

Physical and Natural Setting

Biophysical Regions and Major Habitat Types

Although Nevada is defined on the map by its political boundary, its interconnected landscapes are a subset of four ecoregions of the western United States. Ecoregions are based on biotic and environmental factors that include climate, physiography, water, soils, air, hydrology, and potential natural vegetation communities (Bailey, 1995). Dinerstein et al. (2000) defined ecoregions as “relatively large areas of land and water that contain geographically distinct assemblages of natural communities.” The four ecoregions that overlap Nevada include the Columbia Plateau, Great Basin, Sierra Nevada, and Mojave Desert.

The Columbia Plateau is a broad expanse of sagebrush-covered volcanic plains and valleys in the semi-arid Intermountain West that is crossed by the large riverine systems of the Columbia, Snake, Boise, and Owyhee. The ecoregion covers over 301,000 square kilometers (116,220 square miles) of land – of which 97% is located in Oregon, Idaho, Washington, and Nevada, and the remainder in California, Utah, and Wyoming.

The Columbia Plateau is bordered to the south by the Great Basin ecoregion which encompasses more than 29,137,365 hectares (72 million acres) of semidesert from the east slope of the Sierra Nevada across much of Nevada to the Wasatch Mountains of the western Rocky Mountains in central Utah. Nevada is the most mountainous state in the U.S. with over 300 mountain ranges separated by long, broad valleys. The Great Basin is characterized by salt desert scrub and sagebrush shrublands in the valleys and the lower slopes, and by piñon-juniper woodlands, mountain sagebrush, open conifer forests, and alpine areas in the mountain ranges. Remote mountain tops, isolated aquatic habitats in valley bottoms, weathered badlands, and sand dunes highlight the Great Basin’s unique biological diversity.

Desert slopes on the east side of the Sierra Nevada ecoregion partially descend upon Nevada along the western Great Basin border. Vegetation in this part of the ecoregion is characterized by conifer communities mixed with sagebrush and piñon-juniper in the lower elevations and an alpine zone characterized by bare rock, permanent snow fields, and a few grass or forb species.

Finally, the Mojave Desert characterizes much of southern Nevada. The Mojave Desert extends from southwestern Utah to southeastern California over to western and northwestern Arizona. Creosote scrub, succulents, and yucca-blackbrush community types dominate the ecoregion. Upper elevation community types, atypical of a desert ecoregion, do occur in the sky island mountains and mountain ranges of the Mojave Desert which contain some of the ecoregion’s most isolated communities and species.

Climate

Nevada contains portions of two great deserts, the Great Basin Desert and the northern extent of the Mojave Desert. The Great Basin Desert is a cold desert; the Mojave is the smallest of America’s hot deserts. These two physiographic provinces dominate the Nevada landscape. While the Sierra Nevada barely make a physical incursion into Nevada, its physical presence dominates the entire state by dictating rainfall patterns and vegetation patterns, which in turn strongly influence the distribution of wildlife in the state. The Sierra Nevada reaches an elevation of 4,265 m (14,000 ft). Rising in a relatively short distance from the Pacific Ocean, the principal source of moisture for the region, the mountains force westward-moving and moisture-laden air

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masses upward at a dramatic rate. The rising air masses cool, water condenses and forms droplets, and then precipitates as either snow or rain. Thus, the Sierra Nevada effectively rake the moisture out of storm fronts, collecting the moisture on their own granitic shoulders and growing impressive forests of fir, pine, and cedar. The rain shadow created by the Sierra Nevada is recognizable across the state, but is most pronounced in a belt from Tonopah to Lovelock (Trimble, 1989).

Average annual precipitation in Nevada is 23 cm (9 inches), making it the driest state in the nation. Precipitation falls primarily as snow in the Great Basin and Columbia Plateau and as rain in the Mojave Desert, one of the principal factors distinguishing these two regions. The Mojave region is also far more likely to receive summer rains as it lies at the northern limit of the region of the American Southwest that consistently receives monsoonal rains generated from weather systems originating in the Gulf of Mexico. Within Nevada's Great Basin, only White Pine County receives about a month's worth of monsoonal weather (Trimble, 1989).

The average precipitation figure is misleading in that it masks a tremendous amount of variation across the state. The climate of the Great Basin-Mojave Desert region is one of the most varied and extreme in the world (Hidy and Klieforth, 1990). Individual mountain ranges can lift air masses, wringing out whatever moisture escaped the Sierra Nevada and creating precipitation at higher elevations. This local orographic effect creates a rainfall gradient, with mountains receiving noticeably more precipitation than adjacent basins.

Much of the precipitation that falls in the Great Basin arrives outside of the growing season, a problem that vexed settlers and established an evolutionary challenge for plants. Because snowfall occurs outside of the growing season, Great Basin plants must rely largely on water stored in the soil as snow melts. Summer rains in the state are often gully-washers, brief torrents that run off before much moisture can soak into the soil and benefit plants.

While winters in the Great Basin are cold, summers are conversely hot and dry. A temperature range between winter lows and summer highs of 150 degrees has been recorded in Elko (Trimble, 1989). A temperature swing of 40 degrees in any given summer day is not unusual. In the hot, dry, and usually cloudless summers, evaporation far exceeds precipitation. For example, at Pyramid Lake, evaporation exceeds precipitation by a factor of eight. Water evaporates from the surface of Lake Mead, in the Mojave Desert outside of Las Vegas, at the rate of 2.25 m (88 inches) per year—well above the 0.10 m (4 inches) of rain that falls in an average year in that region of the state.

The Mojave Desert is hotter and drier than the Great Basin. Precipitation here falls more typically as rain, though even more unpredictably than in the Great Basin, and it is just as likely to fall torrentially and run off rapidly. There is also considerable variation in the Mojave region. As with the Great Basin, higher ranges receive more precipitation, and the Spring Mountains outside of Las Vegas are often cloaked in snow during winter months—reliably enough to sustain a small ski resort.

Both the form and timing of precipitation in the Mojave, coupled with warmer temperatures, sustains its markedly different natural communities. Across the state, cold winters, hot summers, and scant and unpredictable rainfall have required a variety of adaptations on behalf of animals in order to survive in Nevada's environment. These climatic forces, along with the influences of geography, have created a fascinating array of wildlife in an often harsh and beautiful setting of North America.

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Geology

With 314 mountain ranges, Nevada's dominant topographic feature is its basin and range topography. Many writers, including John McPhee (1980), have found poetry in the rhythm of this landscape:

Each range here is like a warship standing on its own, and the Great Basin is an ocean of loose sediment with these mountain ranges standing in it as if they were members of a fleet without precedent, assembled at Guam to assault Japan. Some of the ranges are forty miles long, others a hundred, a hundred and fifty. They point generally north. The basins that separate them—ten and fifteen miles wide—will run on for fifty, a hundred, two hundred and fifty miles with lone, daisy-petalled windmills standing over sage and wild rye.

The mountains of the Great Basin are geologically recent—less than 17 million years old—and a product of crustal stretching between the Sierra Nevada to the west and the Wasatch Range of the Rocky Mountains to the east (Wuerthner, 1992). In the intervening millennia, erosion has steadily chipped away at the higher elevations, filling the basins between the ranges with rock and sediment that typically are thousands of meters thick and, in some valleys, more than 6,100 m (20,000 ft) thick. Crustal stretching and faulting are not uniform, and extensive sections of northwestern and southern Nevada are lower than the central part of the state. These regional differences in elevation, on the order of thousands of feet, have strongly influenced the flora and fauna communities that now occupy these areas.

While the mechanism of this mountain building is consistent across the Great Basin, the underlying bedrock and the resulting composition of the mountains vary. Many granite ranges occur in the west, basalt ranges in the northwest, rhyolite mountains in the center, and limestone and sandstone in the east and southwest (Stewart, 1980). In general, then, the bedrock in the west and in a central band across the state is igneous in origin, and most of the rest of the state's bedrock is sedimentary in origin (Fiero, 1986). A small fraction of Nevada's bedrock is metamorphic. This variation in bedrock likewise produces variations in soils, which in turn influence plant communities and ultimately, faunal communities.

The area, that is now the state of Nevada, experienced other past forces that shaped the geological landscape. Several periods of volcanic activity deposited extensive lava flows and ash. The Owyhee Uplands of the Columbia Plateau in northern Nevada are one of the landscapes shaped by this activity. The presence of the landform is significant because that high plateau country drains north into the Owyhee River, and from there into the Snake River. Scattered across the state is evidence of calderas, lava flows, tuff or welded ash, and other reminders of the land's genesis in molten rock.

At various times in its geologic history, extensive parts of the state have either been ocean or lake front property. Until half a billion years ago, most of Nevada did not exist and instead an ocean stretched westward from what was the edge of the North American continent. A broad carbonate reef began to form along the margin of the continent, extending west into the ocean. In a series of events over the next 300 million years, tectonic plates collided with the edge of the continent and progressively added land mass to western North America. At first, oceans receded during the collisions and then advanced, but oceanic sedimentation finally ceased about 200 million years ago.

More recently, Pleistocene Lake Lahontan was the largest of several primarily freshwater lakes that covered significant parts of the state. All of these events—whether marine or freshwater in origin—were extensive enough

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and sustained long enough to leave sedimentary deposits that are now visible in various parts of the state. Remnants of Lake Lahontan's presence can also be seen in shoreline terraces, now parched and high above valley floors and supporting desert shrubs instead of bulrushes and sedges. The limestones that formed beneath the oceans now form a major regional aquifer beneath much of northeaster, eastern, and southeastern Nevada, and springs flowing from this aquifer are important water sources for plants and animals.

Also during the Pleistocene and related to the formation of Lake Lahontan, Nevada experienced periods of glaciation that altered several mountain landscapes. Over millennia, the shear mass of glaciers, aided by the abrasive quality of rocks and debris entrained in their ice, acts to erode the bedrock beneath them. When the glaciers retreated, they left behind cirques in their headwaters and classic U-shaped valleys that reveal the paths of the ice masses. These distinctive landscapes are evident in the Sierra Nevada, but also in other mountains, including the Ruby, Humboldt, and Snake Ranges. Other Nevada ranges with evidence of glaciation include the Spring Mountains, Toiyabe Range, Carson Range, Toquima Range, Jarbidge Mountains, Santa Rosa Range, Independence Mountains, and the Schell Creek Range (Wuerthner, 1992).

The high Sierra Nevada range, which only began its rapid rise 3-5 million years ago, efficiently strips water from east-moving storms and creates the pronounced rain shadow that has produced the characteristically dry climate in Nevada. Yet, to a visitor surveying this arid landscape, it may come as a surprise that water is the dominant force shaping the land. By watching an arroyo following a downpour as it disgorges a viscous sludge that is half earth and half water, one receives an effective demonstration of the power of water to episodically but rapidly shape the landscape.

Unique geological conditions, usually in the form of soils, occur in isolated pockets scattered across the state. These conditions have given rise to regionally adapted plants and, at least in some locations, unique species of invertebrates with extremely restricted ranges. There are two conditions which have supported these unique plant-invertebrate associations. Edaphic communities are, by definition, determined by soil conditions. One example of this is the 140 patches of altered andesite scattered across the west-central Great Basin (Billings, 1950, 1990; DeLucia et al., 1988; all in Brussard et al., 1998). These sites, in contrast to the surrounding sagebrush-dominated landscape, are characterized by the presence of Jeffrey or ponderosa pine, and many of them harbor an endemic species of buckwheat. Another example is the gypsum-derived soils of the Mojave Desert in southern Nevada that support endemic plant communities adapted to this soil type. Some of these plants, such as the Las Vegas bearpoppy, are associated with endemic species of bees.

Another specialized soil condition occurs in the network of Holocene era sand dunes scattered across the state. Extraordinary specialization and speciation has occurred in plants and animals at many of these 32 sites. Beetles are the best studied invertebrate group in Nevada's sand dunes, and many new species have been described from these locales. Butterflies, crickets, and a species of weevil are also unique to these habitats. Many of these species are highly endemic and confined to one or a few small dunes (Brussard et al., 1998). As a whole, the invertebrates of Nevada are poorly studied and it is likely that the occurrence of endemism is far more widespread in these groups than is currently documented.

Fish and Wildlife Resources

Among the 50 states, Nevada ranks eleventh in overall biological diversity (Stein, 2002). Unfortunately, the state follows only Hawaii and California in terms of threats to its species, and Nevada is ranked fifth in the number of species extinctions. From a biological point of view, the Great Basin and Mojave Deserts are landscapes of enormous subtlety. The vast and apparently monotonous expanses of sagebrush actually represent a dozen different species, and many more subspecies. Most of the animals accomplished at life in these deserts are

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colored to blend in with the rocks and vegetation to avoid detection in a land that holds few hiding places. Explorer John C. Frémont declared the region to be “deserving the full examination of a thorough exploration.” Nevada does not reveal its nuances to a car traveling 70 miles per hour across Highway 50.

Nevada’s tremendous diversity of life is derived from its geography. The many mountain ranges with winter snow pack, trees, meadows, and tumbling streams are effectively isolated from one another by the arid and treeless basins. This juxtaposition of landscapes has effectively created isolated islands of habitat, dubbed sky islands. For the less mobile species of small mammals, reptiles, and some insects, populations have likewise become isolated from one another on these montane islands. Over time, this isolation has led to the evolution of new subspecies and species.

The principles of island biogeography explain other aspects of the state’s diversity and the pattern of species across the landscape. Two of the tenets of this branch of ecology state that the number of species on an island will decrease with distance from the mainland (the source of species to populate the island); and the smaller the island, the fewer species the island can sustain. The “mainlands” for the Great Basin province are the Sierra Nevada and the Rocky Mountains. Moving eastward from the tree-rich Sierra Nevada, the number of tree species declines until, in Central Nevada, ranges such as the Toiyabes and Monitors harbor only a few species (Wuerthner, 1992). A similar pattern occurs in Eastern Nevada, where, moving through ranges from east to west, the trees decline in both diversity and in their affinity with the Rocky Mountains. A similar pattern has been documented in mammal populations in Nevada.

While mobile species like birds might be expected to be unaffected by the effects of distance and island size, such is not the case. The reduced number of plant species in the interior mountain ranges translates to lower habitat diversity, which in turn, offers fewer niches for birds to occupy, and thus fewer species overall.

One other characteristic of the Nevada landscape and subsequently its wildlife worth noting is that, resources, principally food and water, occur in abundance in only a few noteworthy places. Across the remainder of the state, such resources are widely scattered at a low density. The distribution of wildlife tends to reflect the distribution of food and water resources, and therefore with few exceptions, wildlife species are not found in high densities within their Nevada ranges. This factor does not reduce the value of wildlife to the health of the natural environment, or the value it brings aesthetically or economically to the state.

With the exception of the Colorado River along the southeastern border of the state and a few tributaries of the Snake River in the north, all of Nevada’s watersheds are isolated systems (Wuerthner, 1992). In general, they originate at springs on the flanks of mountains, descend through desert shrubs, and vanish into sinks and playas. Accordingly, the pattern of isolation and divergence has been even more extreme for Nevada’s aquatic species. During the Pleistocene, this region of the globe was considerably wetter than it is today, and lakes covered significant parts of the state. As the Pleistocene waned and the Earth entered a drier, warmer period, the lakes receded and vanished, sometimes completely, sometimes leaving behind only isolated wetlands and remnant springs. Organisms, such as springsnails (pyrgs) and pupfish that once resided in enormous lakes now persist in tiny seeps and springs, each population cut off from its nearest neighbor, often by miles of desert. Over time, these populations have evolved into species, each uniquely adapted to their tiny corner of the world.

Nevada has 46 endemic species of fishes – species occurring nowhere else in the world. With the human reliance on water, nearly all rivers, springs and aquifers are tapped and at some point dewatered, and this natural competition for water has left the state with more endangered fish species than any other state (Wuerthner, 1992). At least seven Nevada fish species are known to have become extinct, while four other species no longer occur in Nevada although other populations persist beyond the state borders.

One famous example of endemism occurs in southern Nevada, not far from the California border and Death Valley. Devil's Hole is a spring perched on a desolate ledge of black rock, creosote, and cactus. The spring itself is actually at the bottom of a hole, a defile in the rock, wherein resides the world's entire natural population of the Devil's Hole pupfish. Below Devils Hole and 20,000 years ago, a lake once covered the Amargosa Valley floor, and the pupfish swam freely through hundreds of square miles of water. Now, their entire population is confined to a crack in the bedrock, amidst some of the most inhospitable desert found anywhere. This is one of the state's nuances, and a profound experience for those who visit Devil's Hole.

Land and Resource Management

Nevada's borders encompass about 28,732,680 hectares (71 million acres), making it the seventh largest state. The federal government manages approximately 24,685,825 hectares (61 million acres), or 86% of the land base. Of the remaining 14% (approximately 4,046,855 hectares; 10 million acres), 11.5% is private, 1.6 percent tribal, and the remaining 0.8 percent is under state or local government ownership. On a percentage basis, Nevada has more federal land than any other state in the Lower 48. Land status is illustrated in Figure 1. At least 90% of the land in Esmeralda, Lander, Lincoln, Nye, and White Pine counties is federally managed, while overall, 50% or more of the land in each county is federally managed, except the two smallest counties (i.e., Storey and Carson City).

The majority of BLM and USFS land in Nevada is managed under multiple use and sustained yield policies mandated by federal statutes. Multiple uses requires federal agencies to manage the public lands and natural resources for a combination of diverse uses while balancing long-term needs for renewable and non-renewable resources. The BLM and USFS manage multiple use lands for grazing, mining, outdoor recreation, scientific study, and ecological function. Resources currently receiving considerable attention in USFS Forest Plans, BLM Resource Management Plans and Regional Ecological Assessments include wetland and riparian resources, wild horses, biological diversity, forage production, forest health, watershed conditions, wildlife habitat, motorized recreation, and noxious and invasive weeds.

The Bureau of Reclamation has jurisdiction over a large area of the Great Basin and a smaller portion in the Mojave within Nevada. The main area of BOR activities is in the Colorado, Walker, Carson, Truckee, and Humboldt River basins, where there are five operating Reclamation projects and one resource management project.

State land management agencies are similarly mandated to manage resources according to multiple use and sustained yield principles, as defined by state law. State lands include 11 wildlife management areas, 24 state parks, and 500 parcels (91 hectares; 225 acres) of other state lands. There are approximately 3,237,485 hectares (8 million acres) of private land in Nevada. Land uses of private lands are predominantly urban and suburban development and agriculture.

Nevada Stewardship Map

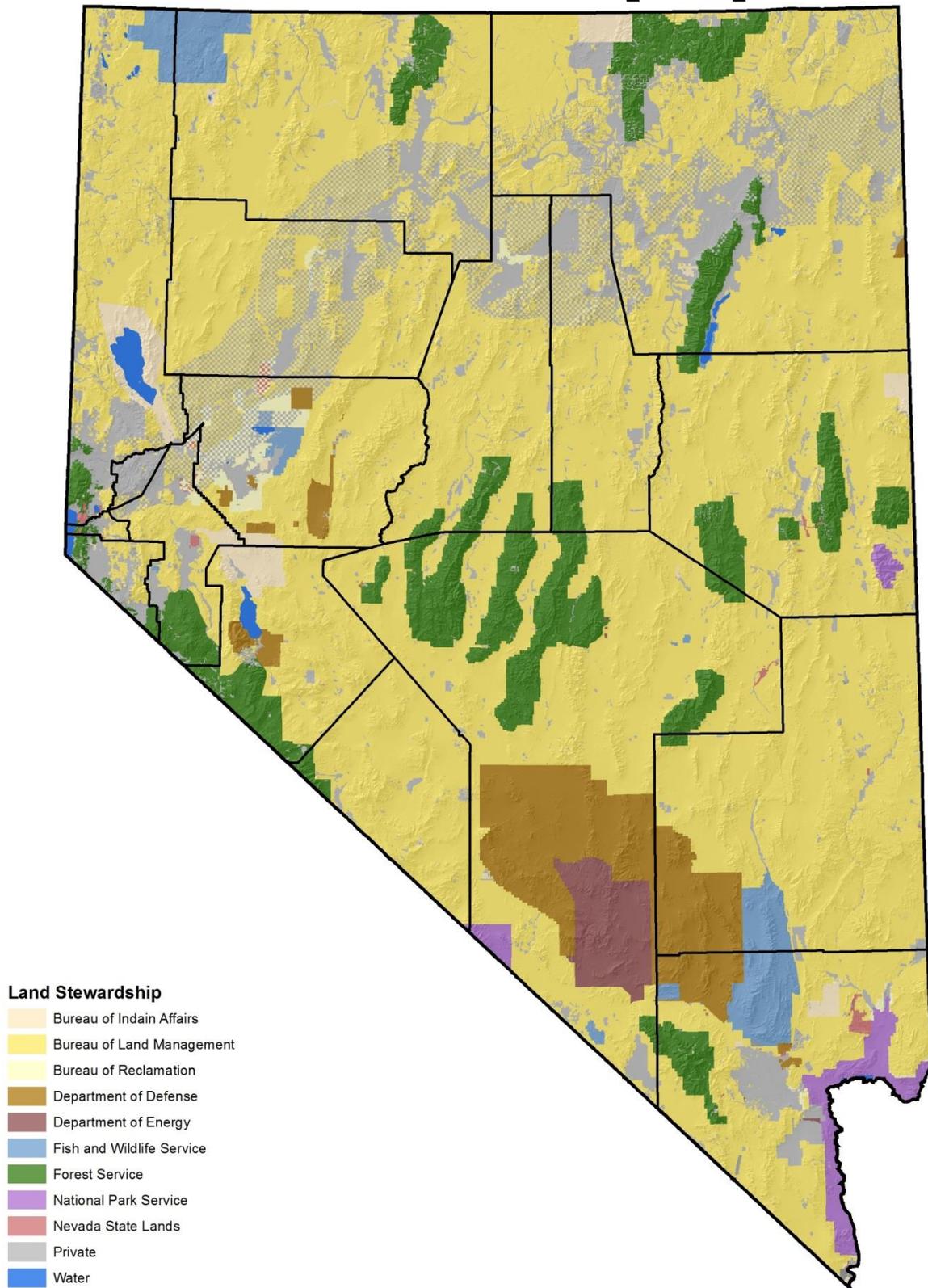


Figure 1. Map of Nevada indicating land ownership/land management patterns.

Human Demographics and Impacts

Up until 2009, Nevada was the fastest growing state in the nation, with three of its most populous cities in the top 20 for growth nationwide. Based on the 2010 U.S. Census study, Nevada experienced a 35% population increase statewide (U.S. Census Bureau, 2010). More specifically, Clark County underwent a 47% population increase (U.S. Census Bureau, 2010) between 2000 and 2010 which also brought about increased infrastructure (roads), housing developments, power lines, and shopping centers, often in areas where wildlife once roamed. Nevada is the most urbanized state in the nation, with nearly $\frac{3}{4}$ of its 2.7 million human population associated with the cities of Las Vegas, Henderson, and Reno.

Even the once-remote rural areas of the state are impacted by population growth. One of the greatest population increases within the state occurred within Lyon County with a 51% countywide increase, particularly in the rural communities of Fernley, Dayton, and Yerington (U.S. Census Bureau, 2010). Rural communities strain to keep up with the influx of urban dwellers fleeing the cities; out-of-state manufacturers moving into a low tax environment; and energy developers pursuing new technology or areas to develop new resources.

Survey data reported as part of Colorado State University's "Wildlife Values in the West 2004" (Teel and Dayer, 2005) survey project provides a baseline for residents' attitudes about wildlife and threatened species. The survey of 633 residents identified 15 activities that Nevada Department of Wildlife may focus on in the coming years, and asked participants to rank their level of importance. "Protecting fish and wildlife in Nevada that are endangered or at risk of becoming endangered," ranked third overall, after apprehension of wildlife violators (first priority) and promotion of boating safety (second priority). In a survey question where agency fiscal constraints were identified as a limiting factor, and participants were asked to identify which 3 of the 15 activities should be chosen, "Protecting fish and wildlife in Nevada that are endangered or at risk of becoming endangered," rose to the top, with 197 respondents supporting this activity as one of their top three priorities.

In that same survey question, it is worthy to note that the second and third priorities overall were for "Managing for adequate populations of all fish and wildlife in Nevada," (second priority) and "Protecting, restoring or acquiring lands to support many different types of fish and wildlife," (third priority). From these responses, it is clear that not only do Nevadans feel strongly about managing all fish and wildlife species, but that they understand that protection and restoration of lands is an essential part of this process.