Cliffs & Canyons

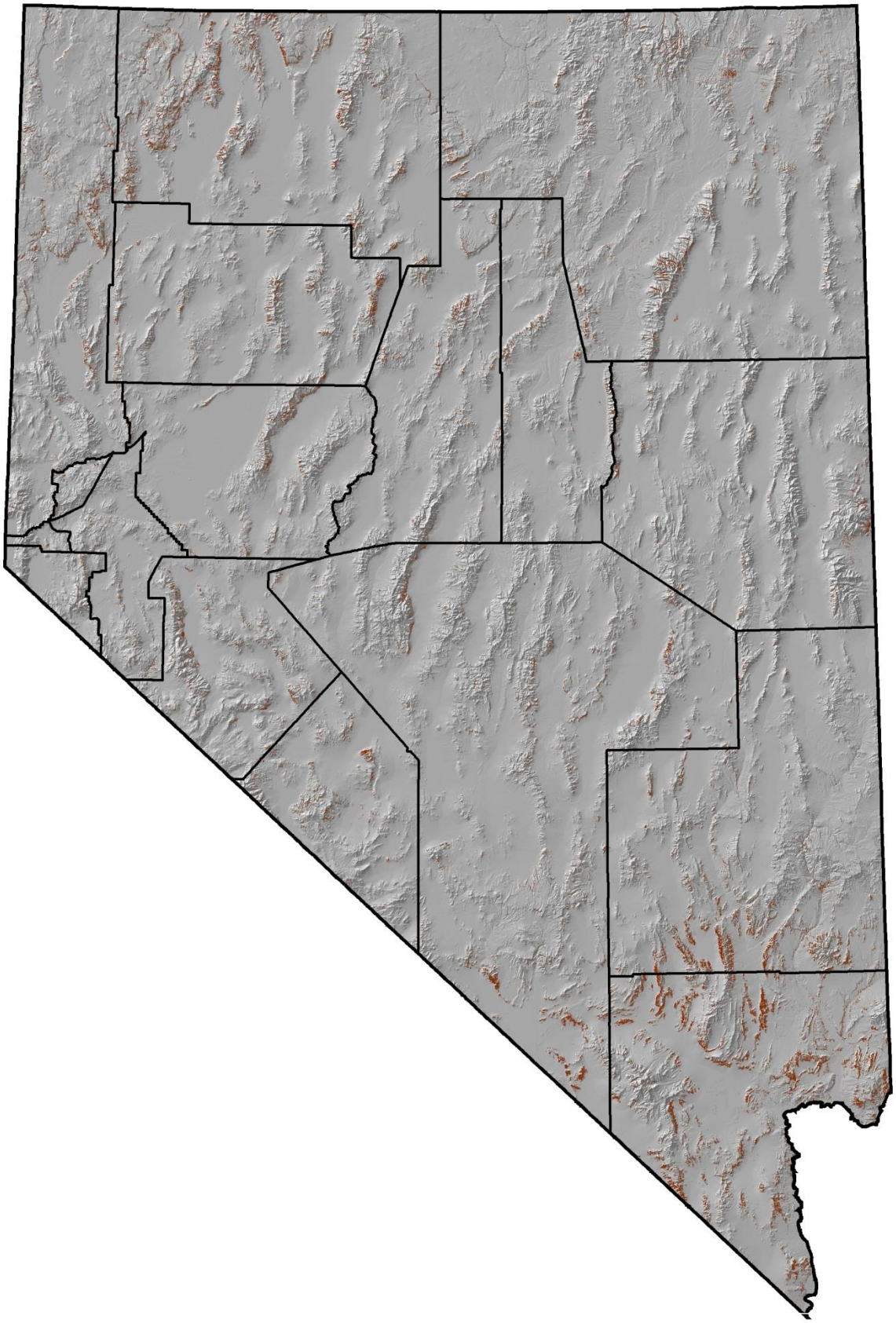

Figure 23: Distribution of Cliffs and Canyons in Nevada.

KEY HABITAT: CLIFFS AND CANYONS

Things to Know….

- Cliff and canyons are vertical or near-vertical cliffs that are sparsely vegetated and comprise of a small fraction of Nevada's total land area.
- Cliff and canyon habitats are important to wildlife as they provide structure for nesting, roosting, or denning; protection from predators; and areas for foraging. Key priority species include Golden Eagle, Peregrine Falcon, and spotted bat.
- Habitat threats include recreation, wind energy development, and mineral extraction.
- Structural aspects of cliffs and canyons are not expected to be impacted directly by climate change.

Ecoregions

Southwest ReGAP 2005

Mojave	197,931 hectares	489,096 acres
Great Basin	159,187 hectares	393,358 acres
Columbia Plateau	95,564 hectares	236,143 acres
Sierra Nevada	533 hectares	1,317 acres
Total	453,215 hectares	1,119,914 acres

Ecological Systems*

SWReGAP Ecological Systems

S007 Sierra Nevada Cliff and Canyon
S009 Intermountain Basins Cliff and Canyon
S010 Colorado Plateau Mixed Bedrock Canyon and Tableland
S016 North American Warm Desert Bedrock Cliff and Outcrop
S019 North American Warm Desert Volcanic Rockland

*TNC biophysical settings were not developed for this key habitat

Key Habitat Description

Vertical and near-vertical cliff lands are scattered throughout Nevada and often harbor unique biodiversity (Nachlinger et al., 2001). These are barren and sparsely vegetated habitats (less than 10% plant cover) of steep cliff faces, narrow canyons, and smaller rock outcrops of various igneous, sedimentary, and metamorphic bedrock. Unstable scree and talus slopes typically occur below cliff faces (NatureServe, 2004). Cliffs and canyons are often associated with uplift of normal faults. Cliffs may also occur in steep-sided, deeply eroded valleys and as the edges of eroded remnants of volcanic flows and sedimentary rock outliers at low to high elevations. In Nevada, cliffs range in elevation from the Colorado River canyons (starting at 150 meters in Clark County) to alpine habitats above 4,000 meters on Boundary Peak and Wheeler Peak in northern Nevada (Neel, 1999). Cliff, crevice, and talus habitats are extremely variable but rather simple in nature. Cliffs can be from six meters to over 900 meters high. Talus slopes can be less than a hectare to several thousand hectares in size (Bradley et al., 2004). Due to the linear nature of cliff and canyon habitats, they comprise a relatively small fraction of Nevada's total land area. Since cliffs are at variable elevations and experience a broad range of

climatic conditions, dominant plant species can be quite different among these habitats and may include various associations of conifers, shrubs, succulents, lichens, and herbaceous species (NatureServe, 2004).

Value to Wildlife

Cliff and canyon habitats are important to wildlife because they provide structure for nesting, roosting, or denning; protection from predators; and areas for foraging. Most cliffs, crevices, and talus slopes provide suitable maternity and night roosting habitat for bats and nesting habitat for birds in the summer. These sights are generally too exposed to provide significant hibernation roost sites in northern Nevada, but there is strong evidence that rock crevices provide wintering habitat in the Mojave Desert ecoregion in southern Nevada (Bradley et al*.,* 2004). Peregrine Falcons, Prairie Falcons, and Black Rosy-Finches are obligate nesters in cliff and canyon habitats. Falcons and other raptors will nest on cliff ledges, and songbirds will construct nests in crevices. Golden Eagles also predominantly choose cliff faces for nesting in Nevada despite the occasional tree nest or even tall greasewood nest (i.e., Carson Sink). In Nevada, Ferruginous Hawks are more recognized as pinyon/juniper nesters, particularly in the eastern half of the state, but from Battle Mountain and Austin westward, Ferruginous Hawks, in noticeably sparser densities, are more prone to use cliff faces and tufa stacks for nesting substrate. Reptiles use rocks and crevices in cliff and canyon habitat for burrowing, overwintering and protective cover. South and west facing slopes are important areas for reptile brumation, while north and east facing slopes are important for aestivation. Rocks and crevices provide extremely important microhabitats that enable reptiles to thermoregulate, create suitable nests, and escape predators. Rock crevices, boulder piles, or talus are most commonly used by ringtails for denning, while alternative denning habitats are used less often (Poglayen-Neuwall and Toweill, 1988). Pikas also utilize rocky habitats but are obligates of talus slopes containing rock 0.2 to 1.0 meter diameter (Beever et al*.,* 2003). In addition to the structural components provided by cliff and canyon habitats, these areas are valuable to foraging bighorn sheep.

Key Elements of Cliffs and Canyons Habitat Important to Wildlife

LEDGES – nesting substrate, protection from predators

- Golden Eagle
- Peregrine Falcon
- Prairie Falcon
- Ferruginous Hawk

CREVICES– nesting, roosting, protection from predators

- Black Rosy-Finch
- Gray-crowned Rosy-Finch
- spotted bat

ROCKY SLOPES– foraging, roosting, protection from predators

- American pika
- bighorn sheep
- gila monster
- Sierra alligator lizard
- western banded gecko
- chuckwalla
- Great Basin collared lizard
- desert night lizard

CANYON BOTTOMS/RIPARIAN ECOTONE– foraging, migration

Western red-tailed skink
Inyo shrew
mule deer
ring-necked snake
rosy boa
northern rubber boa
Sonoran mountain kingsnake
western threadsnake

Existing Environment

Land Uses

- Non-motorized recreation – rock climbing
- Mineral extraction
- Spring development
- Wind energy development

Habitat Conditions

Recreational rock climbing has increased dramatically over the past 30 years, with southern Nevada receiving the highest recreational climbing levels in the state. Increased human disturbance is expected to have altered some cliff and crevice habitats, yet little research or monitoring has been conducted to determine the degree to which climbing activities have affected cliffs and their associated species (Bradley et al*.,* 2004). Gold mining activities in recent decades have focused on ancient hot springs and seeps that flowed from many of Nevada's cliff faces, resulting in the removal of some cliffs with high microscopic ore content. Some springs at the base of cliffs have been developed for agricultural or urban development (Neel, 1999). Talus habitats, particularly those nearer metropolitan areas, are receiving increased use by rock extraction industries (Bradley et al., 2004). Since 2008, demands for non-petroleum-based energy development have accelerated plans to install wind turbines on ridge tops where wind resources are favorable.

Problems Facing the Species and Habitats

The inaccessibility of cliffs and instability and ruggedness of talus slopes affords some protection to this key habitat and its associated wildlife species, but there are some human influences on cliff and canyon habitats in Nevada. Mineral extraction, recreational rock climbing, and spring development may have localized effects on cliff and canyon habitat (e.g., damage or removal of substrate) or wildlife species (e.g., disturbance during nesting or roosting), but the degree of these effects is unknown. Climbers occasionally abandon climbing equipment and may briefly disturb cliff denizens, but their activities normally do not significantly alter the habitat. In southern Nevada, there is growing concern that recreational climbing associated with a burgeoning urban population is reaching levels sufficient to affect nesting raptors (Neel, 1999).

In addition to human-related problems, species face biogeographic and climatic stresses. Pikas are obligates of discontinuously distributed talus habitat and are potentially at increased risk of predation while foraging or dispersing between habitat patches. Decreased persistence of pika populations in Nevada has been associated with lower elevations which have higher temperatures (Beever et al*.,* 2003); however, recent surveys in the northern part of the state have observed pikas at lower elevations (NDOW, in progress). Currently, mammalian

response to climate change includes organism modification of physical characteristics (i.e., phenotypes) and minor adjustments in geographic ranges (Barnosky et al*.,* 2003). Increasing temperatures may result in pikas shifting their range to higher elevations, resulting in changes in population structure and loss of previously suitable talus habitat patches.

While not located in canyons proper, the installation of wind turbine arrays on ridge tops poses threats of collision mortality to resident Golden Eagles, Ferruginous Hawks, and Prairie Falcons as well as the full range of migratory raptors, other migratory birds, and bats using the updrafts from ridge tops and cliff faces for migration assistance. Often, the cliff faces most suitable for raptor nesting are also important structural features in the generation and sustenance of the wind resources necessary for economic wind farm development, thus the potential for conflicts with raptors using the cliffs and updrafts is high.

Predicted Effects of Climate Change

Structural aspects of cliffs and canyons are not expected to be impacted directly by climate change; therefore, the species that are specifically attracted to vertical rock walls or other qualities of rocky substrates are not likely to be impacted by changes to those substrates in and of themselves. It is conceivable that rising ambient temperatures may increase the premium of cliffs and canyons with more complex deep rock/crevice structures that facilitate better cooling capacity. As annual water yield and flow are impacted (particularly in non-carbonate geology), the quality of the canyon bottom ecotone with the riparian zone may be impacted by alterations in high flow regimes, number of days of duration of mesic microhabitats, sumps, seeps, possibly even vegetation changes.

Possible Wildlife Responses to Climate Change

As the streams flowing through canyons approach more of a desert wash character and less of a constant-flow stream, the canyon bottom guild of species may find less suitable habitat in quantity, quality, and duration. None of the species listed in this guild are particularly rigid in their ability to cope with new conditions or move to more suitable areas with the possible exception of Western red-tailed skink.

The persistence of shade in cliffs and canyon habitats, at least for part of the day, may prove to attract species forced to make adjustments by the loss of shrub overstory on the benches above and below the fractured canyon zone, particularly in the Mojave shrub communities. Preliminary if not permanent shifts in distribution from benches and bajadas into the canyons may be the first signal to biologists and land managers that vegetation changes are beginning to impact species distribution and survival.

Priority Research Needs

- Roosting requirements, microhabitat preferences, and general distribution of cliff, crevice, and talus roosting bat species; nightly and seasonal movements of bats from roost to roost (Bradley et al. 2004)
- Population data on cliff-nesting birds in Nevada and population status of Black Rosy Finches (Neel 1999)
- Long-term studies to explain factors contributing to pika extirpation in Nevada that partition natural variability more clearly from anthropogenic influence (Beever et al. 2003)
- Continue various life history studies on Sonoran mountain kingsnake
- Population status and ecology of gila monster
- Population status and ecology of rosy boa

- Population resiliency to harvest pressure for Great Basin collared lizard, chuckwalla, and western banded gecko

Conservation Strategy

Goal: Cliff and canyon habitats capable of sustaining wildlife dependent on the substrate and features for breeding, roosting, denning, and hiding cover, with disturbance during seasons of use kept within sustainable levels.

Objective: Maintain cliff-nesting raptor populations at stable or increasing trend through 2022.

"cliff-nesting raptor" – Golden Eagle, Ferruginous Hawk, Prairie Falcon, Peregrine Falcon
"stable or increasing trend" – as determined via NDOW nesting raptor surveys conducted at regular intervals not to exceed five years.

Action: Continue helicopter surveys of cliff-nesting raptors to keep knowledge of current nest activity, landscape-scale distributions, and responses to wind energy development up-to-date and relevant to wind energy conservation mitigation discussions.

Action: Participate in national and regional Golden Eagle population management efforts for the purpose of informing development of "acceptable take" numbers in the USFWS programmatic take permitting process for Golden Eagles in compliance with Bald and Golden Eagle Act requirements.

Action: Continue to report Peregrine Falcon nest occupancy results to USFWS in compliance with post-delisting requirements.

Action: Support and advocate technological research intended to develop non-lethal wind turbine designs to minimize collision mortality of raptors, other migratory birds, and bats.

Action: Apply appropriate conservation protection to important nesting and roosting sites in cliffs, crevices, and talus habitat.

Objective: Maintain bighorn sheep and mule deer at current distribution with stable or increasing trend through 2022.

"current distribution" – no loss of distinct occurrence locations
"stable or increasing trend" – as determined by NDOW big game surveys conducted annually.

Action: Provide adequate disturbance protection to cliffs and canyons in key lambing and fawning areas.

Action: Minimize contact between bighorn sheep and domestic sheep in cliff/canyon habitats.
Action: Ensure adequate water availability in association with key cliff/canyon habitats through diligent water source inventory and enhanced water development techniques.

Objective: Maintain American pika populations at current distribution through 2022.

"current distribution" – no loss of distinct occurrence locations as monitored by occupied site survey conducted at regular intervals not to exceed 10 years.

Action: Implement a statewide American pika occupancy monitoring program that verifies activity at known American pika sites.

Action: Continue to inventory new pika sites based on new understanding of the range and habitat preferences of the northwestern Nevada subpopulation.

Objective: Maintain chuckwalla, Great Basin collared lizard, and western banded gecko at current distribution with stable or increasing trend through 2022.

"current distribution" – no loss of distinct occurrence locations
"stable or increasing trend" – as determined by appropriate survey method conducted at regular intervals not to exceed five years.

Action: Implement regular population monitoring programs for reptile species of high collection volume with the intent of developing statistically robust, responsive population status and trend estimates.

Objective: Maintain mammals and reptiles of conservation priority at detectable levels in cliff/canyon habitats through 2022.

"mammals" – Inyo shrew; spotted bat
"reptiles" – gila monster; desert night lizard; Western red-tailed skink; ring-necked snake; rosy boa; northern rubber boa; Sonoran mountain kingsnake; western threadsnake
"detectable levels" – as determined by appropriate surveillance surveys conducted at regular intervals not to exceed five years.

Action: Conduct appropriate surveys for reptiles of conservation priority, including Gila monster, rosy boa, Sonoran mountain kingsnake and Western red-tailed skink.

Action: Initiate discovery surveys for rosy boa in southern Nevada to follow up on first published state record from 2011.

Action: Develop priority amphibian and reptile conservation areas (PARCAS) using Partnerships for Amphibian and Reptile Conservation (PARC) criteria for integration into local and federal land use planning and conservation design.

Partnerships

Land Management/Ownership

Land Owner/Manager	Percent
Bureau of Land Management	64
U.S. Forest Service	10
Department of Defense	8
U.S. Fish & Wildlife Service	7
Private	6
National Park Service	4
Tribal	1
Other	<1

Existing partnerships, plans, and programs

Multi-partner

- Nevada Bat Working Group/Nevada Bat Conservation Plan
- Cooperative agreement between Las Vegas Climber's Liaison Council and BLM's Red Rock Canyon National Conservation Area
- Spring Mountains National Recreation Area Conservation Agreement

Federal & State Agencies

- Bureau of Land Management:
- U.S. Forest Service:
- U. S. Fish and Wildlife Service:
- National Park Service
- Nevada Department of Wildlife

Conservation Organizations

- National Audubon Society/Lahontan Audubon Society/Red Rock Audubon Society
- Sierra Club

Bird Initiatives

- Partners In Flight North American Land Bird Conservation Plan
- Nevada Partners In Flight

Other Key Partners

- Counties
- Great Basin Bird Observatory
- HawkWatch International

Focal Areas

Black Mountains
Black Rock Range
Buffalo Hills
Calico Mountains-Pershing
El Dorado Mountains
Granite Range
Hays Canyon Range
High Rock Area
Independence Mountains
Jarbidge Wilderness
Las Vegas Valley
Madelin Mesa
McCullough Range
Montana Mountains
Muddy Mountains
Pancake Range
Pine Forest Range
Ruby Mountains
Santa Rosa Range
Sheldon NWR
Shoshone Range
Silver Peak Range
Snake Mountains
Snake Range
Spring Mountains
Toiyabe Range
Trout Creek Mountains
Tuscarora Mountains
Virgin River Valley
Wassuk Range

Fire Canyon Photo Courtesy of P. Conrad

Caves & Mines

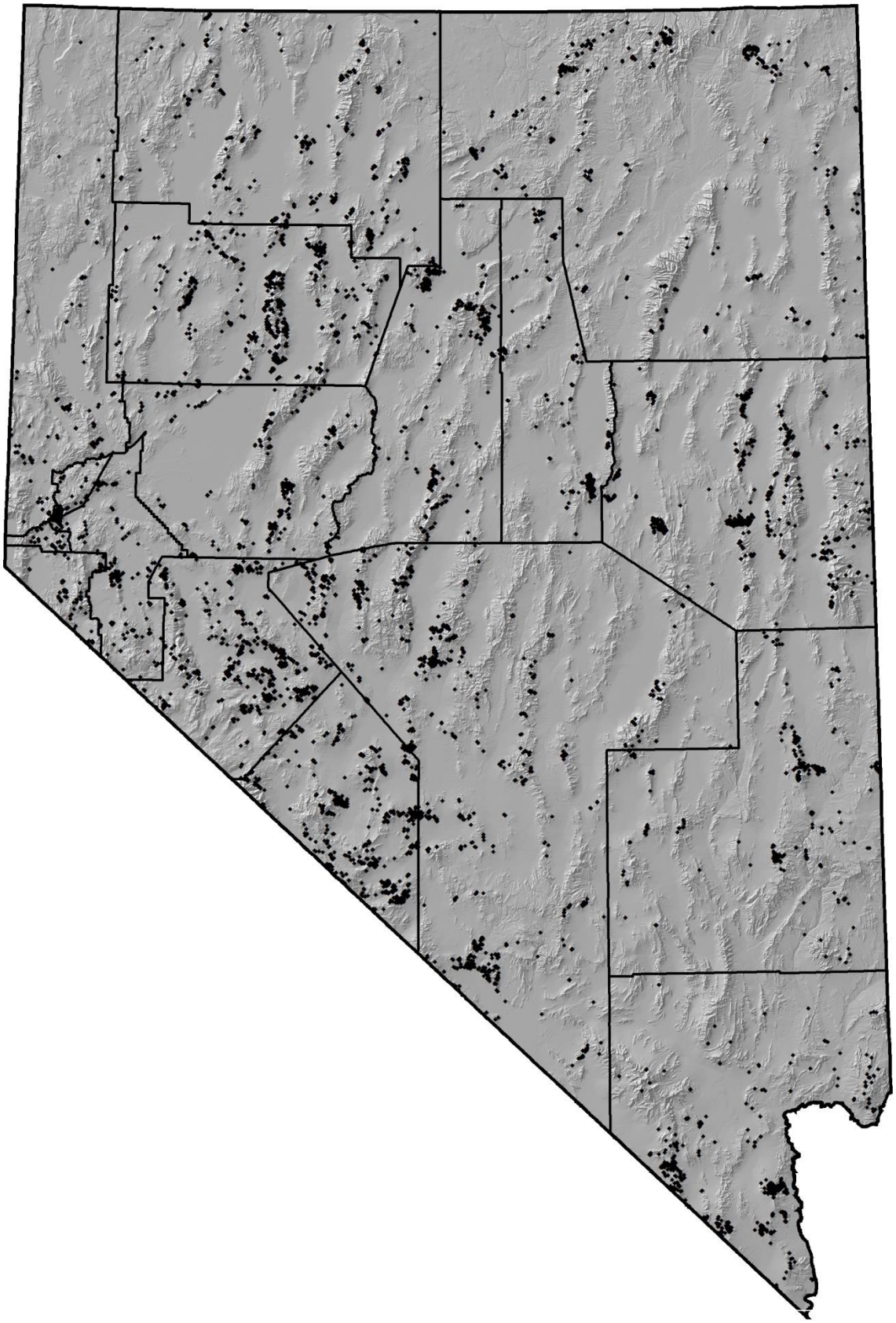

Figure 24: Distribution of Caves and Mines in Nevada.

KEY HABITAT: CAVES AND MINES

Things to Know….

- Caves and mines are found throughout Nevada but are the rarest of wildlife habitat types.
- Provides roosting sites for 19 species of bats and several bird species. Key priority species include Townsend's big-eared bat, Allen's big-eared bat, and Black Rosy-Finch.
- Key threats include disease, disturbance, and loss of cave or mine.
- These underground habitats are more or less insulated from temperature change above ground by overlying rocks and soil.

Ecoregions

Caves and mines are found in all of Nevada's ecoregions in a variety of ecological systems. It is not currently possible to provide an estimate of numbers or aerial extent of caves and mines.

Key Habitat Description

Natural caves are found throughout Nevada. The highest concentration of caves is in sedimentary deposits, particularly those where limestone solution processes have carved caverns in the parent rock. Igneous deposits, primarily volcanic deposits, also contain a substantial number of natural caves or hollow tubes formed by flowing lava and natural fracturing. Metamorphic parent rock types provide the lowest number of natural caves in Nevada although fracturing occasionally produces suitable cave formations (Bradley et al*.,* 2004). Terrestrial and aquatic habitats are present in caves. Terrestrial habitats are typically composed of flood debris (including logs, twigs, and leaves from the surface), animal feces, clay floors, rocky floors, and bedrock walls and ceilings. Aquatic habitat may be comprised of streams, springs, or drip pools.

Historic and active mines are also found throughout the state wherever hard rock mining districts occur. Historical mine distribution does not mirror natural cave distribution and occurs in almost all rock types. As compared to the surrounding landscape, caves, shafts, and adits are the rarest of all wildlife habitat types in the Intermountain West and likely comprise less than one percent of the total habitat available (Bradley et al*.,* 2004).

Cave, shaft, and adit (horizontal mine workings) habitats range in elevation from 150 meters along the Colorado River to near 4,000 meters on Boundary and Wheeler peaks in northern Nevada and can be simple or complex. In complex systems, warm air traps can vary from 20-30°F below outside ambient temperature in the summer or above outside ambient temperature in the winter. Multiple entrances can result in greater air flow into and through the structure affecting the internal microclimate. Geothermal heating can also affect internal microclimate. With the exception of algae growth in some artificially lighted caves, plants do not occur in this habitat type. Plant composition at surface openings varies with elevation, precipitation, latitude, and longitude (Bradley et al., 2004).

Value to Wildlife

Tunnel mines that were excavated since the mid-1800s provide potential roosting sites for 19 of Nevada's bat species although relatively few support significant colonies (Brussard et al*.*, 1998). There are a number of historical mining fixtures in Nevada; however, many are not used by bats due to a variety of factors such as lack

of available shelter, unsuitable microclimate, and human disturbance. Because they are not widely distributed across the landscape, suitable subterranean habitats (e.g., caves and mines) for roosting bats are particularly valuable.

As mentioned above, cave, shaft, and adit habitats can be simple or complex. The longer adits and those with a greater number of vertical and horizontal connections to the surface are generally the more complex habitats and seem to be preferred by bats, especially for hibernating and maternity sites. Simple structures can also be very important and are necessary for several species during certain parts of their life cycles (Bradley et al*.,* 2004). Bats utilizing subterranean habitats are not the only species that may benefit from the shelter provided by these habitats. Mines, caves, and crevices are the preferred winter roosts of Black Rosy-Finch and Gray-crowned Rosy-Finch. Desert tortoises have been found "inhabiting" adits, and Say's Phoebe, swallows, and Barn Owls have all been observed nesting and occupying mines (Durbin and Coyner, 2004; personal communication, Jennifer Newmark, Administrator, Nevada Natural Heritage Program, December 2011).

Nevada's cave systems provide habitat for several obligate invertebrate cave dwellers that are restricted to these environments throughout their life cycle. These obligate species include two aquatic amphipods (*Stygobromus lacicolus* and *S. tahoensis*), a harvestman (*Cryptobunus ungulatus ungulatus*), a pseudoscorpion (*Microcreagris grandis*), and a bristletail (*Condeicampa langei*) (NNHP, 2004; Peck, 1998). The harvestman and pseudoscorpion are on the Nevada Natural Heritage Program's at-risk species list. Because of the extreme isolation, uniqueness, and harsh conditions of the cave environment, many of the species that occur there are rare.

Key Elements of Caves and Mines Habitat Important to Wildlife

ROOSTING

Allen's big-eared bat
California leaf-nosed bat
cave myotis
fringed myotis
little brown myotis
Townsend's big-eared bat
western small-footed myotis
long-eared myotis
Black Rosy-Finch
Gray-crowned Rosy-Finch

DENNING/THERMOREGULATION

gila monster
desert tortoise

Existing Environment

Land Uses

- Mineral/resource extraction
- Non-motorized recreation – caving
- Scientific research

Habitat Conditions

Urban and rural population growth in the last several decades, particularly in western and southern Nevada, has prompted a dramatic increase in human exploration of caves and abandoned mines. As such, increased human disturbance in the form of non-natural light sources, elevated noise levels, soil and structure disturbance, and vandalism have altered many of these habitats (Bradley et al., 2004).

Nevada's geology provides ideal conditions for the deposition of a large variety of valuable and useful minerals, and miners and prospectors have been attracted to these minerals for over 150 years. Many of the mine openings left behind by miners and prospectors have become unstable because of exposure to environmental elements and decay of support timbers. Internal features of historic mines can also deteriorate and become very unstable and dangerous. Of the estimated 200,000 to 300,000 mining-related features in the state, the Nevada Division of Minerals estimates that 50,000 are significant hazards that require some type of securing. The State of Nevada's Abandoned Mine Lands program has been proactive in working to prevent human injuries or fatalities related to abandoned mine hazards since 1987. Securing hazards includes backfill and foaming projects across the state which permanently eliminates mine openings for wildlife use (Durbin and Coyner, 2004). Since 2004 the cooperative efforts of Nevada State Division of Minerals, Bureau of Land Management, U.S. Forest Service and Nevada Department of Wildlife have resulted in the closure of nearly 1500 mine hazards after bat resource assessments were made. Of those closures, over 450 have been made using bat-friendly techniques that preserved the important nature of the site to bat use.

Problems Facing the Species and Habitats

Their large colonies, low birth rates, high infant mortality, high roost fidelity, and long life spans make most bat populations vulnerable to human and natural disturbances in roosting and foraging habitat. Most bats are very sensitive to disturbance and will readily abandon a site, and even their young, if disturbed. Disturbance during hibernation can cause bats to awaken prematurely which is energetically very expensive. The resulting decrease in body fat reserves can cause the bat to die of starvation during hibernation. Many bats are directly killed by humans out of fear and misunderstanding, and in some cases roosts are destroyed in an effort to eradicate a colony of bats.

Contemporary open-pit mining operations are often located in historical mining districts. In situations where historical adits and shafts are carved away by the expansion of an open-pit mine, these habitats are lost permanently. In other areas adjacent to renewed mining, disturbance to foraging areas and direct disturbance to bats can cause serious declines in populations, alter species composition or cause an entire roost to be abandoned. Some effective mitigation in these situations has occurred (Bradley et al*.,* 2004). Recreational caving, guano harvest, and to a lesser extent, scientific fieldwork (i.e., inventory, monitoring, and scientific research) can be disruptive during critical stages in the life history of bats, particularly maternity and hibernation periods (Bradley et al*.,* 2004; Pierson and Brown, 1992). Some eradication projects designed to protect the public from rabies transmission have been implemented (Bradley et al*.,* 2004). Fear and misunderstanding of bats creates a public perception that these animals are not beneficial and are dangerous, creating a direct threat to species survival.

In 2006, a new threat to subterranean-roosting bats was discovered in bat hibernacula in New York State – a fungal infection now known as "White-nose Syndrome." Since its discovery, the sickness has spread to 18 states and killed more than a million subterranean hibernating bats. Researchers have identified the causative agent as *Geomyces destructans*, a fungus new to science. Since the discovery and state-by-state onslaught of this deadly disease, decontamination protocols to reduce the transmission of the fungus, surveillance strategies, and

diagnostic procedures have been developed. As of this writing, White-nose Syndrome had not yet been discovered in Nevada.

In 1983 a new source of songbird mortality in Nevada was identified – one that is closely tied to mining activities. Cavity-nesting birds were entering and becoming trapped in hollow, plastic mine claim markers. Work to date has shown that hollow mine claim markers represent a substantial mortality factor for several cavity-nesting and non-cavity nesting species that occupy Nevada for at least part of their life cycle.

The scale of this problem has been documented over numerous years during mine claim marker removal projects. A total of 43 species mortalities have been documented including four species identified in the Nevada Wildlife Action Plan as Species of Conservation Priority. Recent legislation, (NRS 517.030) allows the removal of all extant, standing, plastic hollow mine claim marker posts and to deposit them in a horizontal position on the ground at the site of removal.

Predicted Effects of Climate Change

To a certain extent, the suitability of subterranean sites provided by Nevada's caves and abandoned mines for bat roosting and hibernation is maintained by the site's relatively constant internal "climate," at least during the traditional time of bat use. These underground habitats are more or less insulated from temperature change above ground by overlying rocks and soil. Seasonal fluctuations of temperature are minimized and the effects of local temperature change are likely to be less than and lag well behind surface temperature changes, but as The Coast and Wetlands Society (Inc.) of Australia warned an Australian House Standing Committee on Climate Change, Environment and the Arts, *"This does not mean that subterranean habitats and their biota will be immune from the effects of climate change as changes to rainfall patterns will have impacts and these could be spread out over very long periods of time."* The technology and understanding to be able to predict what those effects might be and how long they might be in taking effect is not available to us at the current time.

Possible Wildlife Responses to Climate Change

Wildlife species using caves and mines as an important element of their natural history are most likely to experience the impacts of climate change outside their subterranean refuges before inside. Initial impacts to insectivorous bats would be expected to come from changes in insect diversity and quantity that might be counter to current dietary preferences and/or necessary available biomass. The following comes from a USGS webpage "Impacts of Climate Change on Life and Ecosystems" (Bogan, 2003):

> *"In temperate latitudes, both northern and southern, bats avoid seasonal food shortages by either hibernating, often in caves or mines, or by migrating to regions where food is still available. We suspect that nearly all attributes of hibernation or migration are mediated by combinations of changes in ambient light regimes, temperature, and food resources. The dependence of temperate-zone bats on the interplay of these factors ultimately revolves around the bats' ability to acquire sufficient energy (in the form of food) to either last them through a hibernation sequence or through the rigors of (sometimes) long-distance migration. Temperature changes that would affect the supply of food to bats or otherwise upset an energy balance that has evolved over millennia should have significant consequences for bats. Also, climate changes that would lead to changes in the internal temperatures of roosts that have been used by bats for decades will force bats to locate and use new or different roosts."*

Currently, there are little or no empirical data from which functional models yielding predictions could be built.

Priority Research Needs

- Information on life history, population status and trend, location of key concentrations, and conservation needs of caves and mine roosting bats.
- Individual movement patterns between seasons, specific roost requirements, microclimate needs, frequency of roost shifting, winter hibernacula preferences, and locations of significant colonies of priority bat species.
- Use of caves and mines for roosting and foraging (particularly for the long-eared myotis), migration staging sites, and lekking sites.
- Population status and trend of Black Rosy-Finch
- Population status, distribution, and ecology of gila monster
- Extent of use by desert tortoise

Conservation Strategy

Goal: Healthy, secure wildlife communities in structurally intact subterranean habitats, including natural caves and fissures with naturally functioning hydrologic processes; and the diversity of artificially created habitat features associated with mines

Objective: Through continued collaboration with Nevada Division of Minerals, BLM, and USFS, conduct 200 mine feature assessments per year and install 50 bat-friendly closure structures per year through 2022.

"mine feature assessments" – internal/external bat surveys
"bat-friendly closure structures" – bat gates or cupolas that allow the free ingress and egress of bats from a mine feature.

Action: Continue the proper evaluation of subterranean mines destined for closure activities as wildlife habitat prior to closure in appropriate season and weather conditions.

Action: When possible, retain wildlife habitat by selecting alternative mine closure methods such as hazard signs, fencing, and/or properly designed bat gates.

Action: Develop and implement temporal and spatial use recommendations in known nesting, nursery, or other roost areas that will minimize disturbance to wildlife by recreational cavers, guano harvesters, prospectors, or scientists.

Objective: Maintain stable or increasing populations of priority bats associated with caves and mines through 2022.

"stable or increasing populations" – as determined by ANABAT presence/absence surveys or other appropriate surveys conducted at regular intervals not to exceed five years.

Action: Initiate a statewide, statistically robust ANABAT surveillance survey network to systematically monitor presence/absence of priority bat species.

Action: Initiate a White-nose Syndrome surveillance monitoring network with emphasis on early detection and triggered conservation/regulation response.

Action: Actively participate in national and regional White-nose Syndrome working groups.

Action: Identify and properly survey caves and mines that are potential habitat for wildlife and document the comprehensive distribution of these habitats and their species.

Action: Identify and map key hibernation, maternity, bachelor, staging, leking, and night roost sites in caves, mine shafts, and adits that either currently support or have historically supported populations of bats.

Action: For sites with substantial bat use, develop coordinated protection plans with local entities and responsible parties.

Action: Where protection of key cave or mine roosting sites is not an option, explore mitigation possibilities such as designing and constructing alternate roost sites. Implement proper exclusion methods prior to site disturbance, alteration, or permanent closure.

Action: Create and implement a public outreach program focused on the conservation of cave and mine habitats and their associated species.

Objective: Guide habitat restorations efforts to reduce the number and density of mine claim markers across the landscape to restore natural habitat and reduce indirect mortality to Species of Conservation Priority through partnership with conservation organizations and volunteers.

Action: Actively participate in mine-claim marker removal projects and efforts with various key partners.

Partnerships

Land Management/Ownership of recently mined or quarried lands in Nevada

Ownership statistics for mines and natural caves are difficult to summarize. Data layers are being compiled to address this information need.

Existing partnerships, plans, and programs

Multi-partner

- Abandoned Mines Program
- Abandoned mines cooperative agreement between Bureau of Land Management and Nevada Division of Minerals
- Spring Mountains National Recreation Area Conservation Agreement

Bat Conservation Initiatives

- Nevada Bat Conservation Plan

- Western Bat Working Group
- Bat Conservation International

Federal & State Agencies

- Bureau of Land Management
- U. S. Forest Service
- National Park Service
- Nevada Department of Wildlife
- Nevada Division of Minerals
- Nevada Natural Heritage Program

Other Key Partners

- Counties

Townsend's Big-eared Bat Photo Courtesy of N.M. Public

Developed Landscapes

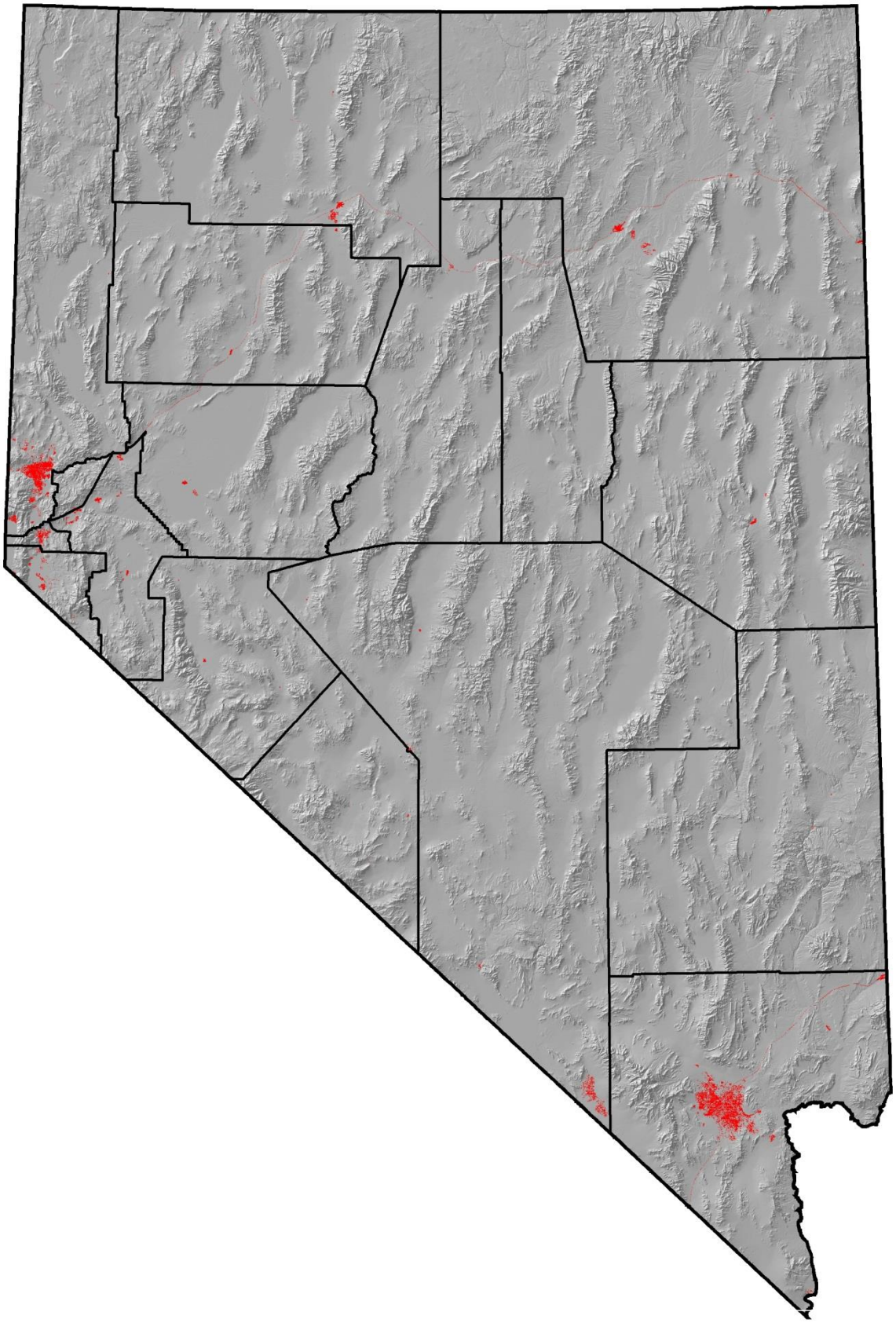

Figure 25: Distribution of Developed Landscapes in Nevada.

KEY HABITAT: DEVELOPED LANDSCAPES

Things to Know….

- Developed lands consist of residential lots, urban, and industrial areas.
- Developed lands do provide some habitat value to a variety of species, such as Peregrine Falcon.
- Habitat threats include direct mortality, predation, disease, and human conflicts.

Ecoregions

Southwest ReGAP 2005

Mojave	48,166 hectares	119,020 acres
Great Basin	43,628 hectares	107,855 acres
Sierra Nevada	1,404 hectares	3,470 acres
Columbia Plateau	402 hectares	993 acres
Total	93,600 hectares	231,338 acres

Ecological Systems*

SWReGAP Ecological Systems

N21 Developed, Open Space-Low Density

N22 Developed, Medium-High Density

*No TNC biophysical settings developed for this group

Key Habitat Description

Developed lands generally fall into two recognizable categories each of which offers its own set of challenges and opportunities to wildlife. Open space-low density developments are generally suburban in nature and consist primarily of residential lots of varying size with school grounds, athletic fields, golf courses, and parks interspersed throughout. Residential lots are generally single-family homes with yards varying from roughly a quarter-acre (0.10 hectare) to one acre (0.40 hectare) or more, but (except for the most upscale neighborhoods) rarely exceeding five acres (2.0 hectares). Yards are typically converted to lawn trimmed with ornamental shrubs, trees, and flower beds. Ball fields, school yards, and parks are generally open and converted to lawn to varying degrees with scattered ornamental trees, resembling tiny patches of irrigated savanna. In desert areas where water availability is becoming of increasing concern, the pattern of planting yards to lawn is being discouraged in favor of xeriscaping (landscaping with rock and desert vegetation requiring little or no water). A sudden addition to this category includes the large number of graded developments where housing was to be developed, vegetation has been removed and lots have been graded to some degree. No structures are present in these areas and the sites have become fallow sites where weeds have become established.

Medium-high density development is generally urban or industrial in nature and is characterized by almost complete site construction with very little soil substrate left open to support vegetation. Grounds are mostly paved with asphalt or concrete. Buildings are generally industrial, commercial, and/or high-rise, ranging in height from single-story commercial buildings 6m (20 ft) high to skyscrapers nearing 200m (650 ft) high. Commercial buildings generally start at about one half-acre (0.20 hectare) in area, and warehouses, factories, and casinos can cover dozens of acres. The cumulative effect of commercial/industrial development can cover

hundreds of acres. Vehicular traffic through these lands is typically high-volume throughout the day. Noise and artificial night light levels are elevated around the clock.

Value to Wildlife

While the conversion of native habitat to developed lands creates many adjustment challenges for the native wildlife community and most often results in the eventual eviction of the native wildlife community, developed landscapes are nonetheless repatriated by a new wildlife community capable of exploiting the ancillary benefits of human civilization. Wildlife populate open space and make do and sometimes even flourish with the resources provided by shade trees, covered porches or garages, lawn irrigation, pools, ornamental shrubs and rock walls, and flower gardens. Predator species also take advantage of the prey species attracted to these urban resources. Along the wildland-surburban interface, coyotes prey on pets and eat dog food left on the back porch; black bears, raccoons, and mustelids rummage through garbage cans and dumpsters for food, and mule deer graze on flowers, ornamental shrubs, and fruit trees. In many cases the wildlife are considered a nuisance. Many species of songbirds are able to live in suburban environments as long as the surrogate plant communities are in place and somewhat extensive in the aggregate. Park and golf course ponds become popular loafing spots for ducks, Canada Geese, and other water birds including fish-eating birds when fish are present. Even high-rise buildings and bridges are not totally bereft of wildlife. Some species of bats have become quite acclimated to roosting in expansion grooves under bridges or in crevices or under verandas on high-rise hotels, and apartment buildings. Even Peregrine Falcons have exhibited an ability to adapt to urban development and have learned to treat secluded “ledges” on the sheer sides of skyscrapers as nothing more than a stylized version of a granite cliff. The wildland-urban interface is often a patchwork of developed, undeveloped, and initially disturbed open lots in which the native wildlife community can still operate, although under decidedly elevated risk. Horned lizards and other reptiles can still find their way into suburban open space through corridors leading to the wildland margin, and even bighorn sheep will venture from their mountain habitats under the cover of evening to graze on prime golf course and park grasses where they occur at the wildland interface. Oftentimes, residents on the edge of the suburban-Mojave Desert interface report finding a desert tortoise that has wandered into their yard. As with most other wildlife, desert tortoises are attracted to water, food and shelter that are so often provided in suburban backyards.

Key Elements of Developed Landscapes Important to Wildlife

URBAN/SUBURBAN PONDS – resting, foraging

- Northern Pintail
- Redhead
- Canvasback
- northwestern pond turtle
- water shrew

BUILDINGS/BRIDGES – nesting, roosting

- Peregrine Falcon
- little brown myotis
- pallid bat

GOLF COURSES – foraging

- Western Burrowing Owl
- bighorn sheep

mountain pocket gopher
Gila monster

BACKYARDS – nesting structure, thermal cover, foraging
Rufous Hummingbird
Scott's Oriole
Mountain Quail
mule deer
western banded gecko
desert horned lizard
desert tortoise
Gila monster

Existing Environment

Land Uses

- Motorized recreation
- Non-motorized recreation
- Utility rights-of-way
- Urban/suburban development
- Industrial Development
- Road development
- Waste and hazardous materials disposal

Habitat Conditions

Habitat conditions in developed landscapes are not comparable to those that existed on these landscapes prior to their development. However, there are distinct differences in habitat conditions among the various developed landscape types. Suburban habitats can be enhanced by the judicious selection of wildlife-friendly landscaping vegetation, and many states have invested significantly in urban wildlife programs that provide consultation and technical expertise to urban and suburban landowners interested in upgrading their residential lot for wildlife. Generally speaking, suburban landscapes are friendly to the usual wildlife community adapted to successfully exploiting it, while urban landscapes exhibit elevated risk and hostility to wildlife trying to establish within them. A few exceptions, mentioned above, exist, but for the most part it is much more difficult for urban landscapes to support wildlife communities of significant diversity than it is for suburban areas.

Problems Facing the Species and Habitats

Despite the positive aspects discussed above, it must be recognized that despite the fact that maintenance of developed landscapes results in productive urban wildlife habitats, the native wildlife diversity and habitats that once existed there have been lost. Also, as alternative water supplies are sought, acquired, and developed to support Nevada's urban population growth, native wildlife communities dependent upon reliable water sources elsewhere in the state may be adversely affected.

Wildlife in urban and suburban landscapes are at constant elevated risk to predation by domestic pets, disease transmission at popular concentration centers, traffic and picture window collision mortality, contamination by pollutants, exposure to household pesticides, and a host of threats associated with the artificial human

environment. Wildlife also come into conflict with humans over a host of lifestyle issues – e.g., venomous reptiles attracted to water and shade, wild ungulates consuming garden plants, herons and other species feeding on domesticated pond flora and fauna, waterfowl inflicting damage on golf course turfs and private swimming pools, and wildlife making their way into residences and inflicting damages on property and household goods. Interactions and conflicts between wildlife, humans, and their properties, in developed landscapes will continue to increase concerns regarding human safety and property damage. As a result, societal acceptance of living in proximity to wildlife is likely to diminish over time.

Priority Research Needs

- Methods of wildlife extension that enable residents to "handle" their own wildlife problems through the management of the environmental parameters that create wildlife conflicts in developed landscapes.
- "Values/Willingness to Pay" marketing research to determine the willingness of urban/suburban residents to contribute to the administration of fully-developed extension and wildlife control programs through various proposed funding mechanisms
- Assess potential impacts of captive pet desert tortoises on wild desert tortoise populations and recovery.

Conservation Strategy

Goal: Thriving wildlife communities adapted to productive urban/suburban landscapes.

Objective: An increase in the public perception of the value of wildlife as a "quality-of-life" indicator in urban/suburban landscapes by 2022.

Action: Develop an urban/suburban wildlife extension program that assists residents with the full array of wildlife-related issues, including voluntary habitat enhancement, proactive wildlife conflict management, and "living with wildlife" outreach elements.

Action: Develop and expand urban trail networks, interpretive centers which will promote understanding and acceptance of Nevada's wildlife.

Action: Develop partnerships with city and county governments that promote the purchase and preservation of open space as wildlife habitat.

Action: Provide Wildlife Action Plan support to city and county open space planning efforts such as River Walk corridor development, park design and interpretation, wetland wildlife viewing facilities, etc. through active participation in steering committees and provision of "watchable wildlife" planning services and products.

Action: Partner with agencies and municipal entities to sponsor wildlife watching events such as the Spring Wings Festival, etc. Work with local and state tourism personnel, and identify and initiate at least one major wildlife watching event in the Eastern Region and the Southern Region to promote economic development.

Action: Develop Watchable Wildlife recreation facilities on NDOW Wildlife Management Areas.

Objective: Decrease public wildlife complaints and decrease on-site call responses by 2022.

Action: Continue to develop an urban/suburban wildlife extension program that assists residents with proactive wildlife conflict management and "living with wildlife" outreach elements.

Action: Continue to develop a coordinated, wildlife control program that responds to calls of necessity promptly, deals with the situation forthrightly and professionally, and takes the opportunity to turn contacts with the public into positive experiences.

Action: Develop and implement a public outreach program that identifies the value of wildlife and agency services in developed landscapes and explore ways to garner public support for funding of these services.

Objective: Decrease the number of unwanted pet desert tortoises significantly by 2022.

Action: Educate and provide outreach to desert tortoise custodians on legal acquisition of a pet desert tortoise, appropriate habitat and escape-proof yard, regulations pertaining to desert tortoises, and discourage breeding and encourage the possession of one male desert tortoise per household.

Action: Consider appropriate regulations to decrease the numbers of unwanted pet desert tortoises.

Action: Develop a funding mechanism to pay for the care and disposition of unwanted pet desert tortoises.

Partnerships

Land Management/Ownership

Land Owner/Manager	Percent
Private	83.2
Bureau of Land Management	10.1
Other	1.6
Bureau of Reclamation	1.4
County Lands	1.4
Department of Defense	1.2
City Lands	1.1

Existing partnerships, plans, and programs

- Wild Animal Infirmary For Nevada
- Wild Wings
- Desert Tortoise Adoption Program
- Desert Tortoise Hotline and Pick Up Service

Federal & State Agencies

- Nevada Department of Wildlife
- Nevada Department of Agriculture
- Nevada Division of Forestry
- USDA Wildlife Services
- U.S. Fish and Wildlife Service

Counties/Cities

- Clark, Washoe, Douglas, and Lyon Counties
- County Parks and Recreation
- Municipal Animal Control
- Urban redevelopment committees

Conservation Organizations

- Desert Tortoise Conservation Center/San Diego Zoo
- Tortoise Group
- Lahontan Audubon Society
- Red Rock Audubon Society
- Sierra Club

Other Key Partners

- Nevada Partners in Flight
- Great Basin Bird Observatory

Focal Areas

Carson Range
Carson Sink
Carson Valley
Las Vegas Valley
Pahrump Valley
Truckee Meadows
Virgin River Valley

Agricultural Lands

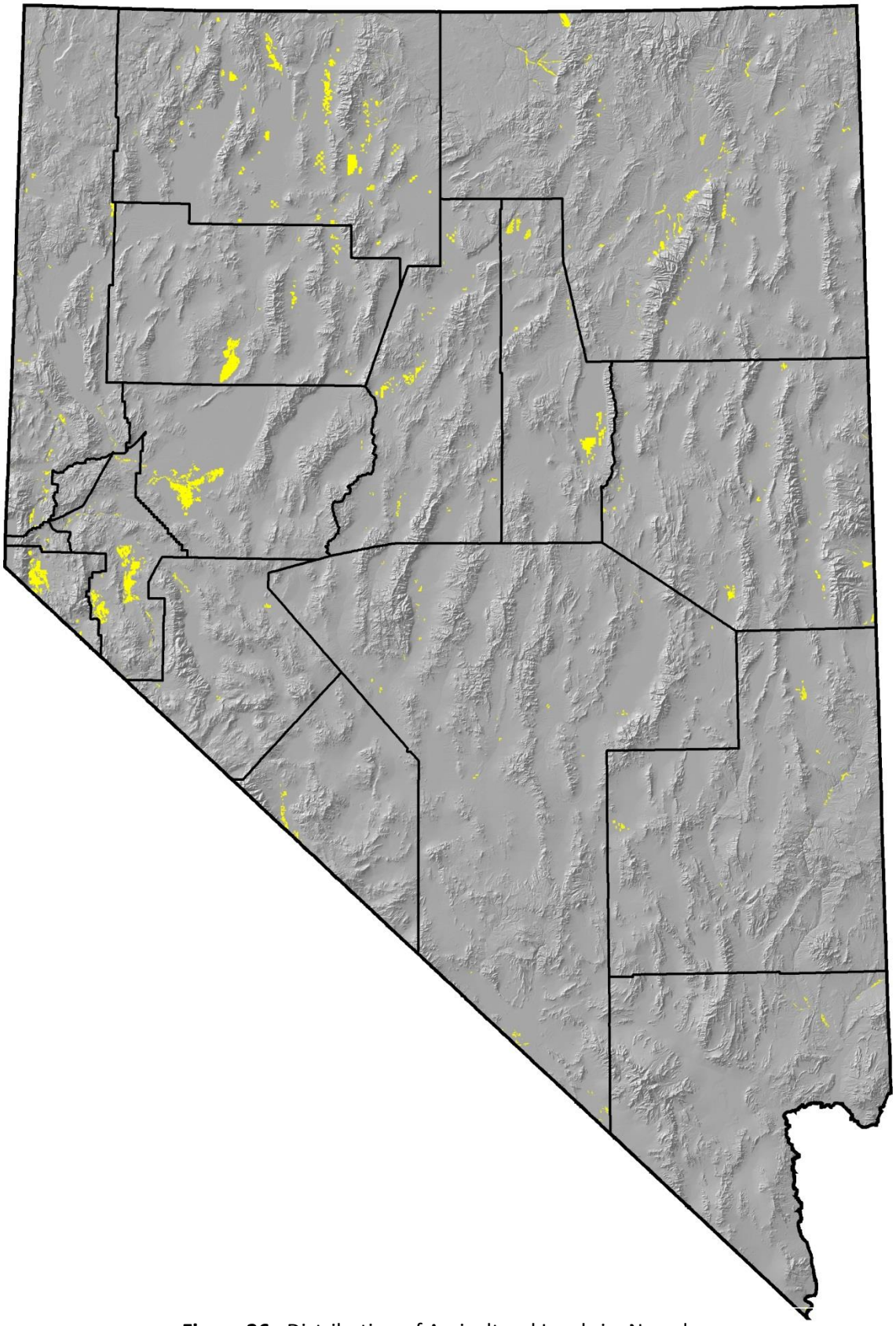

Figure 26: Distribution of Agricultural Lands in Nevada.

KEY HABITAT: AGRICULTURAL LANDS

Things to Know….

- Agricultural lands are found throughout Nevada at elevations from 600 to 7,500 feet and primarily in valley bottoms.
- High value habitat with flooded fields, unharvested hay fields, and fallowed fields. Key priority species include Greater Sage-grouse, Long-billed Curlew, and mule deer.
- Habitat threats include non-native invasive plants, shifts in land use, and timing conflicts between agricultural practices and key wildlife use periods (such as breeding).
- Climate change effects include a reduction in flood irrigated crop acres, unpredictable effects of runoff timing on harvested haymeadow, and a short-term increase in fallow field acreages could occur which can lead to conversion to invasive plant species
- The most available prescriptive action is to provide technical and financial assistance to private landowners for wildlife and habitat conservation.

Ecoregions

Southwest ReGAP 2005

Great Basin	181,262 hectares	447,900 acres
Columbia Plateau	36,738 hectares	90,781 acres
Mojave	4,258 hectares	10,523 acres
Total	222,258 hectares	549,204 acres

Ecological Systems*

SWReGAP Ecological Systems

N80 Agriculture

*No TNC biophysical settings were developed

Key Habitat Description

Agricultural crops are grown throughout Nevada, from 600 feet above sea level on the Fort Mohave Indian Reservation to over 7,500 feet elevation in the northern latitudes. Precipitation ranges from less than seven cm in the south to close to 38 cm at higher elevations in the north, while temperatures vary from -25 degrees F in the north to over 110 degrees F in the south. Most agricultural crops are grown in valley bottoms and on alluvial deposits. Hay, either alfalfa or grass, is the primary harvested crop (76% of Nevada's agricultural acreage), while wheat, barley, potatoes, onions, and garlic are also grown in much lesser amounts.

Value to Wildlife

Although Nevada is comprised mostly of publicly managed lands, the private lands tend to be in areas of high value to fish and wildlife species. These tend to be in valley bottoms in areas where water availability is above average. Therefore, agricultural lands host a variety of species, for at least some portion of the year, and provide

a critical link for the survival of terrestrial species with varying habitat requirements on larger landscapes. Nevada's agricultural lands contribute to wildlife conservation in three basic conditions: flooded fields, unharvested hay, and fallow fields. Flooded fields are visited by a host of bird species that feed on the invertebrates displaced (beetles, etc.) or drowned (earthworms) by the flooding. Flooded fields are particularly important in the maintenance of breeding White-faced Ibis in valleys where agriculture and wetlands share prominence (e.g., Lahontan Valley, Churchill County). Unharvested hay, whether grass or alfalfa, is used by nesting birds such as Long-billed Curlew and in some places Greater Sage-Grouse. Meadows with tall, unharvested grass serve the nesting needs of Greater Sandhill Crane and Bobolink. Fallow fields in Nevada tend to attract ground squirrel colonies and if left undisturbed for long periods, generally experience a rodent population build-up that attracts a host of predatory raptors, including Prairie Falcon, Ferruginous Hawk, and Short-eared Owl. After summers of drought when total acreage tends not to be planted to full capacity, the concentrations of wintering raptors in agricultural zones such as Lovelock, Mason Valley, and Lahontan Valley can be impressive.

Species of Conservation Priority by Species Assemblage

FALLOW FIELDS-foraging, burrowing, small mammal populations that attract raptors

Prairie Falcon
Short-eared Owl
Ferruginous Hawk

FLOODED FIELDS – foraging

White-faced Ibis
American Avocet
Tricolored Blackbird

UNCUT MEADOW/HAY – nesting

Canvasback
Redhead
Northern Pintail
Greater Sandhill Crane
Long-billed Curlew
Wilson's Phalarope
Bobolink
Greater Sage-Grouse
Pahranagat Valley montane vole
mule Deer
Southwest blackhead snake

COTTONWOOD TREES – nesting structure, thermal cover, protection from predators

western red bat
Bald Eagle

CORNERS, MARGINS, FENCEROWS – perch sites for foraging bird species

Western Burrowing Owl

GENERALIST – perch sites, foraging
desert Horned Lizard
Common Nighthawk
little brown bat

Existing Environment

Land Uses

- Agriculture
- Livestock grazing
- Urban/suburban development
- Species harvest

Habitat Conditions

Active agricultural lands are relatively stable in the wildlife habitat values they provide when consistently managed although these values may vary cyclically with season and climatic variation. Trends toward more efficient methods of irrigation (drip, circular pivot) have proven less advantageous for wildlife, which are more compatible with traditional flood irrigation and grass hay operations.

Problems Facing the Species and Habitats

The key to maintaining agricultural lands for wildlife conservation in Nevada is in the timing of agricultural activities (irrigation, pesticide application, harvest) to avoid conflicts with key wildlife uses, mostly during the breeding season. Invasive weeds degrade both agricultural and wildlife habitat value. In addition to invasive weeds, threats to the long-term productivity of Nevada's agricultural lands may include increased pressure upon prime lands from residential and commercial development. When prime farm land converts to urban or suburban development, the wildlife values associated with agriculture are lost for generations. While a declining economy may result in lower pressures for conversion of agricultural lands due to urban/suburban development, it can also impact an agricultural producer's ability to consistently manage their lands from year to year. For example, alfalfa fields that are notably important to wildlife may be taken out of production because of the high costs of diesel fuel used to run irrigation pivots. Prolonged periods of decreased production will affect species that have traditionally depended upon these areas for nesting, foraging, or protective cover.

Predicted Effects of Climate Change

The following analysis is extracted from *"Economic Impacts of Climate Change on Nevada"* a review and assessment conducted by The Center for Integrative Environmental Research, Univ. Maryland (2008).

> *"Warmer temperatures, more rain and less snow in winter, and less rain in summer are predicted to impact agricultural productivity through a reduction in snow pack, earlier snowmelts, and increased runoff. Agriculture in general is predicted to become a riskier economic venture as seasons grow more unpredictable and competition for water resources with urban/suburban/commercial development increases."*

Based on those predictions, a reduction in acreage of flood-irrigated crops (e.g., alfalfa or haymeadow), unpredictable effects of runoff timing on harvested haymeadow, and a short-term increase in fallow field

acreages could occur. Eventually, these plant communities within fallowed fields are likely to convert to non-native or noxious weed species unproductive for native wildlife communities.

Possible Responses of Wildlife to Climate Change

An overall reduced acreage of flooded alfalfa has probably already had a negative impact on the average size of the White-faced Ibis nesting population in Lahontan Valley (NDOW 2011). Average annual White-faced Ibis pair counts have decreased from ~2,800 (1986 to 1997) to ~1,900 (1998-2010) or roughly 32% since alfalfa acreage has been retired through water rights transfers and irrigation project operating criteria have been tightened. Other priority species likely to be negatively impacted by reduced foraging habitat include Long-billed Curlew and Wilson's Phalarope.

It is very difficult to predict specific effects of the climate change predictions above on grass haymeadow production, but transition to exotic forbs in early (haymeadow) riparian condition classes has already been discussed in the Intermountain Rivers and Streams chapter. To recount for specific agricultural land concerns, species dependent on productive, well-flooded haymeadow include Greater Sandhill Crane, Bobolink, Northern Pintail, Long-billed Curlew, Wilson's Phalarope, and mule deer. Species dependent on drier substrates but with significant build-up of residual vegetation (predominantly native grasses) include Short-eared Owl and Pahranagat Valley montane vole. Negative impacts of altered runoff patterns to the hydration of oxbows and other low floodplain depressions where cattails and bulrushes might grow could be expected to impact American Avocets, American Bitterns, Canvasbacks, Redheads, Tricolored Blackbirds, and river otters.

Initial increases in fallow acreage might benefit Ferruginous Hawks, Prairie Falcons, and Western Burrowing Owls. All three species would prey on ground squirrels and other rodents that would initially colonize these zones marginal to active cultivation.

Taking Prescriptive Action

Since agricultural lands were not included in our terrestrial habitats climate change analysis, no specific prescriptions were solicited from our expert restoration panels, but extensive interagency emphasis to provide wildlife conservation project assistance to private landowners has been deployed since 2001. Conservation programs under the Farm Bill such as the Wildlife Habitat Improvement Program (WHIP), Wetlands Reserve Program (WRP), Grasslands Reserve Program (GRP), and others administered by the Natural Resource Conservation Service (NRCS) have focused on projects and easements, such as protecting riparian floodplains by fencing out livestock from sensitive areas while allowing for alternative water delivery systems in pastures, restoring developed springs and spring brooks for the benefit of endemic fish and amphibians, and designing rotational grazing systems by fencing larger pastures into smaller ones. In 2010, the United States Department of Agriculture (USDA) launched a new effort to sustain working ranches and conserve Greater Sage-Grouse populations in the West known as the Sage-Grouse Initiative. Agricultural producers in Nevada can enroll in NRCS programs to simultaneously improve habitat for Sage-Grouse and improve sustainability and productivity of their native rangelands.

Other programs available to private landowners include the Partners for Fish and Wildlife Program (Partners Program) administered by USFWS and the Nevada Landowner Incentive Program (NLIP) administered by NDOW. The Partners Program has been working with private and tribal landowners who want to voluntarily improve fish, wildlife, and plant habitat on their lands. Similarly, the NLIP has worked with many of Nevada's citizen stewards through a federally funded competitive grant program. The Nevada Department of Agriculture Plant

Industry Division works to 'effectively coordinate resources and efforts toward proactive prevention, control, and management of invasive weed species in Nevada to benefit all land users in the state.'

Most of these programs involve a cost-share for project implementation. In addition to funding, all of these programs can provide technical assistance to landowners wishing to enhance habitat or modify management practices on their lands. Examples of projects include: control of non-native, noxious weeds; planting of native vegetation; installation of wildlife friendly fencing or exclosures to protect sensitive habitats; development of livestock grazing management plans to address specific needs of wildlife; purchase of conservation easements; implementation of prescribed burns to enhance or protect wildlife habitat; and removal of fish passage barriers (or installation to protect native fish populations from non-native fish species).

Priority Research Needs

- Demonstration of specific contributions of agricultural lands to wildlife conservation in Nevada
- Integration of private lands into landscape management design
- Integration of wildlife-based Best Management Practices with operational activities of agricultural enterprises
- Incentive strategies to facilitate pro-active wildlife conservation on agricultural lands in Nevada

Conservation Strategy

Goal: Healthy, secure wildlife communities in economically viable agricultural operations managed to meet wildlife needs for cover, food, and breeding while meeting the needs and objectives of landowners.

Objective: Improve 500 acres of riparian/meadow per year through 2022.

"500 acres" – computed as five projects per year averaging 100 acres in size per project

Action: Implement Sage-Grouse meadow restoration projects through landowner assistance programs available from NRCS, USFWS, or NDOW.

Action: Create incentives for landowner participation through the demonstration of increased economic value of restored meadows.

Objective: Achieve or maintain Greater Sage-Grouse brood use of recovered meadows by or through 2022.

"Achieve or maintain… brood use" - Specific contributions of habitat improvement to Sage-Grouse population improvement are hard to project because there is a disproportionate significant reliance on meadow habitats by brooding Sage-Grouse hens that is not readily geospatially computable; therefore, presence/absence of Sage-Grouse broods is the only practically measurable parameter available.

Objective: Provide habitat for up to 100 new breeding pairs of Long-billed Curlews (60 birds) on restored meadows through 2022.

"100 new breeding pairs" – computed at a rate of 15 breeding pairs per 250 acres (Hartman 2009), 500 acres of new restoration annually, and a 30% positive species response rate.

Action: Whenever possible, restore meadow habitats in contiguous blocks of 250 acres as opposed to smaller patches.

Objective: Provide habitat for 15 new breeding pairs of Short-eared Owls on restored meadows by 2022.

"15 new breeding pairs" – computed at a rate of one new potential territory per restoration project, 50 projects completed over the 10-year period, and a 30% positive species response.

Action: Whenever possible, restore meadow habitats in contiguous blocks of 125 acres or more in order to meet minimum patch requirements for Short-eared Owl nesting pairs (Holt 1992 *in* NatureServe 2011).

Action: Implement meadow management practices that encourage the buildup of residual vegetation through the nesting season to maximize rodent densities in Short-eared Owl nesting areas

Objective: Provide habitat for 15 new breeding pairs of Greater Sandhill Cranes on restored meadows through 2022.

"fifteen"15 new breeding pairs" – computed at a rate of one new potential territory per restoration project, 50 projects completed over the 10-year period, and a 30% positive species response.

Action: Implement meadow management practices that encourage the maintenance of uncut vegetation through the nesting and fledging season in order to maximize the escape cover value of meadow habitat to minimize incidence of predation on crane colts and increase colt survival.

Objective: Maintain a 10-year average of 3,000 nesting pairs of White-faced Ibis statewide through 2022.

"10-year average" – marsh-bird-nesting is cyclically tied to 10-year drought patterns; therefore, regularly occurring peaks and lows need to be factored in to the management target computation.

"3,000 nesting pairs" – 2,000 nesting pairs in Lahontan Valley averaged over a 10-year period plus 1,000 nesting pairs scattered over other suitable nesting sites around the state (Humboldt WMA, Humboldt River, Ruby NWR, etc.)

Action: Support efforts and assistance programs designed to preserve flood-irrigated croplands associated with key nesting colony sites (e.g. Lahontan Valley) from urban/suburban/commercial development and/or diversion of water rights to urban/commercial uses.

Action: Foster productive partnerships with farmers and ranchers through active acknowledgement of the value of flood-irrigation to wildlife and the importance of maintaining traditional farm practices on the Nevada landscape.

Objective: Maintain Ferruginous Hawk, Prairie Falcon, and Western Burrowing Owl populations at stable or increasing trend through 2022.

"stable or increasing trend" – as determined by NDOW raptor nesting surveys conducted regularly at intervals not to exceed five years.

Action: Support efforts and assistance programs designed to encourage and preserve fallow croplands as a standard element of productive agricultural landscapes in key raptor breeding and wintering sites (Lovelock Valley, Paradise Valley, Mason Valley, etc.)

Action: Coordinate educational efforts to encourage leaving fallow croplands with extension and NRCS programs that promote crop rotation as an important element of agricultural land health and productivity.

Action: Create incentives for farmers and ranchers to refrain from poisoning colonial rodents on fallow croplands and adjacent rangelands except where clear health risks have been identified.

Objective: Increase the current level of customer participation in private landowner wildlife conservation assistance programs significantly by 2022.

Action: Initiate a comprehensive species/habitat relationships analysis to define the key contributions of agricultural lands and activities to species conservation.

Action: Identify the role of private agricultural lands on landscapes under consideration for species conservation planning; develop coordinated management strategies involving stakeholders that recognize and account for the contribution of all properties to the successful achievement of conservation objectives for a particular landscape.

Action: Raise the value of wildlife to landowners by identifying wildlife conservation benefits that contribute positively to private landowner conservation assistance program evaluations, resulting in more successful competition for project funds.

Action: Maximize landowner participation in conservation programs by providing a full range of funding opportunities through the coordination of state, federal, and non-profit funding sources into an attractive and functional private lands assistance program that serves the needs of landowners while achieving tangible improvements in wildlife habitats.

Action: Encourage landowners and businesses to voluntarily invest in the improvement of natural resources to maintain the long-term ecological, economic, and social values provided by private lands.

Action: Develop and implement an outreach program featuring the importance of private agricultural lands to wildlife conservation in Nevada.

Action: In cooperation with landowners where appropriate, develop marketable aspects of wildlife management on their lands, including quality recreational experiences.

Action: Publicly recognize the contributions of individual landowners to wildlife conservation through awards and other appropriate forums.

Action: Coordinate activities with Nevada Division of Forestry where tree planting or removal is recognized as a benefit to wildlife species.

Action: Design adaptive management strategies with wildlife monitoring elements and secure funding to measure project success by wildlife response toward the achievement of mutually-crafted objectives.

Action: Share resources and guides with Nevada landowners describing the use of proven conservation practices for improving wildlife habitat while enhancing the agricultural landscape. Practices include wildlife plantings, riparian habitat management, wildlife watering facilities, suggested grazing and haying management practices; discuss materials acquisition, funding, and technical consultation opportunities; describe rotating land uses, resting pastures, adjusting grazing treatment timing and duration, maintenance of mixed habitat types, edge-effect concepts, etc.

Partnerships

Land Management/Ownership

Land Owner/Manager	Percent
Private	79.4
Bureau of Reclamation	10.7
Bureau of Land Management	4.9
Tribal	3.2
Other	1.8

Existing partnerships, plans, and programs

Federal & State Agencies

- USDA Natural Resource Conservation Service and Conservation Districts
- Bureau of Land Management
- Bureau of Reclamation
- U.S. Forest Service
- U.S. Fish & Wildlife Service
- Nevada Department of Wildlife
- Nevada Division of Forestry
- Nevada Department of Agriculture

Conservation Organizations

- National Audubon Society/Lahontan Audubon Society/Red Rock Audubon Society
- The Nature Conservancy
- University of Nevada Cooperative Extension Service

Other Key Partners

- Great Basin Bird Observatory

Focal Areas

Amargosa Desert
Big Smoky Valley - North
Carson Sink
Carson Valley
Fish Lake Valley
Marys River Drainage
Moapa Valley - East
Pahrump Valley
Ruby Valley
Salmon Falls Creek Area
Snake Valley
Spring Valley
Steptoe Valley
Truckee Meadows
Upper Reese River Valley
Virgin River Valley
White River Valley

Barren Landscapes

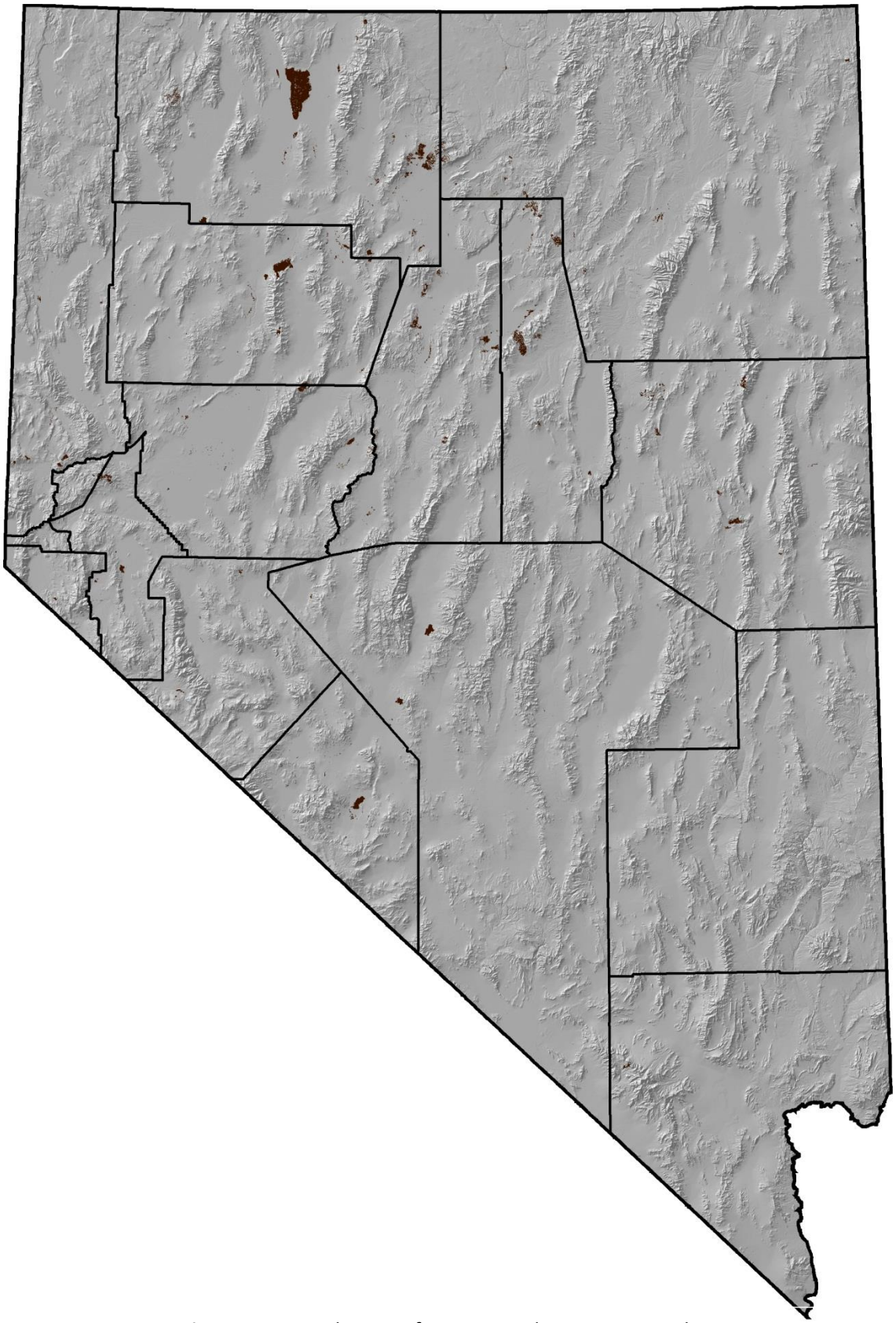

Figure 27: Distribution of Barren Landscapes in Nevada.

KEY HABITAT: BARREN LANDSCAPES

Things to Know….

- Barren landscapes are naturally "barren" or have become barren as a result of activity, such as mining or fire.
- These sites typically are avoided by wildlife since there is little cover and forage value, but may be inhabited by chuckwalla, western banded geckos, and other reptiles in areas of close juxtaposition with food-producing habitats.
- Habitat threats include non-native invasive plants, erosion, and recreation (OHV).
- Annual grasses will experience a range expansion into barren lands as a result of climate change.

Ecoregions

Southwest ReGAP 2005

Great Basin	68,904 hectares	170,262 acres
Columbia Plateau	38,971 hectares	92,297 acres
Sierra Nevada	352 hectares	869 acres
Mojave	721 hectares	1,783 acres
Total	108,948 hectares	269,211 acres

Ecological Systems*

SWReGAP Ecological Systems

N31 Barren Lands, Non-Specific

D03 Recently Mined or Quarried

D02 Recently Burned

*No TNC biophysical settings were developed

Key Habitat Description

This ecological system includes lands that are either barren in their natural state or have been subject to landscape altering forces such as mining or fire and are barren as a result of these actions. Areas classified as barren lands include areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits, and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total ground cover in these areas. Recently mined or quarried areas are those areas two hectares or more in size, where open pit mining or quarries were visible in satellite imagery acquired for SWReGAP between 1999 and 2001. Similarly, areas visible in the 1999-2001 satellite imagery for SWReGAP that had burned in the recent past and were clearly evident in the imagery were classified as recently burned.

Value to Wildlife

For disturbed sites, much of the value of these sites lies in their potential for restoration to meet wildlife habitat needs. As areas essentially denuded of cover that offer little or no food values, these sites tend to be avoided by wildlife, though exceptions occur. Some reptiles will utilize these areas, though probably making only brief

incursions before returning to more favorable habitat types. Bighorn sheep will also utilize these areas, primarily during daily or seasonal movements. Finally, where ledges and crevices occur in open pit mine walls, bats and some species of cliff-nesting birds will utilize such sites for nesting or roosting.

This ecological system does contain natural elements. In particular, the talus and slide elements can be used for cover and foraging areas for a variety of wildlife, and they are critical to American pika. Pika require a secure environment where they can readily escape from predators, cache the hay supplies that allow them to endure long winters, and most important offer a refuge from warm temperatures which this species is physiologically incapable of surviving.

Key Elements of Barren Lands Habitat Important to Wildlife

HIGH WALLS – nesting or roosting in ledges and crevices

Prairie Falcon
Peregrine Falcon
Ferruginous Hawk
Golden Eagle
Great Basin collared lizard
bighorn sheep
chuckwalla

ROCKY SLOPES AND TALUS– foraging, protection from predators, thermal cover, food storage

American pika
long-eared myotis
spotted bat

GENERALIST – using a variety of elements in multiple habitats

western banded gecko
long-nosed leopard lizard
greater short-horned lizard
desert horned lizard

BARREN FLATS/BURNED – movement corridors, nesting substrate (ground nesters)

Common Nighthawk
Western Burrowing Owl

Existing Environment

Land Uses

- Motorized recreation
- Minerals/oil/gas extraction
- Utility rights-of-way
- Military mission
- Road development
- Improper Fire Restoration Policy
- Species Harvest

Habitat Conditions

Sites that have been modified from their original form and largely stripped of the natural vegetation communities that once characterized them are considered to be in poor condition. Though not entirely devoid of wildlife values, the sites certainly offer less to wildlife than when they were in their natural state. In sites that have been altered by ground-moving activities, little to no soil remains to reestablish vegetation, however, mine reclamation plans typically call for the replacement of soil and reseeding of sites. In burned areas, the native seed bank may be absent because of the heat of the burn or because the native vegetation at the site had long-ago been supplanted by invasive species. Mid-to-low elevation burned sites are at considerable risk of being invaded by cheatgrass, requiring difficult and expensive management intervention to reverse or reclaim. Burned lands converted to cheatgrass are of reduced value to wildlife and livestock, and reduce agency options when managing these landscapes under a multiple use mandate.

Sites which are barren by nature have relatively fewer habitat values to offer wildlife. If left undisturbed, these sites can be considered to be in good condition, at least within the context of their inherent potential. Some scree and talus slopes in Nevada have been selected as a ready source of rock material and have been or are being mined.

Problems Facing the Species and Habitats

Disturbed areas, particularly at mid-to-low elevations, can be conduits for weed invasion. These sites may also be susceptible to erosion, either facilitated by wind and rain or by OHV use in the disturbed area. The forces that create barren landscapes are by their nature agents of habitat alteration and destruction, and generally without active restoration can result in landscape conversion. Typically, without some form of active restoration effort, these sites continue to decline, and so problems for some of these landscapes include a lack of adequate response, including, in some cases, “no action” after a fire. Mineral, oil, or gas extraction practices can lead to habitat destruction, wildlife displacement, toxic waste ponds, and additional habitat loss through development of infrastructure such as roads and site development. These impacts are typically mitigated through site reclamation plans, but for sites where no such plans were adopted these changes can lead to permanent habitat loss.

Predicted Climate Change Effects

Specific climate change analysis was not conducted as part of the terrestrial habitat project administered by TNC, but barren ground was identified as one of the type conversions for the lower Mojave shrub types (salt desert scrub, creosote bush/bursage, and thermic blackbrush) as the effects of fire regime alteration by annual grass/forb invasion played themselves out to ultimate effect. Should higher temperatures be coupled with higher annual rainfall as much as 20% in areas such as the Tonopah region as some models predict (Univ. Maryland 2008 – see Agricultural Lands chapter*)*, reclamation efforts on disturbed lands such as mines and tailings might even benefit over the short term, but for the most part, an increase in barren lands sparsely vegetated by annual grasses and forbs is not a scenario generally anticipated in positive terms with regard to wildlife habitat value.

Vertical hardrock surfaces (cliffs, high walls, stacks, etc.) are for the most part inured to climate change themselves, but the conversion of the attendant vegetation of these surfaces (such as it may be) from native perennial to exotic annual would generally be viewed as a loss in wildlife habitat value. Softer vertical surfaces

(e.g. high-wall Lahontan beach deposits) would be subjected to greater erosion events under climate change scenarios of more winter rainfall, earlier and more intensive runoff.

Possible Wildlife Responses to Climate Change

In general, an increase in barren lands under these classification types would not be considered beneficial to wildlife – not even the priority species identified in this chapter. The impacts of the incremental loss of the Mojave shrub layer have already been discussed in the Mojave Shrub chapter and again in the Dunes and Badlands chapter. Wildlife use of expanding acreages of barren lands would be restricted to the edges within reasonable reach of shade and escape cover except in the odd cases where available water might be restricted to the interior of barren lands or stress from harassment or predation might drive herds or individuals out into these lands for relief.

Priority Research Needs

- Vegetation restoration techniques – seed mixes, timing of planting, seed sources, local plant adaptations
- Detailed wildlife/habitat relationships information that can be applied to specific restoration site design for the Species of Conservation Priority
- Cost-effective restoration protocols for stopping the advance of cheatgrass

Conservation Strategy

Goal: Natural or restored landscapes capable of supplementing the life history needs of wildlife adapted to disturbed habitats, habitats in transition, or newly created landscapes, habitats, or opportunities.

Objective: As operations cease or shift away from inactive disturbed lands and tailings, reclaim mine sites to function as habitat for wildlife, particularly Species of Conservation Priority through 2022.

Action: Develop a working relationship among WAP partners and working mines, facilitated by the Nevada Mining Association, to collaboratively develop techniques for improving reclaimed site conditions, incorporating the needs of priority species.

Objective: Where "windows of effectiveness" exist after wildfire, take positive action to revegetate burned sites in habitats susceptible to cheatgrass invasion within one year of burning through 2022.

Action: Continue to develop and improve restoration techniques using native seed mixes and plant stocks.

Action: Prioritize affected landscapes to identify those sites where reseeding should be a priority.

Action: Treat burned sites in an expedient manner, timing seeding to best take advantage of naturally available moisture.

Action: Integrate WAP strategies for sagebrush and invasive grasslands and forblands into this strategy, particularly elements pertaining to fire management and site restoration.

Partnerships

Land Management/Ownership

Land Owner/Manager	Percent
Bureau of Land Management	75.3
Private	22.4
Other	2.3

Existing partnerships, plans, and programs

Federal & State Agencies

- Bureau of Land Management
- U.S. Forest Service
- Natural Resources Conservation Service/Nevada Conservation Districts
- Nevada Division of Forestry
- Nevada Department of Wildlife

Other Key Partners

- Counties
- University of Nevada (UNR, UNLV)
- Sierra Club
- Mining Industry/Nevada Mining Association
- Eastern Nevada Landscape Coalition
- Eastern Nevada Landscape Restoration Program
- Great Basin Restoration Initiative

Focal Areas

Big Smoky Valley - North
Black Rock Range
Buffalo Hills
Butte Valley - South
Carson Sink
Cherry Creek Range
Clan Alpine Mountains
Fish Lake Valley
Huntington Valley
Independence Mountains
Madelin Mesa
Mud Spring drainage
Pahrump Valley
Roberts Creek Mountains
Ruby Mountains
Ruby Valley
Santa Rosa Range
Sheldon NWR
Shoshone Range
Spring Mountains
Toiyabe Range
Toquima Range
Tuscarora Mountains
White River Valley