State of Nevada

Comprehensive Wildlife Conservation Strategy

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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 California 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. 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 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 two or three 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. It is simply one of the many fascinating qualities of Nevada's wildlife resources.

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 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 67 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 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 bedrock crack, amidst some of the most inhospitable desert found anywhere. This is one of the state's natural 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 24,685,824 hectares (61 million acres), or 86 percent of the land base. Of the remaining 14 percent (approximately 4,046,856 hectares; 10 million acres), 11.5 percent 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. Land status is illustrated in Figure 1. At least 90 percent of the land in Esmeralda, Lander, Lincoln, Nye, and White Pine counties is federally managed, while overall, 50 percent 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 use requires federal agencies to manage the public lands

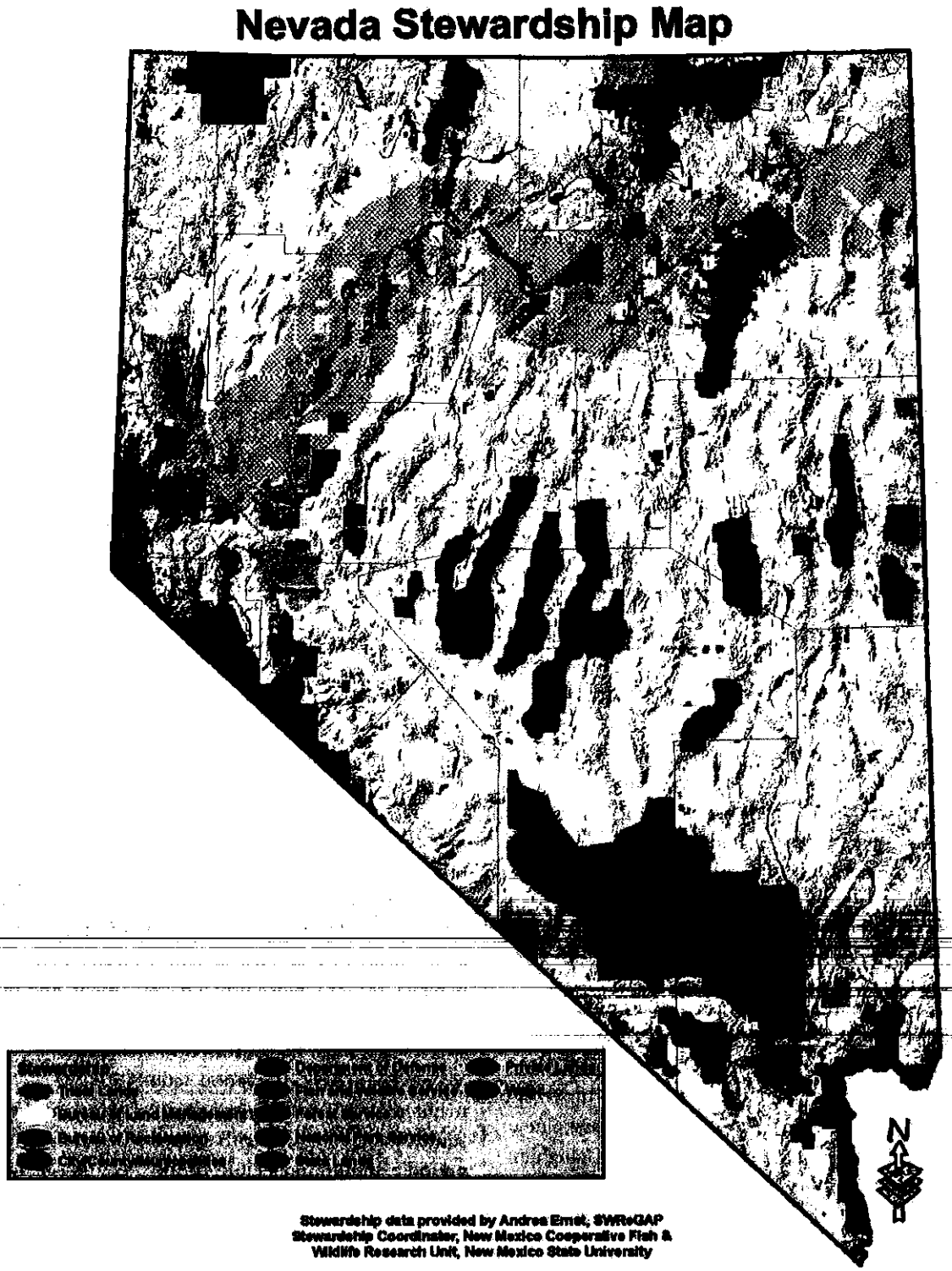


Figure 2. Map of Nevada indicating land ownership/land management patterns.

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 and BLM Resource Management Plans include wetland and riparian resources, wild horses, biological diversity, forage production, forest health, watershed conditions, wildlife habitat, motorized recreation, and noxious and invasive weeds.

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; 224 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.

Human Demographics and Impacts

In terms of human population, Nevada is the fastest growing state in the nation, with three of its most populous cities in the top 20 for growth nationwide. Each month, 6,400 new residents move to Las Vegas, and each month additional roads, housing developments, power poles, and shopping centers spring up, often in areas where wildlife once roamed. Nevada is the most urbanized state in the nation, with nearly ¾ of its human population in the cities of Las Vegas, Henderson, and Reno.

Even the once-remote rural areas of the state are impacted by population growth. Rural communities strain to keep up with the influx of urban dwellers fleeing the cities; out-of-state manufacturers move into a low tax environment; energy developers pursue new technology to develop new resources. From Laughlin at the south end of the state, all the way to Elko in the north, the state is experiencing exponential growth.

Survey data recently reported as part of Colorado State University's "Wildlife Values in the West 2004" (Teel, T.L. & Dayer, A.A. (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 wildife 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 three of the 15 activities should be chosen, "Protecting fish and wildife 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.

Challenges in Wildlife Conservation

Nevada is uniquely challenged in approaching effective wildlife conservation, in part because of its generally arid climate, geography, and relative scarcity of water resources, which has created a unique endemic biota easily subject to threats and stressors. Beyond these inherent conditions, however, human factors including a long history of land use activities altering natural habitats, recent intense urban development, and the widespread occurrence of invasive plant and animal species that must be addressed to ensure the effectiveness of conservation actions and the maintenance of wildlife and their habitats into the future. When coupled with natural stressors such as periodic, but unpredictable, drought conditions from short-term climatic variation, human-related stressors can create a compounding effect which significantly influences the ability of habitats to maintain wildlife diversity on a landscape scale. Although some of these anthropogenic stressors, such as urban development and large-scale modification of hydrologic systems for water supply and flood control, may not be reversible and are necessary costs associated with human

settlement and needs, others can be managed or corrected in ways that reduce negative effects or positively assist in implementing conservation.

Although Nevada's unique landforms and natural history are important elements in understanding and addressing the challenges inherent in developing this strategy to comprehensively conserve our wildlife resources, it must be understood that challenges for species and habitats across Nevada are closely tied to anthropogenic land use activities. Any strategy for addressing these challenges and effective conservation must include a definition and attempt to understand the stress on species and their habitats. In the broad sense, the sources of stress can be categorized into actions related to agriculture, hydrology, recreation, natural resources extraction, development, military activities and a few additional actions which do not fall into these general areas.

Although organized agricultural activities are not a significant broad-scale stressor in Nevada, where they do occur, land-use actions such as agricultural and pasture conversion can influence wildlife through loss of native vegetation communities and species diversity, changes in vegetative structure characteristics, and increased disturbance to wildlife. Improper agricultural practices have the potential for significant local impacts; water and soil pollution can occur from improper waste management in intensive agriculture operations such as feedlots; and improper application of pesticides and herbicides can cause incidental mortality of non-target sensitive species and disruption of physiological processes, including reproduction. Improper soil conservation practices cause soil erosion and sedimentation of streams and floodplains, and the improper application of fertilizers can result in nutrient loading of streams and contamination of animal tissues.

Livestock grazing on Nevada range has a long history and is one of the state's most important industries. Proper livestock grazing and wildlife conservation are compatible on the landscape, but problems have arisen in areas where improper grazing practices occurred historically or currently persist. Stresses to wildlife and their habitats related to improper livestock grazing include alteration of vegetation composition, decrease in structure and cover through the removal of vegetation, selective removal of preferred forage species, soil compaction inhibiting plant recruitment and inducing erosion, and dispersal of undesirable invasive species. Improperly managed grazing impacts aquatic systems through erosion, sedimentation, nutrient loading, and degraded water quality, and can result in the loss of nesting cover, escape cover, and wildlife food sources in associated terrestrial habitats. Depending on the specific aquatic system characteristics, in-stream watering can cause negative substrate modification and direct mortality from trampling to endemic fishes and early life stages of endemic amphibians. Infrastructure associated with grazing management, particularly the construction of fences, results in the interruption of wildlife movements across landscapes and also causes or contributes to the direct mortality of wildlife.

Throughout Nevada, water is a scarce and valuable resource essential for both human needs and the maintenance of wildlife and their habitats, thus the development and alteration of hydrologic resources is a significant source of stress to wildlife resources. The development and operation of dams and impoundments at all scales, ranging from major reservoirs on the Colorado River to small-scale impoundments for water storage and flood control throughout the state, is an obvious human induced change to the landscape. These structures modify hydrologic regimes and interrupt natural flow dynamics that result in modified channel and floodplain processes both up- and downstream from dams and their impoundments. Dams play a key role in the fragmentation of aquatic habitats and modify the nature of both aquatic and terrestrial habitats through inundation upstream and de-watering downstream, frequently creating conditions more favorable to nonnative plant and animal species.

Channel modification to lotic (flowing water) aquatic systems, through ditching, diking and diversion is another significant source of stress to wildlife resources. The effect of these activities on aquatic and associated riparian habitats may include loss or modification of substrate diversity and structure, loss of streambank vegetation and increasing risk of erosion, loss of connectivity between channel and floodplain and within lotic systems by creating barriers to later movement by aquatic species; and actual dewatering and desiccation

of aquatic habitats, which can cause direct mortality, reductions in habitat availability, and fragmentation or loss of connectivity within or between aquatic systems.

The development of springs and seeps, a common historic practice for livestock watering, domestic water supply and other purposes, is of concern, given the critical importance of spring resources widely distributed across Nevada's landscape as sources of surface water for terrestrial wildlife, and also because many springs and seeps of all sizes support unique endemic aquatic biota. The development and modification of spring sources and source pools directly alters or removes important aquatic habitats; modifications can limit access to remaining surface water by wildlife; and the diversion of water away from outflow channels can modify, reduce, or destroy associated riparian and wetland habitat, as well as limit or eliminate flowing water habitats for endemic species associated with springbrooks.

Although not directly related to the development and alteration of spring systems, groundwater development has been a historic source of stress for Nevada wildlife and habitats and continues to represent a significant ongoing problem. As demonstrated in areas such as Ash Meadows and Pahrump Valley in southern Nevada, excessive groundwater withdrawal can alter groundwater flow and recharge patterns, resulting in loss of connectivity between groundwater and surface water habitats and concurrent impacts to plant communities and surface flow of groundwater from springs and seeps. These effects are often not well understood and can vary considerably depending on local geology, the characteristics of groundwater development actions, and the nature of the groundwater resources being accessed.

The characteristics and extent of recreational activities vary tremendously across the spectrum of Nevada's wildlife habitats, dictated by factors such as access and proximity to urban development as well as the aesthetic appeal of individual habitat types to recreationists. Stresses include wildlife displacement, altered movements, decreased reproductive success, erosion, and direct habitat alteration and destruction. Recreational participants can act unknowingly as conduits for weed invasion. Motorized recreation, including off-highway vehicles, snowmobiles, watercraft, and other devices can result in noise disturbance to wildlife, thus affecting movements, behavior and reproductive success. Improperly operated, these vehicles can accelerate erosion, and accelerate the invasion of weeds. In particular, improper operation in sensitive areas at sensitive times of year (e.g., during the snowmelt season), or in desert washes, have potential to cause significant damage. Even non-motorized recreation, activities such as trail development, hiking, mountain biking, horse riding, cross-country skiing, rock-climbing, and spelunking, can cause habitat fragmentation and disturbance to wildlife. Although physical recreation development, for projects such as ski areas, snow parks, developed campgrounds and day-use areas, boat access, and organized event staging areas are likely not a large-scale source of stress across Nevada, these types of actions can cause localized disturbance from human activity and result in soil compaction and vegetation loss.

Wildland fire is a natural process, and plays an important role in the creation and maintenance of Nevada's terrestrial habitats and vegetative communities. Fire plays an important role in the restoration and management of those communities and habitats; however, fire management must be implemented with full consideration of all of its aspects and consequences. Improperly applied, fire suppression has altered natural ecological processes through the build-up of fuels; increased risk of catastrophic wildfire resulting in permanent loss of habitat values; accelerated conversion to alien plant communities; increased erosion and sedimentation; and increased fire frequency and spread of self-sustaining non-native communities. Further community-level effects can include the disruption of successional cycles; the unnatural maintenance of successional stages and vegetation structure and condition; and tree community encroachment into shrub and grasslands habitats. Improper fire restoration policy can compound the effects of fires and fire suppression, through exotic plant introductions from seed mixes, improper early grazing access to restored areas, and inadequate response to post-fire restoration needs, including "no action" after a fire. Finally, while the application of prescribed fire to maintain habitat health is appropriate and necessary in certain situations, this land management technique must be applied with irrefutable knowledge of the fire history of the habitat type, its response mechanisms and fire return interval.

Nevada's basin and range topography in concert with climatic fluctuation also contributes to the isolation of several species of mammals, including an impressive fragmentation of chipmunk species and subspecies, pikas, golden-mantled ground squirrels, yellow-bellied marmot, bushy-tailed woodrat, long-tailed vole, and western jumping mouse (Brussard, et al. 2004). These island populations were once connected during the Pleistocene (Grayson 1987), but are now reduced in size and many populations have become extinct. Brussard et al. states, "If extirpated, relict mammal populations that are isolated on montane islands probably could not re-colonize under current climatic conditions." These extirpations may also eliminate genetically unique populations (Grayson 1987).

Historic numbers and distribution of Nevada's 23 bat species are not known, but it is certain that the introduction of thousands of adits, shafts, and other subterranean mine workings during the historic mining era of the latter half of the 1800s significantly shifted bat distribution away from historic sites to these man-made cataracts. Today, Nevada's subterranean roosting bat species are heavily dependent on historic mine workings to support certain aspects of their life history needs. Nevada represents the northernmost extension of the range of several bat species with much more extensive Pan American ranges – including Allen's big-eared bat, big free-tailed bat, cave myotis, California leaf-nosed bat, and western mastiff bat.

Nevada's largest carnivore is the black bear, present in the thin margin of the Sierra Nevada occurring on the east shore of Lake Tahoe. Mountain lions were not particularly numerous in Nevada prior to the 1940s, but significant ingress into the state occurred concomitant with the mule deer population boom of that period. Today mountain lions occur throughout the state and are thriving. Other carnivores include coyote, kit fox, gray fox, and bobcat. The red fox is making serious incursions into previously unoccupied range in eastern Nevada with its distribution generally on the move from northeast to southwest, but very little is known about the status of the Sierra Nevada red fox, a California subspecies that may or may not exist on the Nevada side of Lake Tahoe. Mustelid carnivores include northern river otter, mink, long-tailed weasel, ermine, American badger, striped skunk, spotted skunk, and American marten. Of these, the American marten has experienced the most habitat loss and is now known only from isolated sites in the Sierra Nevada east of Lake Tahoe. Raccoons and ringtails round out Nevada's fairly rich carnivore community.

Mule deer were much less numerous in Nevada until the period between the 1920s and the 1950s, when federal land management agencies were created and a significant release from livestock grazing, mostly sheep, effected a massive montane shrub regeneration event resulting in a mule deer population boom (Wasley 2004). Today, after a second population peak event in the mid-1980s, mule deer have been on the decline as wildfire has significantly impacted winter ranges throughout the state, taking out native vegetation and facilitating the invasion of exotic grasses and weeds. Bighorn sheep have been returned to much of their pre-settlement range throughout Nevada with significant assistance from an NDOW-sportsmen's organization partnership that has implemented a highly successful transplant program since the 1980s, utilizing capture/relocation techniques supported by an aggressive water development program. Pronghorn are currently enjoying a population boom in positive response to changes in range condition that are shifting from overall shrub dominance to more grass/forb-dominated vegetative communities. Rocky Mountain elk are also currently expanding their range across the state in response to improved range conditions with more significant grass components.

Birds

About 467 species of birds have been recorded in Nevada. Of these, about 129 species occur irregularly in the state as accidentals or vagrants (i.e., birds that are well out of the recognized range of the rest of their species). Of the remaining 338 species, 241 are known to have a portion of their breeding population in the state (E. Ammon, Great Basin Bird Observatory, personal comm. 2005) and a small percentage of our total bird species are year-round residents of the state. The balance migrate through Nevada in spring or fall or use the state as their wintering area.

The 467 species on Nevada's checklist of birds represent 49 Families in 17 Orders; considerable diversity within the Class Aves for the driest state in the Union.

- Waterbirds are well represented here and include members of the Order Gaviformes (loons), Podicipediformes (grebes), Pelecaniformes (pelicans and cormorants), Ciconiiformes (herons, egrets) and Anseriformes (ducks and geese).
- Sixteen species of hawks and falcons of the Order Falconiformes regularly occur in the state.
- Representative of the Galliformes (grouse and quail) can be found almost everywhere in Nevada.
- Wading birds, shorebirds, gulls, and terns are well represented by Gruiformes and Charadriiformes, though the vast majority of the diversity in shorebirds occurs in the state during spring and fall migration.
- Columbiformes include the doves, which range from the Mojave Desert to the higher elevations of the numerous mountain ranges. One recent invader, the Eurasian Collared Dove, may be the newest bird species on Nevada's list. The Collared Dove began its incursion into the state in Clark County where it is now seen regularly. The species also appeared recently in Reno and Elko.
- The Cuculiformes include the (Western) Yellow-billed Cuckoo, a candidate for listing under the Endangered Species Act, which was probably once fairly well represented in the state, and the Greater Roadrunner, which remains fairly common in the Mojave Desert.
- Owls of the Order Strigiformes are broadly distributed across Nevada. The Great Horned Owl is probably the most common species in this Order.
- The Caprimulgiformes are also abroad at night, and these include the goatsuckers and nighthawks.
- In the Order Apodiformes, the hummingbirds are surprisingly diverse in Nevada. This order also includes swifts.
- The Belted Kingfisher, found state-wide along streams and rivers in the state, is the single representative of Coraciiformes.
- Piciformes (woodpeckers) are found in Joshua trees and riparian stringers in the Mojave Desert, to the montane forests of the state's higher elevations.
- Finally, the Order Passeriformes includes all of the songbirds, a huge Order. In this Order in Nevada there are numerous species of flycatchers, jays, vireos, swallows, wrens, thrushes, warblers, tanagers, towhees, sparrows, blackbirds, and finches.

No species of bird can be classified as endemic to Nevada–a native occurring here and nowhere else. One species–the Himalayan Snowcock, occurs only in the Ruby Mountains of Nevada and nowhere else in North America. However, that species was introduced from Asia and is managed as a game bird, and because it is not native to the state it is not considered an endemic.

Avifaunal diversity in Nevada is linked to a variety of factors, the most dominant of which is the state's geography. With 314 mountain ranges, an elevation range of 150 - 4,000 m (479 - 13,140 ft), 2 deserts, portions of 4 ecoregions, 7 major habitat types, and 27 "key habitats," the state offers considerable habitat diversity for birds. Other factors affecting bird diversity and linked to geography to varying degrees include precipitation patterns, continental bird migration patterns, and the dominant Basin and Range topography of the state.

With a few noteworthy exceptions, birds in Nevada tend to be distributed at low densities across the landscape. This distribution is probably a reflection of food resources, which likewise tend to be rather widely dispersed in the Great Basin and Mojave Deserts. The exception to this generality usually occurs in the few locations in the state where water also occurs in abundance. In high water years, places like the Lahontan Valley and Franklin Lake Wildlife Management Areas, can teem with remarkable numbers of waterbirds. Ruby Lake National Wildlife Refuge, which has a fairly reliable water supply, supports good numbers of birds almost throughout the year. A few locales across the state regularly support large numbers of colonial breeding birds. Pinyon Jays, a noisy, conspicuous, and gregarious bird, concentrate in large flocks where piñon pine nut crops are abundant and constitute an exception to the rule of water as the attraction for concentrations of birds.

The Great Basin Desert occupies much of Nevada and Utah, and extends into portions of Oregon, Idaho, Washington, Arizona, Colorado, and Wyoming. Basin and range topography is the dominant land form in the

Nevada and Utah portions of the desert, and a significant influence on the composition and distribution of the state's avifauna. Nevada's basins tend to be arid expanses of low desert shrub-dominated landscapes. Some basins hold winter run-off for short periods of time, offering valuable stop-over sites for waterbirds in spring migration. Fewer still are the basins that have permanent water sources, and these places offer habitat to birds in value that far exceeds the small extent of the watered lands.

These arid basins separate the north-south trending mountain ranges, which due to effects of elevation and aspect, tend to be better watered and support forests of piñon-juniper, pine, fir, spruce, oak, and aspen. For less motile species of mammals and reptiles, the basins constitute a significant barrier to movement and can lead to isolated populations and the rise of endemism. But for birds the basins may offer a deterrent to movement on a short term basis, although these landscapes are readily traversed during migration or after juvenile birds disperse from their nests.

Moving from the low-elevation basins to the ridge lines of adjacent mountain ranges it is possible to cross through eight elevationally defined vegetation zones. Each of these zones–Absolute Desert, Lower Mojavean, Blackbrush, Saltbush, Sagebrush, Pygmy Conifer, Montane, and Alpine–have their own characteristic suite of birds. Even the driest and apparently inhospitable landscapes have birds, at least during some portion of the year. Many species of desert birds are adapted to life without access to water. These species meet their water needs through their solid diets of seeds, insects, fruit, reptiles, or small mammals, and also through behavioral and physiological adaptations that help to conserve water.

The Mojave Desert intrudes into southern Nevada and brings with it a bird community that is distinctly different from the Great Basin Desert bird community. The Mojave Desert extends well south from southern Nevada into California and Arizona, and so the birds have a greater affinity with those landscapes than with the rest of Nevada. The Greater Roadrunner, Vermillion Flycatcher, Gambel's Quail, Inca Dove, Ladder-backed Woodpecker, and Verdin are a few of the species characteristic of this landscape. Likewise, species like Greater Sage-Grouse and Bobolink that typify parts of the Great Basin landscape are absent from the Mojave. The altitudinal influences on vegetation, and accordingly, bird communities, still holds true for the Mojave.

Two major cordilleras flank the Great Basin and also influence the bird communities. On the western edge of the Great Basin lies the Sierra Nevada Range. Because of their altitude, rainfall, and proximity to the markedly different climate of the Pacific coast states, the Sierras also have their own bird community. This community barely intrudes into Nevada, and the more arid climate of the state probably discourages significant eastward incursions of Sierran birds into the state. Nonetheless, the Sierra Nevada Ecoregion is the only place in the state where birds such as Mountain Quail, Red-breasted Sapsucker, White-headed Woodpecker, and Pygmy Nuthatch occur reliably. It is also the locale for even rarer incursions of species like the Pileated Woodpecker and the Great Grey Owl.

On the eastern flank of the Great Basin lie the Rocky Mountains. Positioned as they are in eastern Utah, their influence on Nevada's avifauna is moderated by distance. Nonetheless, species in eastern Nevada certainly show a greater affinity with this extensive mountain range. Species like Red Crossbill, Black Rosy-Finch, and the Greater Sandhill Crane are a part of the northeastern and east-central Nevada landscape, but have their population centers in the Rocky Mountain states.

Pacific Flyway

Nevada lies within the Pacific Flyway, the primary seasonal movement corridor for waterbirds migrating west of the Rocky Mountains. The majority of waterbird migration in this flyway takes place west of the Sierra Nevada, with another concentration of birds following the Rocky Mountains. However, some ducks, geese, shorebirds, and wading birds in this river of migration do cross Nevada.

This particular component of the great migration phenomenon adds significantly to the diversity of species in the state. Birds which breed thousands of miles away in the high arctic or in the bays and coves of the Pacific Coast stop each year at wetlands in Nevada. These migration stop-overs provide foraging and resting opportunities and critical fuel for the

extraordinary journeys required of migrants. Positioned as it is in the flyway, Nevada has significant responsibility for the maintenance of these populations.

Raptor and Passerine Migration

Migrating raptors rely on upwelling air currents generated by air rising up mountain slopes. Raptors save critical energy in migration by utilizing this rising air to gain altitude. With 314 mountain ranges, this orographic effect is widespread in the state. Most mountain ranges in Nevada probably support a raptor migration, although the migration appears to be diffuse across the landscape, in part because mountain ranges are so abundant. The one noteworthy exception to this diffuse pattern of movement is the Goshute Mountains. Here several mountain ranges converge from the north and concentrate raptor movements along the Goshutes, which act like the throat of a funnel. As many as 20,000 raptors of at least 13 species have been recorded passing over the Goshute Mountains by HawkWatch International (Smith and Vekasy 2001).

Little research has been conducted on migration of the Passeriformes through Nevada. Because the Great Basin is a hostile setting for most songbirds, migration through the Great Basin is probably weak, with most birds pursuing routes along the Sierra Nevada and Rocky Mountain ranges. Though the majority of birds probably circumvent our landscape, some passerines do cross Nevada. Springs, seeps, streams, and lakes, however few, are probably critical to sustaining these birds as they cross the desert. North-south trending valleys with surface water, such as Oasis Valley, Meadow Valley Wash, Pahranagat Valley, and the White River Valley probably concentrate migrating songbirds. The evidence for this phenomenon is strong in Oasis Valley (McIvor 2005), but poorly researched elsewhere.

Bird Species of Concern

Appendix C contains a list of Bird Species of Concern selected as the focus of the Nevada Comprehensive Wildlife Conservation Strategy. The list is divided into two sections. The first 64 birds comprise the first-tier species of concern identified as being of highest priority for informing management planning. The remaining 50 birds in the second portion of the list fall below a sub-heading titled "Stewardship Species." The list of species was prioritized by evaluating 10 ranking variables for each species.

The species populating Appendix C were identified through a series of ongoing conservation efforts and by soliciting the input of biologists working in Nevada's landscapes. Sources of bird species of concern include the Continental Partners in Flight conservation plan (Rich et al. 2004), the Nevada Partners in Flight conservation plan (Neel 1999), the North American Waterfowl Management Plan (2004), and the U.S. Shorebird Conservation Plan (Brown et al. 2001).

Reptiles

Currently, 54 reptile species are recognized in Nevada, consisting of 15 families and 39 genera. The Nevada Natural Heritage Program recognizes one additional species, the Mexican garter snake, based on a historical occurrence, however, it is presumed extinct. One lizard, the Mediterranean house gecko, and five turtles likely introduced as pets are introduced species, while the remaining 53 reptiles are native Nevada taxa.

Nevada's native reptiles can be categorized in three major groups: turtles (4 species), snakes (26 species), and lizards (24 species). Several species, including the desert horned lizard, western whiptail lizard, longnose leopard lizard, gopher snake and striped whipsnake are quite common, utilize a variety of habitats, and are found essentially throughout the entire state; while others have restricted habitat requirements or are found in small isolated populations in Nevada, such as the northern alligator lizard, Gilbert's skink, Sonoran mountain kingsnake, and the western diamondback rattlesnake.

Many of Nevada's native reptile species can be categorized as either Great Basin or Mojave Desert species. Typical Great Basin reptile species include the western rattlesnake, rubber boa, and the greater and pygmy short-horned lizards. The warmer year-round temperatures associated with the Mojave Desert provide habitat for a diversity of numerous heat-tolerant reptile species such as desert tortoise, chuckwalla, desert iguana, western banded gecko, southwestern black-headed snake, glossy snake, and the sidewinder rattlesnake.

The nature of Nevada's current reptilian fauna may

have been influenced by the historical climatology of the Basin and Range and Mojave Desert provinces dating back 14,000 years to the last Ice Age. During that time, cooler, wetter conditions prevailed, which shifted habitats down-slope. With the advent of our current epoch, the Holocene, the overall climatic trend for much of the current Nevada region is characterized by increasing temperature and decreasing precipitation, resulting in hotter, drier conditions, especially in the basins. As a result, once abundant forest ecosystems are retreating up-slope to cooler, wetter conditions. One result of this trend is a pattern of isolated forested mountain ranges. These changes left the valley bottoms to species better adapted to warmer, drier conditions, and other species, such as the Sonoran mountain kingsnake and northern alligator lizard, isolated in smaller populations, generally at higher elevations associated with wetter conditions. Nevada's interior Basin and Range topography also contributes to the isolation of some species.

Many of Nevada's reptile species possess unique and varied characteristics and habits. Several lizard species, including the chuckwalla and desert iguana, are chiefly herbivorous, while most other lizard species are omnivorous, and all snakes are carnivorous. Nevada is home to three horned lizard species. Of these, the greater and pygmy short-horned lizards which occur in the Great Basin and Columbia Plateau, are viviparous, or give birth to live young; while the desert horned lizard occurring in the Mojave Desert is

Mojave black collared lizard are all examples of diurnal species. The lyre snake, which occurs in the Mojave region, is unique in that it immobilizes its prey via venom directed along grooved teeth. Although venom is usually exclusively associated with rattlesnakes, in addition to the lyre snake, the banded Gila monster, one of only two venomous lizards in the world, also use this adaptation in their pursuit of food. Fortunately, only one Nevada reptile species, the desert tortoise, is currently on the federal List of Threatened and Endangered Species. This is due primarily to habitat loss and disease.

In addition, one subspecies of aquatic reptile, the Northwestern Pond Turtle is possibly native to Nevada. The origin of the pond turtles has not been definitively determined as genetic tests so far performed have not shown significant differences among the widely distributed populations (Washington State to Baja California). Although, records show that pond turtles were present in Nevada near the beginning of the 20th century, more sensitive testing is needed to gain a clear understanding of the genetic affiliation of the Nevada populations.

Overall, there is relatively little specific published literature pertaining to Nevada's native reptile species (with a few exceptions), and much work, including research and survey, is needed to fill in the knowledge gaps for many species.

Aquatics

A list of all known extant aquatic wildlife (fish, amphibians, mollusks, and crustaceans) is included in Appendix H. More detailed information by species for Species of Conservation Priority is included in the Species Accounts, and is included for all aquatic taxa in Appendices B through E.

Amphibians

Amphibians are typically found associated with other aquatic resources in Nevada and are considered important indicators of ecological health in areas where they would normally be expected to occur. Much like other aquatic-dependent biota, their distribution is sporadic in association with the distribution of water resources in this arid environment, and isolation of amphibian species and sub-populations has resulted in a high level of endemism and metapopulation uniqueness in proportion to the small number of amphibian species statewide. This metapopulation isolation and relative scarcity across the landscape also makes Nevada amphibian populations particularly susceptible to localized habitat alterations and short-term climatic changes such as extended drought. Their life history (an aquatic and a terrestrial phase) and very permeable skin also make them particularly susceptible to ecological changes. There are documented worldwide declines of amphibians, with the causes being as yet largely undetermined, but some of the hypothesized causes are increased UV radiation, environmental contaminants, introduced species, and disease.

Seventeen species of amphibians have been found in

the wild in Nevada. Of these, 16 are in the order Anura (7 frogs, 8 toads, and 1 spadefoot toad), and 1 species of the order Caudata (salamanders). One of the frog species, the Las Vegas Valley leopard frog is believed to be extinct, and another, the mountain yellow-legged frog, is thought to be extirpated from Nevada. The relict leopard frog was once believed to be extirpated from Nevada, but was rediscovered near Lake Mead in the 1990s. Two of the amphibian species found in Nevada are introduced – the tiger salamander and the bullfrog.

Relatively good amphibian distribution data is limited to a few species (Columbia spotted frog, Amargosa toad, and the relict leopard frog), derived largely from scientific collection permit reporting, which includes a significant amount of survey data from federal and state surveys, and university studies. Anecdotal information for some species, such as Pacific chorus frogs and western toads, indicates that their populations are relatively stable, but there is little official documentation. Other species, such as the northern leopard frog appear to be on the decline in some areas, but again, documentation is limited. Although worldwide amphibian population declines and extinctions are cause for concern, there is some evidence that detected declines in most Nevada species can be attributed largely to local identifiable factors such as short-term climate cycles and alterations to habitat quality and availability. However, the absence of good data, particularly for widespread and patchily distributed species such as the northern leopard frog and chorus frog, makes accurate determination of status and trend for many amphibians difficult at best, and limits the ability to develop and implement proactive conservation actions if required.

Fishes

More so than terrestrial wildlife species, the taxonomic diversity and distribution of Nevada's fishes are influenced by our state's geologic and hydrographic history (Hubbs and Miller 1948; Hubbs et al 1974). Throughout the Great Basin ecoregion, glacial and postglacial changes in climate and hydrology have alternately connected and isolated hydrologic systems and their associated biota, creating a globally unique endemic aquatic fauna surprising in its diversity and much at odds with current climatic conditions. Conversely significant parts of Nevada's land area fall within the larger Colorado River, Snake River, and Bonneville drainages, and support endemic fauna specifically representative of those systems, although frequently also with unique adaptations as a result of isolation from climatic and geologic change.

With settlement and development of Nevada, its endemic aquatic fauna has been augmented with a wide variety of introduced fish species, many from the Mississippi River drainage and associated systems. Dominating many of Nevada's lakes and reservoirs, introduced centrarchid fishes represent challenges for managing endemic species, but support diverse and important sport fisheries. Stream and river systems, particularly in central and northern Nevada, support primarily salmonid fisheries with both native and introduced trout species. Beginning in the early 20th century, aggressive introduction programs established nonnative trout species, including brook, brown and rainbow trout, in many stream and river systems statewide, and the majority of those waters still maintain important recreational fisheries to this day. More recent sport fish management efforts have focused on the conservation and expansion of remaining populations of endemic salmonids such as cutthroat, redband and bull trout, while maintaining sport fishing opportunities through the stocking of nonnative trout species in appropriate locations.

Although approximately 151 species or subspecies of fish have been found in the wild in Nevada, at least 37 of these are nuisance introductions of species that have no commercial or recreational value, or are incidental observations of nonnative species which may not persist in the wild as viable populations. Twenty species of nonnative game fishes, the majority of them occurring from intentional introductions, support a significant part of Nevada's recreational sport fisheries.

Nevada's endemic fish fauna consists of at least 87 described species and subspecies, although the precise number is hard to determine. Taxonomic and systematic description of this diverse resource is ongoing with a number of potential endemic fish subspecies still poorly defined. The heritage of Nevada's complex geological and hydrographic history is reflected in the systematic and genetic relationships within its native fishes.

Because of the isolated and biologically unique nature of many endemic fish populations, and alterations to

aquatic habitats which have occurred over time, a significant proportion of Nevada's endemic fish species are afforded protection under state statutes or the federal Endangered Species Act. Twenty-five Nevada fishes are listed under the ESA (19 as endangered and 6 as threatened), and an additional 21 species or subspecies are listed under Nevada Administrative Code (NAC) as sensitive or protected. These 46 species or subspecies represent 53 percent of Nevada's endemic fish biota as currently defined. Active conservation programs are in place for a majority of these fishes to varying degrees, ranging from a few formal federally sponsored recovery programs to cooperative working groups and conservation implementation processes under state and partnership leadership. In all cases, significant challenges exist to effective fish conservation, principally from introduced (intentionally and illegally) aquatic species and the difficulty of addressing and correcting alterations to the landscape and aquatic habitat systems which have occurred over the past 140 years.

In the context of the CWCS planning process, the 41 fish species or subspecies identified as Species of Conservation Priority in this plan largely parallel those already afforded some level of protection, although exceptions of inclusion or exclusion occur. This is logical given the process used and the need to evaluate the most current information available on species status and conservation needs, and the different time frame to be expected from the administrative processes required to provide or alter legal species protections. Other endemic fishes with lower conservation need rankings remain as important elements of Nevada's native biota and diversity, and active conservation is essential for all these species to ensure their persistence for future generations.

Aquatic mollusks

Bivalves

Freshwater mussels are among the most endangered organisms in North America. Some of the major threats nationally are siltation, pollution, impoundment (damming of rivers and streams), mining of river gravel, and loss of hosts. Before the advent of plastics, the interior of freshwater mussel shells were often used for making buttons. A widespread fishery in the eastern United States led to steep declines in populations.

Five species of true freshwater mussels (order Unionida) have been reported in Nevada and are assumed to be native. The majority are in the family Unionidae (California Floater, Oregon Floater, Winged Floater, Western Ridged Mussel). The Western Pearlshell belongs to the family Margaritiferidae. Freshwater mussels are found in various aquatic habitats, and have an interesting life history. Some are known to live over 100 years, and many have a unique mechanism for larval dispersal. Freshwater mussels need a fish or uncommonly, an amphibian host, during their early developmental stage. This behavior is unique among bivalve mollusks, and also links the health of their populations to that of their fish hosts. When appropriate hosts are lost from a system, freshwater mussels are unable to reproduce. The majority of NDOW's records (which are very few in number) are occurrences of the California Floater in the Humboldt River system. The Western Ridged Mussel has also been documented recently at a limited number of sites. Discussions with numerous field staff from NDOW, other agencies, and researchers indicate a much wider distribution of freshwater mussels in Nevada, but limited to the northern half of the state. Also, shells have been found at numerous locations, indicating at least historical presence. Since live freshwater mussels are imbedded in the substrate they are not casually detected unless there are mortalities.

Fingernail clams and pea clams, small bivalves usually only a millimeter or so in size, are not technically freshwater mussels. They belong to the order Veneroida, family Sphaeriidae, and are not dependent on a host. They appear to be widely distributed throughout the state, and hundreds of records are available for them, primarily through scientific collection activity reports supplied to NDOW.

No Nevada mollusks are either federally or state listed. However, the California floater is ranked in Nevada as critically imperiled by the Natural Heritage Program, and has been included on the list of Aquatic Species of Conservation Priority. Little is known about Nevada bivalves, especially historic and current distributions and population trends. Hosts have been identified for relatively few species of freshwater mussels. Genetics

of the California Floater and other western mussels are currently being studied to assess whether distinct populations occur. Some key questions regarding bivalve mollusks in Nevada are distribution, genetics, and host species.

Gastropods

Freshwater, gill-breathing mollusks occur throughout North America, primarily in springs. In Nevada, many species specialize in extreme habitats including springs with temperatures ranging from 3° C (37° F) to 44° C (111° F). More species of *Pyrgulopsis*, the largest genus of springsnails, occur in the Great Basin than anywhere else in the United States. Most springsnail populations are highly isolated because springs and seeps are widely dispersed and disconnected. Indeed, many species' entire range is in just one small spring. A number of springsnail populations are declining, almost faster than we can learn about them. Their aquatic habitats are rare and sensitive to drought and to the manner in which water resources are used.

Much remains to be learned about the diversity of Nevada's invertebrate populations, their distribution, conservation status, and special ecological functions. Over 100 species of freshwater snails have been documented in Nevada. One species of Pyrgulopsis was recently added to the federal candidate list (the Elongate mud meadows Pyrg – *Pyrgulopsis notidicola*) but none are currently afforded state protection. As scientists continue to monitor and survey populations, new species will likely be described and more will be learned about Nevada's exceptional gastropod diversity.

Crustaceans

There are approximately 30 identified crustacean species in Nevada, falling into three classes: Malacostraca (crayfish, amphipods, scuds, etc.), Ostracoda (ostracods), and Branchiopoda (fairy, clam, and tadpole shrimp). Most crayfish species found in Nevada have been introduced and exist outside their native range; these introduced crayfish are one of the major problems facing many of Nevada's Aquatic Species of Conservation Priority. Some of the main impacts of non-indigenous crayfish to warm water fauna include predation upon early life stages of fish and amphibians, and also on adult life stages of small-bodied fish (most of the ESA-listed fish in Nevada fall into this category). The emphasis is therefore to prevent the spread of non-native crayfish into areas where they do not yet exist, and control or eradicate introduced crayfish where they threaten other aquatic species that are at risk. Most of the crayfish introductions probably occurred through the release of live bait. Introduced crayfish can be very destructive to native aquatics through predation and/or competition. Actions have been identified in various conservation plans to reduce or eliminate introductions that have proved detrimental to important native aquatics. State regulations are in place to prevent spread of crayfish through release of live bait, and a public program should soon be in place targeting the release of pets.

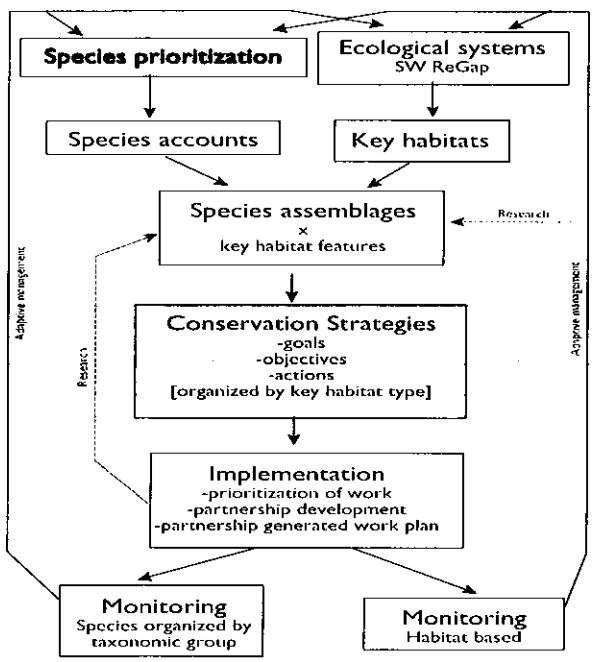
There is little documentation of Nevada's macroinvertebrate crustacea species, many of which are ephemeral pool specialists (e.g., fairy shrimp and tadpole shrimp). In order to survive the temporary, often harsh environments they inhabit, part of their life cycle includes an encysted egg that can survive long periods of desiccation and temperature extremes. These species are not included on the CWCS Species of Conservation Priority list because so little is known about them in Nevada.

Aquatic Insects

The Nevada Department of Agriculture has jurisdiction over insects. Their mission is to encourage the advancement and protection of agriculture and related industries for the benefit of Nevada citizens. Their focus, therefore, is on insects detrimental to agriculture. The Nevada Natural Heritage Program tracks sensitive species, including insects. Nevada's sensitive aquatic insects can be found in Appendix H. Further information can be found on NatureServe (www.NatureServe.org).

Identification of Species of Conservation Priority

The Species of Conservation Priority identification process for nongame terrestrial vertebrates (birds, mammals, and reptiles) began in July, 2002. After initially gathering input from partner land management agency personnel at the field level, a Species Priority Matrix (see Appendix A.) was developed using standard species conservation prioritization methodology (Natural Heritage Scorecard; Panjabi et al. 2001). A separate prioritization process was developed for fish, amphibians, and mollusks by the NDOW Fisheries Bureau in December, 2004, and the NDOW Game Bureau designed and executed the Game Animals prioritization process in early 2005. For a complete description of all the prioritization processes, their ranking criteria, and results, please refer to Appendix A, "Identification of Species of Conservation Priority."



Results

Birds

The species priority processes identified 72 bird species as Species of Conservation Priority, including four upland game birds and four hunted waterfowl species (Table 1.) Of the total, there are 25 species of water birds, eight birds of prey, and 39 other land birds. Two species, Yuma Clapper Rail and Southwestern Willow Flycatcher are listed as Endangered under the Federal Endangered Species Act, the Bald Eagle is federally listed as Threatened, and the Yellow-billed Cuckoo is federally listed as a Candidate Species and is also listed as a Sensitive Species in Nevada. Three species are listed as State Sensitive – Northern Goshawk, Loggerhead Shrike, and Brewer's Sparrow. The availability and productivity of water, wetlands and riparian areas loom large as influential in the prioritization of species in Nevada. Twenty-five priority species are associated with open water or wetlands, while another 20 land birds are predominantly associated with riparian habitats. Twelve priority species are primarily found in the Mojave Desert, which translates toward higher Area Responsibility for Nevada since it shares the Mojave Desert with only three other states. Six species are coniferous forest dwellers – a habitat type of restricted distribution in the state.

Stewardship Birds

In addition to the 72 bird Species of Conservation Priority, there are 44 species that are identified as priority species in one or more of the regional or continental bird conservation plans (see "Other Key Plans and Programs," p. 39) that did not "make the cut" in the Nevada ranking process. By recognizing these species in the CWCS, Nevada is acknowledging its stewardship responsibility for these species, but with an assumption that if we are successful in our conservation strategies for the 72 Species of Conservation Priority, we expect the Stewardship Species to be adequately provided for. Adaptive management and regular review of the comprehensive species list will allow us to adjust our approach for Stewardship Species that are found to be inadequately covered. An additional seven species ranked "above the cut" in the Species Priority Matrix, but were not listed as priority species in any of the supporting bird conservation plans, and upon further analysis, were not considered to be particularly acute to Nevada's conservation responsibility.

Mammals

Forty-two mammals were originally identified as Species of Conservation Priority by the Species Priority Matrix process, and three mammals were added by the Game Bureau Priority Matrix (Table 2.). Two species (pygmy rabbit and American marten) were identified in both processes. Stakeholder review resulted in the addition of 4 more species (long-eared myotis, hoary bat, desert kangaroo rat, and Wyoming ground squirrel), to bring the total priority mammals to 49.

Table 1. Nevada Species of Conservation Priority - Birds

Common Name	Scientific Name	Common Name	Scientific Name
Common Loon	*Gavia immer*	California Spotted Owl	*Strix occidentalis*
Eared Grebe	*Podiceps nigricollis*	Short-eared Owl	*Asio flammeus*
Western Grebe	*Aechmophorus occidentalis*	White-throated Swift	*Aeronautes saxatalis*
Clark's Grebe	*Aechmophorus clarkii*	Costa's Hummingbird	*Calypte costae*
American White Pelican	*Pelecanus erythrorhynchos*	Rufous Hummingbird	*Selasphorus rufus*
Western Least Bittern	*Ixobrychus exilis*	Lewis' Woodpecker	*Melanerpes lewis*
Snowy Egret	*Egretta thula*	Red-breasted Sapsucker	*Sphyrapicus ruber*
		White-headed	
White-faced Ibis	*Plegadis chihi*	Woodpecker	*Picoides albolarvatus*
Northern Pintail	*Anas acuta*	Olive-sided Flycatcher	*Contopus borealis*
			Empidonax traillii
Cinnamon Teal	*Anas cyanoptera*	Willow Flycatcher	*adastus*
		Mountain Willow	*Empidonax traillii*
Canvasback	*Aythya valiseneria*	Flycatcher	*brewsteri*
		Southwestern Willow	*Empidonax traillii*
Redhead	*Aythya americana*	Flycatcher	*extimus*
Bald Eagle (contiguous			
US pop)	*Haliaeetus leucocephalus*	Black Phoebe	*Sayornis nigricans*
Northern Goshawk	*Accipiter gentilis*	Loggerhead Shrike	*Lanius ludovicianus*
Swainson's Hawk	*Buteo swainsoni*	Arizona Bell's Vireo	*Vireo bellii arizonae*
Ferruginous Hawk	*Buteo regalis*	Gray Vireo	*Vireo vicinior*
			Gymnorhinus
Peregrine Falcon	*Falco peregrinus*	Pinyon Jay	*cyanocephalus*
Mountain Quail	*Oreortyx pictus*	Verdin	*Auriparus flaviceps*
Blue Grouse	*Dendragapus obscurus*	Bendire's Thrasher	*Toxostoma bendirei*
Columbian Sharp-tailed	*Tympanuchus phasianellus*		
Grouse	*columbianus*	Crissal Thrasher	*Toxostoma crissale*
Greater Sage-grouse	*Centrocercus urophasianus*	Le Conte's Thrasher	*Toxostoma lecontei*
Yuma Clapper Rail	*Rallus longirostris yumanensis*	Phainopepla	*Phainopepla nitens*

Greater Sandhill Crane	*Grus canadensis*	Virginia's Warbler	*Vermivora virginiae*
Western Snowy Plover	*Charadrius alexandrinus*	Lucy's Warbler	*Vermivora luciae*
Black-necked Stilt	*Himantopus mexicanus*	Hermit Warbler	*Dendroica occidentalis*
American Avocet	*Recurvirostra americana*	Grace's Warbler	*Dendroica graciae*
Willet	*Catoptrophorus semipalmatus*	Abert's Towhee	*Pipilo aberti*
Long-billed Curlew	*Numenius americanus*	Brewer's Sparrow	*Spizella breweri*
Least Sandpiper	*Calidris minutilla*	Black-chinned Sparrow	*Spizella atrogularis*
Long-billed Dowitcher	*Limnodromus scolopaceus*	Sage Sparrow	*Amphispiza belli*
Red-necked Phalarope	*Phalaropus lobatus*	Bobolink	*Dolichonyx oryzivorus*
Franklin's Gull	*Larus pipixcan*	Tricolored Blackbird	*Agelaius tricolor*
Forster's Tern	*Sterna forsteri*	Scott's Oriole	*Icterus parisorum*
Black Tern	*Chlidonias niger*	Gray-crowned Rosy-finch	*Leucosticte tephrocotis*
Western Yellow-billed Cuckoo	*Coccyzus americanus*	Black Rosy-finch	*Leucosticte atrata*
Western Burrowing Owl	*Athene cunicularia*	Cassin's Finch	*Carpodacus cassinii*

Table 2. Nevada Stewardship Bird Species

Common Name	Scientific Name	Common Name	Scientific Name
Great Blue Heron	*Ardea herodias*	Clark's Nutcracker	*Nucifraga columbiana*
Black-crowned Night-heron	*Nycticorax nycticorax*	Bank Swallow	*Riparia riparia*
Cooper's Hawk	*Accipiter cooperii*	Juniper Titmouse	*Baeolophus ridgwayi*
Prairie Falcon	*Falco mexicanus*	Cactus Wren	*Campylorhynchus brunneicapillus*
Black-bellied Plover	*Pluvialis squatarola*	Black-tailed Gnatcatcher	*Polioptila melanura*
Greater Yellowlegs	*Tringa melanoleuca*	Mountain Bluebird	*Sialia currucoides*
Spotted Sandpiper	*Tringa macularia*	Western Bluebird	*Sialia mexicana*
Marbled Godwit	*Limosa fedoa*	Swainson's Thrush	*Catharus ustulatus*
Western Sandpiper	*Calidris mauri*	Sage Thrasher	*Oreoscoptes montanus*
Dunlin	*Calidris alpina*	Orange-crowned Warbler	*Vermivora celata*
Bonaparte's Gull	*Larus philadelphia*	Nashville Warbler	*Vermivora ruficapilla*
California Gull	*Larus californicus*	Black-throated Gray Warbler	*Dendroica nigrescens*
Flammulated Owl	*Otus flammeolus*	Macgillivray's Warbler	*Oporornis tolmiei*
Northern Pygmy-owl	*Glaucidium californicum*	Wilson's Warbler	*Wilsonia pusilla*
Lesser Nighthawk	*Chordeiles acutipennis*	Yellow-breasted Chat	*Icteria virens*
Calliope Hummingbird	*Stellula calliope*	Summer Tanager	*Piranga rubra*
Broad-tailed Hummingbird	*Selasphorus platycercus*	Green-tailed Towhee	*Pipilo chlorurus*
Williamson's Sapsucker	*Sphyrapicus thyroideus*	Vesper Sparrow	*Pooecetes gramineus*
Red-naped Sapsucker	*Sphyrapicus nuchalis*	Black-throated Sparrow	*Amphispiza bilineata*
Three-toed Woodpecker	*Picoides tridactylus*	Grasshopper Sparrow	*Ammodramus savannarum*
Gray Flycatcher	*Empidonax wrightii*	Fox Sparrow	*Passerella iliaca*
Dusky Flycatcher	*Empidonax oberholseri*	Black-headed Grosbeak	*Pheucticus melanocephalus*
Ash-throated Flycatcher	*Myiarchus cinerascens*	Blue Grosbeak	*Guiraca caerulea*
Brown-crested Flycatcher	*Myiarchus tyrannulus*	Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*

Steller's Jay	*Cyanocitta stelleri*	Hooded Oriole	*Icterus cucullatus*
Western Scrub Jay	*Aphelocoma californica*		

Table 3. Nevada Species of Conservation Priority – Mammals

Species	Scientific Name	Species	Scientific Name
Merriam's shrew	*Sorex merriami*	San Antonio pocket gopher	*Thomomys bottae curtatus*
Trowbridge's shrew	*Sorex trowbridgii*	desert pocket mouse	*Chaetodipus pencillatus*
vagrant shrew	*Sorex vagrans*	Fletcher dark kangaroo mouse	*Microdipidops megacephalus albiventer*
montane shrew	*Sorex monticolus*	Desert Valley kangaroo mouse	*Microdipidops megacephalus nasutus*
Inyo shrew	*Sorex tenellus*	pale kangaroo mouse	*Microdipidops pallidus*
water shrew	*Sorex palustris*	California kangaroo rat	*Dipodomys californicus*
Preble's shrew	*Sorex preblei*	desert kangaroo rat	*Dipodomys deserti*
broad-footed mole	*Scapanus latimanus*	brush mouse	*Peromyscus boylei*
California leaf-nosed bat	*Macrotus californicus*	Ash Meadows montane vole	*Microtus montanus nevadensis*
little brown myotis	*Myotis lucifrugus*	Pahranagat Valley montane vole	*Microtus montanus fucosus*
fringed myotis	*Myotis thysanodes*	sagebrush vole	*Lemmiscus curtatus*
western small-footed myotis	*Myotis ciliolabrum*	Wyoming ground squirrel	*Spermophilus elegans nevadensis*
long-eared myotis	*Myotis evotis*	Allen's chipmunk	*Tamias senex*
cave myotis	*Myotis velifer*	Humboldt yellow-pine chipmunk	*Tamias amoenus celeris*
Allen's big-eared bat	*Idionycteris phyllotis*	Hidden Forest Uinta chipmunk	*Tamias umbrinus nevadensis*
western red bat	*Lasiurus blossevillii*	Palmer's chipmunk	*Tamias palmeri*
hoary bat	*Lasiurus cinereus*	northern flying squirrel	*Glaucomys sabrinus*
western yellow bat	*Lasiurus xanthinus*	western jumping mouse	*Zapus princeps*
spotted bat	*Euderma maculatum*	Sierra Nevada red fox	*Vulpes vulpes necator*
Townsend's big-eared bat	*Corynorhinus townsendii*	kit fox	*Vulpes macrotis*
big free-tailed bat	*Nyctinomops macrotis*	ringtail	*Bassaryscus astutus*
American pika	*Ochotona princeps*	American marten	*Martes americana*
pygmy rabbit	*Brachylagus idahoensis*	northwestern river otter	*Lontra canadensis*
mountain beaver	*Aplodontia rufa*	Mule Deer	*Odocoileus hemionus*
mountain pocket gopher	*Thomomys monticola*	Nelson Bighorn Sheep	*Ovis canadensis nelsoni*
Fish Spring pocket gopher	*Thomomys bottae abstrusus*	California Bighorn Sheep	*Ovis canadensis canadensis*

Sixteen priority mammal species have "protected" status in Nevada. Of those, eight species are further listedas "Sensitive", and one species (spotted bat) is further listed as "Threatened" under Nevada Administrative Code. Three species (Ash Meadows montane vole, Hidden Forest Uinta chipmunk, and Sierra Nevada red fox) may be extinct in Nevada. Thirteen of Nevada's 23 bat species made the priority list, reflecting a recent intensity of focus associated with the drafting of the Nevada Bat Conservation Plan. Seven species of shrews made the list because so little is known about their status and distribution in the state. Sixteen priority rodent species exist in Nevada in fragmented populations, and as such may require local conservation action to maintain them.

Reptiles

Eighteen reptiles were identified as priority species by the Species Priority Matrix process. Two more species, western diamondback rattlesnake and Panamint alligator lizard, were added during stakeholder review, bringing the priority reptile total to 20 (Table 3.). The desert tortoise is listed federally as Threatened under the Endangered Species Act. The banded Gila monster is protected in Nevada under NAC 503. Although its origin cannot be absolutely determined, the northwestern pond turtle may be Nevada's only native aquatic turtle, and it now only persists in small populations in the Truckee and Carson Rivers. The Sonoran mountain kingsnake occurs in what are thought to be very small fragmented populations in east-central Nevada. These populations appear not to be connected to the species' larger range in central Utah. Very little is known about the population dynamics of the rest of the priority reptiles, and this gives biologists pause when considering the ramifications of collection activities on species status and trend. Several species popular with collectors seem to exhibit patchy distribution on the landscape influenced by physiographic features such as rocks and boulders. Impacts of unmonitored collection in areas of localized intensity and their effects on the maintenance of local populations remains a concern although there has been no definitive data collected identifying any specific problems. Perhaps of greater concern is the rapid loss of habitat, particularly in the Mojave Desert where fifteen of the twenty priority reptiles occur.

Table 4. Nevada Species of Conservation Priority – Reptiles

Species	Scientific Name	Species	Scientific Name
northwestern pond turtle	*Clemmys marmorata*	desert night lizard	*Xantusia vigilis*
desert tortoise	*Gopherus agassizii*	long-tailed brush lizard	*Urosaurus graciosus*
western banded gecko	*Coleonyx variegatus*	Gilbert's skink	*Eumeces gilberti*
common chuckwalla	*Sauromalus obesus*	Sierra alligator lizard	*Elgaria coerulia shastensis*
desert iguana	*Dipsosaurus dorsalis*	Shasta alliagator lizard	*Elgaria coerulia palmeri*
Great Basin collared lizard	*Crotaphytus bicynctores*	Panamint alligator lizard	*Elgaria panamintina*
Long-nosed leopard lizard	*Gambelia wislezenii*	banded gila monster	*Heloderma suspectum cinctum*
desert horned lizard	*Phrynosoma platyrhinos*	Sonoran mountain kingsnake	*Lampropeltis pyromelana*
greater short-horned lizard	*Phrynosoma hernandesi*	Sonoran lyre snake	*Trimorphodon biscutatus*
pygmy short-horned lizard	*Phrynosoma douglasii*	western diamondback rattlesnake	*Crotalis atrox*

FishesSpecies of Conservation Priority

The species priority process identified 40 fish species/sub-species as Species of Conservation Priority (SCP), including 23 minnows and carp, 7 splitfins (springfishes and poolfishes), 5 suckers, 3 pupfishes and 2 salmonids. Of these, 32 (80%) are listed as Sensitive Species in Nevada; 25 (63%) are additionally listed as Endangered (19) or Threatened (6) under the Federal Endangered Species Act (ESA). More so than terrestrial wildlife species, the taxonomic diversity and distribution of Nevada's fishes are influenced by our state's geologic and hydrographic history (Hubbs and Miller 1948; Hubbs et al 1974). Throughout the Great Basin ecoregion, glacial and postglacial changes in climate and hydrology have alternately connected and isolated hydrologic systems and their associated biota, creating a globally unique endemic aquatic fauna surprising in its diversity. Of the 40 fish Species of Conservation Priority, 32 are endemic only to Nevada and another 6 have a critical role in species conservation though the species extends beyond Nevada. Most fish populations in Nevada are isolated geographically; 32 of the SCP fishes have disjunct or

fragmented habitat (no significant connectivity between multiple locations of occurrence or only one location) and another 3 have a fair degree of habitat fragmentation. It should be remembered that other endemic fishes with lower conservation need rankings are important elements of Nevada's native biota and diversity, and active conservation is essential for all these species to ensure their persistence for future generations. The following list contains only those fish species deemed of greatest conservation priority (Species of Conservation Priority); a complete list of fish species is found in Appendix H (Comprehensive Nevada Species List), and information about conservation actions for those with lower rankings can be found in the Implementation, Effectiveness Monitoring, and Adaptive Management Section, Aquatics Sub-section.

Table 5. Nevada Species of Conservation Priority – Fish

Common Name	*Scientific Name*
Ash Meadows Amargosa pupfish	*Cyprinodon nevadensis mionectes*
Ash Meadows speckled dace	*Rhinichthys osculus nevadensis*
Big Smokey Valley speckled dace	*Rhinichthys osculus lariversi*
Big Smokey Valley tui chub	*Gila bicolor ssp. (unnamed)*
Big Spring spinedace	*Lepidomeda mollispinis pratensis*
Bonytail	*Gila elegans*
Bull trout	*Salvelinus confluentus*
Clover Valley speckled dace	*Rhinichthys osculus oligoporus*
Cui-ui	*Chasmistes cujus*
Desert dace	*Eremichthys acros*
Devils Hole pupfish	*Cyprinodon diabolis*
Diamond Valley speckled dace	*Rhinichthys osculus ssp. (unnamed)*
Fish Lake Valley tui chub	*Gila bicolor ssp. (unnamed)*
Flannelmouth sucker	*Catostomus latipinnis*
Hiko White River springfish	*Crenichthys baileyi grandis*
Independence Valley speckled dace	*Rhinichthys osculus lethoporus*
Independence Valley tui chub	*Gila bicolor isolata*
Lahontan Cutthroat Trout - Quinn/Blackrock & Upper Humboldt DPS	*Oncorhynchus clarkii henshawi*
Lahontan Cutthroat Trout - Western DPS	*Oncorhynchus clarkii henshawi*
Moapa dace	*Moapa coriacea*
Moapa speckled dace	*Rhinichthys osculus moapae*
Moapa White River springfish	*Crenichthys baileyi moapae*
Monitor Valley speckled dace	*Rhinichthys osculus ssp. (unnamed)*
Moorman White River springfish	*Crenichthys baileyi thermophilus*
Oasis Valley speckled dace	*Rhinichthys osculus ssp. (unnamed)*
Pahranagat roundtail chub	*Gila robusta jordani*
Pahranagat speckled dace	*Rhinichthys osculus velifer*
Pahrump poolfish	*Empetrichthys latos latos*
Preston White River springfish	*Crenichthys baileyi albivallis*

Common Name	*Scientific Name*
Railroad Valley springfish	*Crenichthys nevadae*
Railroad Valley tui chub	*Gila bicolor ssp. (unnamed)*
Razorback sucker	*Xyrauchen texanus*
Virgin River chub	*Gila seminuda*
Virgin spinedace	*Lepidomeda mollispinis mollispinis*
Wall Canyon sucker	*Catostomus sp.*
Warm Springs pupfish	*Cyprinodon nevadensis pectoralis*
White River desert sucker	*Catostomus clarkii intermedius*
White River speckled dace	*Rhinichthys osculus ssp. (unnamed)*
White River spinedace	*Lepidomeda albivallis*
White River springfish	*Crenichthys baileyi baileyi*
Woundfin	*Plagopterus argentissimus*

Stewardship Fishes

As noted above, the majority of the species that fell into the aquatic species of greatest conservation priority are already federally listed. Some species with other legal protections and ongoing conservation efforts fell below the matrix cutoff, but were noted by reviewers as worthy of special attention. These species are noted as Stewardship Species. The conservation efforts already in place for these species needs to continue in order to maintain a lower conservation priority status than those on the SCP list.

Table 6. Nevada Stewardship Species – Fish

Common Name	*Scientific Name*
Bonneville Cutthroat Trout	*Oncorhynchus clarkii utah*
Fish Creek Springs tui chub	*Gila bicolor euchila*
Inland Columbia Basin Redband Trout	*Oncorhynchus mykiss gairdneri*
Meadow Valley speckled dace	*Rhinichthys osculus ssp. (unnamed)*
Meadow Valley Wash desert sucker	*Catostomus clarkii ssp. (unnamed)*
Newark Valley tui chub	*Gila bicolor newarkensis*
Relict dace	*Relictus solitarius*
Tui chub in Dixie Valley	*Gila bicolor ssp. (unnamed)*
Warner sucker	*Catostomus warnerensis*
Warner Valley Redband Trout	*Oncohrynchus mykiss pop 4*
Yellowstone Cutthroat Trout	*Oncorhynchus clarkii bouvieri*

Amphibians

Seven amphibian species were designated Species of Conservation Priority, 4 frogs and 3 toads. Of these, three are Candidates for federal ESA protection. The main factors are urban development, water diversions, and introduced species, especially bullfrogs. Habitat connectedness is especially important for amphibians since they need both aquatic habitats (at a minimum for breeding) and terrestrial habitats to complete their life cycle. Aquatic habitats are often in a state of flux (e.g. beaver dam complex successional processes) and

may disappear for a variety of reasons. In order for a population to survive, there must be the ability to move to a new site; habitat fragmentation prevents this necessary movement.

Table 7. Nevada Species of Conservation Priority – Amphibians

Common Name	*Scientific Name*
Amargosa Toad	*Bufo nelsoni*
Great Basin Columbia Spotted Frog - NE sub-population	*Rana luteiventris pop. 3*
Great Basin Columbia Spotted Frog - Toiyabe sub-population	*Rana luteiventris pop. 3*
Great Plains Toad	*Bufo cognatus*
Mountain Yellow-Legged Frog	*Rana muscosa*
Northern Leopard Frog	*Rana pipiens*
Relict Leopard Frog	*Rana onca*
Southwestern Toad (aka Arizona Toad)	*Bufo microscaphus*

Bivalves

There are two scientific orders of bivalves in Nevada, the Unionoida (freshwater mussels) and the Veneroida (fingernail clams). The latter do not need a host and appear to be relatively ubiquitous in Nevada. Only one species of freshwater mussels (the California floater) was selected as a SCP, although all the native freshwater mussel species in Nevada face the same threats, and others are even more sensitive to a decrease in water quality. An example is the Western Ridged Mussel, which has been extirpated elsewhere in its native range. Species of freshwater mussels that occur (or have occurred) in Nevada have been eliminated from portions of rivers and even entire watersheds in their western United States range through the combined effects of habitat loss, pollution, blockage of anadromous fish, and introduced species.

Nearly three-quarters of all 297 native freshwater mussel species in North America are imperiled and nearly 35 went extinct in the last century. They are one of the most endangered groups of animals on Earth, yet little is known about their life history, habitat needs, or even how to distinguish different species - especially in western North America. Their lifecycle is closely linked to fish species, so impacts to fish also impact these bivalves. Without adequate knowledge of their current and historic distributions, most of the Nevada bivalves remain unranked. Information about conservation actions for the 4 freshwater mussel species not listed as SCP (see Appendix H for a complete list) can be found in the Implementation, Effectiveness Monitoring, and Adaptive Management Section, Aquatics Sub-section.

Table 8. Nevada Species of Conservation Priority – Bivalves

Common Name	*Scientific Name*
California Floater	*Anodonta californiensis*

Gastropods

There are 74 gastropods (snails) on the list of Species of Conservation Priority, the vast majority of which are springsnails, and one of which, the Elongate mud meadows Pyrg – *Pyrgulopsis notidicola*) is an ESA Candidate species. None are currently on NDOW's protected list . Most springsnail populations are highly isolated because springs and seeps are widely dispersed and disconnected. Indeed, many species' entire range is in just one small spring. A number of springsnail populations are declining, almost faster than we can learn about them. Their aquatic habitats are rare and

sensitive to drought and to the manner in which water resources are used.

Table 9. Nevada Species of Conservation Priority – Gastropods

Common Name	*Scientific Name*
Hydrobe, Steptoe	*Eremopyrgus eganensis*
Juga, smooth	*Juga interioris*
Pebblesnail, Ash Meadows	*Pyrgulopsis erythropoma*
Pebblesnail, Moapa	*Pyrgulopsis avernalis*
Pebblesnail, Pahranagat	*Pyrgulopsis merriami*
Pebblesnail, Pyramid Lake	*Fluminicola dalli*
Pebblesnail, Turban	*Fluminicola turbiniformis*
Pebblesnail, Virginia Mountains	*Fluminicola virginicus*
Snail, Badwater	*Assiminea infima*
Springsnail, Antelope Valley	*Pyrgulopsis pellita*
Springsnail, bifid duct	*Pyrgulopsis peculiaris*
Springsnail, Big Warm Spring	*Pyrgulopsis papillata*
Springsnail, Butterfield	*Pyrgulopsis lata*
Springsnail, Camp Valley	*Pyrgulopsis montana*
Springsnail, carinate Duckwater	*Pyrgulopsis carinata*
Springsnail, Carlin	*Pyrgulopsis bryantwalkeri*
Springsnail, Corn Creek	*Pyrgulopsis fausta*
Springsnail, Crittenden	*Pyrgulopsis lentiglans*
Springsnail, Crystal Spring	*Pyrgulopsis crystalis*
Springsnail, distal-gland	*Pyrgulopsis nanus*
Springsnail, Dixie Valley	*Pyrgulopsis dixensis*
Springsnail, Duckwater	*Pyrgulopsis aloba*
Springsnail, Duckwater warm springs	*Pyrgulopsis villacampae*
Springsnail, Elko	*Pyrgulopsis leporina*
Springsnail, elongate Cain Spring	*Pyrgulopsis augustae*
Springsnail, elongate Mud Meadows	*Pyrgulopsis notidicola*
Springsnail, elongate-gland	*Pyrgulopsis isolata*
Springsnail, Emigrant	*Pyrgulopsis gracilis*
Springsnail, Fairbanks	*Pyrgulopsis fairbanksensis*
Springsnail, Fish Lake	*Pyrgulopsis ruinosa*
Springsnail, Flag	*Pyrgulopsis breviloba*
Springsnail, flat-topped Steptoe	*Pyrgulopsis planulata*

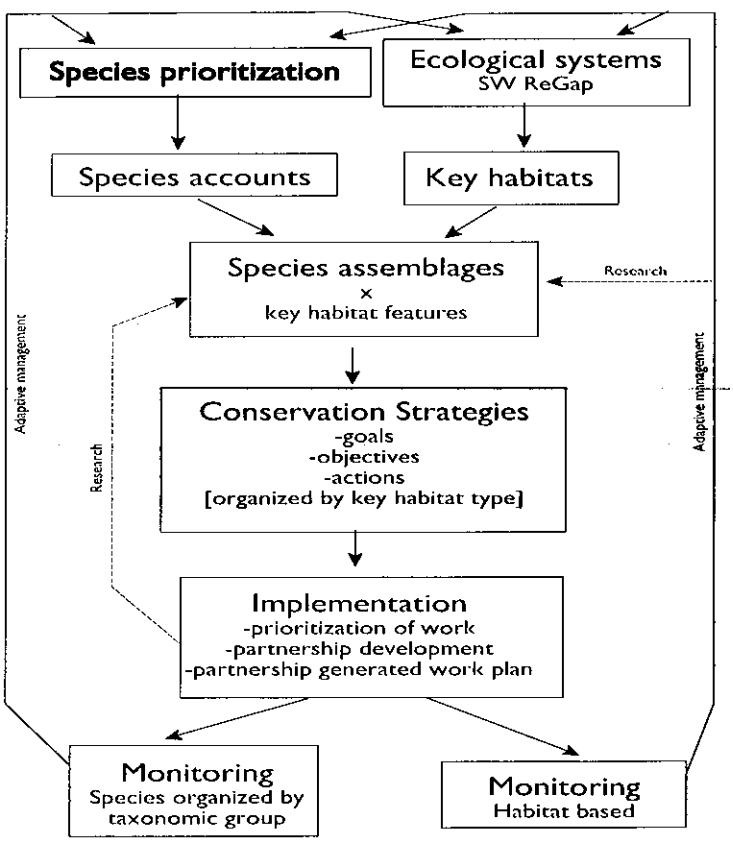
Common Name	*Scientific Name*
Springsnail, Fly Ranch	*Pyrgulopsis bruesi*
Springsnail, Hardy	*Pyrgulopsis marcida*
Springsnail, Hubbs	*Pyrgulopsis hubbsi*
Springsnail, Humboldt	*Pyrgulopsis humboldtensis*
Springsnail, Kings River	*Pyrgulopsis imperialis*
Springsnail, Lake Valley	*Pyrgulopsis sublata*
Springsnail, Landyes	*Pyrgulopsis landeyi*
Springsnail, large gland Carico	*Pyrgulopsis basiglans*
Springsnail, Lockes	*Pyrgulopsis lockensis*
Springsnail, longitudinal gland	*Pyrgulopsis anguina*
Springsnail, median-gland	*Pyrgulopsis pisteri*
Springsnail, Moapa Valley	*Pyrgulopsis carinifera*
Springsnail, neritiform Steptoe Ranch	*Pyrgulopsis neritella*
Springsnail, northern Soldier Meadow	*Pyrgulopsis militaris*
Springsnail, northern Steptoe	*Pyrgulopsis serrata*
Springsnail, northwest Bonneville	*Pyrgulopsis variegata*
Springsnail, Oasis Valley springsnail	*Pyrgulopsis micrococcus*
Springsnail, ovate Cain Spring	*Pyrgulopsis pictilis*
Springsnail, Pleasant Valley	*Pyrgulopsis aurata*
Springsnail, Sada's	*Pyrgulopsis sadai*
Springsnail, small gland Carico	*Pyrgulopsis bifurcata*
Springsnail, southeast Nevada	*Pyrgulopsis turbatrix*
Springsnail, southern Duckwater	*Pyrgulopsis anatina*
Springsnail, southern Soldier Meadow	*Pyrgulopsis umbilicata*
Springsnail, southern Steptoe	*Pyrgulopsis sulcata*
Springsnail, Spring Mountains	*Pyrgulopsis deaconi*
Springsnail, squat Mud Meadows	*Pyrgulopsis limaria*
Springsnail, sterile basin	*Pyrgulopsis sterilis*
Springsnail, sub-globose Steptoe Ranch	*Pyrgulopsis orbiculata*
Springsnail, transverse gland	*Pyrgulopsis cruciglans*
Springsnail, Twentyone Mile	*Pyrgulopsis millenaria*
Springsnail, upper Thousand Spring	*Pyrgulopsis hovinghi*
Springsnail, Vinyard's	*Pyrgulopsis vinyardi*
Springsnail, White River Valley	*Pyrgulopsis sathos*
Springsnail, Wong's	*Pyrgulopsis wongi*
Tryonia, Amargosa	*Tryonia variegata*

Common Name	*Scientific Name*
Tryonia, desert	*Tryonia porrecta*
Tryonia, grated	*Tryonia clathrata*
Tryonia, minute	*Tryonia ericae*
Tryonia, Monitor	*Tryonia monitorae*
Tryonia, Point of Rocks	*Tryonia elata*
Tryonia, sportinggoods	*Tryonia angulata*

Terrestrial mollusks and crustaceans, arachnids, and insects were not included in the species prioritization process for the initial round of planning. Nevada Department of Wildlife possesses statutory management responsibility for mammals, birds, reptiles, amphibians, fishes, mollusks and crustaceans. NDOW does not possess statutory management responsibility for other invertebrate families, including arachnids, and insects. Statutory management responsibility for the management of insects in Nevada belongs to the Nevada Department of Agriculture, but to date, there has been very little state focus on the conservation of rare insects beyond participation in management strategy development for endangered butterflies which as a result of their federal listing have become the primary responsibility of the U.S. Fish and Wildlife Service. The Nevada CWCS Development Team contacted its key conservation partners in the management of terrestrial invertebrates with the intent to construct conservation strategy, but the supporting biological information was not in a state of readiness sufficient to support moving forward before the CWCS deadline. The CWCS Team will convene an expert working group to construct conservation strategy as a priority task in the next phase of CWCS development and implementation. Key conservation partners will include the Biological Resources Research Center of the University of Nevada, Great Basin College, and the U.S. Fish and Wildlife Service.

Defining Nevada's Landscape for Wildlife

To develop the Nevada Comprehensive Wildlife Conservation Strategy, an ecological framework for strategy development was devised for initial analyses using ecoregions and modified Bailey's sections. Four ecoregions and 10 modified Bailey's sections overlap Nevada (Figure 5) (CPET 1999, Mayer et al. 1999, MDEPT 2001, Nachlinger et al. 2001). Modified Bailey's sections are divisions within an ecoregion that are defined by similarities of geomorphic process, surface geology, soils, drainage networks, and regional climate patterns.



Although there are several different ecoregional classifications in use in the United States, there is a great deal of overlap in all of the maps and scrutiny reveals more similarities than differences (Groves 2003). Ecoregional boundaries should not be taken too literally because there is typically a gradual transition from one major ecosystem type to another and only rarely are ecoregional boundaries represented by distinct edges. In addition, most ecoregions will contain patches of habitats that are more representative of adjacent ecoregions. We also recognize that ecological classification is not a panacea for all taxa or biological features for Nevada's CWCS. As the Nevada CWCS evolved, the complexity and often redundant nature of attempting to create a strategic plan using modified Bailey's sections as our units of planning became evident. Specifically, key habitat types for wildlife occur across multiple sections and

Key Habitat: Grasslands and Meadows

Ecoregions

Great Basin	179,867 hectares	444,452 acres
Columbia Plateau	133,982 hectares	331.069 acres
Mojave Desert	1,493 hectares	3,690 acres
Sierra Nevada	1,137 hectares	2,810 acres
Total	316,479 hectares	782,021 acres

Ecological Systems

S083 Southern Rocky Mountain Montane-Subalpine Grassland
S085 Rocky Mountain Subalpine Mesic Meadow
S090 Intermountain Basins Semi-Desert Grasslands
S134 North Pacific Montane Grassland

Key Habitat Description

This key habitat type encompasses a wide range of grassland types that are not necessarily similar to one another, except that they are distinguished from wet meadow types by either occurring on xeric sites or at least drying out some part of the year. These types range from riparian grasslands on the floodplains of the Humboldt River and its tributaries, to xeric grassy slopes and swales on the alluvial fans, to montane meadows dominated by grasses, and subalpine meadows dominated by forbs. Characteristic grass and forb species occurring in these habitats include Indian ricegrass, Great Basin wildrye, creeping wildrye, various bluegrasses, needle-and-thread, sand dropseed, Idaho fescue, western aster, western yarrow, tufted hair grass, and cinquefoil.

Value to Wildlife

Wildlife values of grassland and meadow habitats vary significantly among the different ecological systems bundled in this group, and they vary significantly among plant communities within a single ecological system. On the Humboldt River floodplain, for instance, irrigated hay meadow is important to many nesting birds, including Willet, Long-billed Curlew, and Cinnamon Teal. These sod-forming meadows also build up abundant rodent populations when dry, serving as important hunting grounds for hawks and owls. Great Basin wildrye, on the other hand, is fairly limited in species diversity (Rawlings and Neel 1989). The one Preble's shrew documented during NDOW's Humboldt River wildlife inventory (1986-88) was captured in Great Basin wildrye, however. Light shrub occurrence in these grassland systems will attract Loggerhead Shrikes and Sage Thrashers. Stands of ricegrass and needlegrass occurring within the cold desert scrub landscape can be quite important to kangaroo mice and kangaroo rats as a primary food source.

Montane meadows serve as critical brooding habitat for Greater Sage-Grouse within the sagebrush landscape, offering succulent forbs vital to the development of the chicks as well as brooding hens. When these meadows are allowed to build up residual grass materials (such as occurs within a rested pasture), population numbers of montane voles and other rodents will increase, in turn attracting Short-eared Owls that nest on the ground under grassy hummocks. Mule deer feed on the forbs in meadows. Several wildlife species are restricted to the grasslands and meadows of the Sierra Nevada, including Aplodontia, mountain pocket gopher, and broad-footed mole. Aplodontia reside in overgrown meadows with water running through them, where they have an opportunity to burrow into creek banks or under thick-matted vegetation. The pocket gopher and mole prefer soils loose enough to burrow in.

Key Elements of Grasslands and Meadows Habitat of Importance to Wildlife

Grass – foraging, nesting (ground-nesters)

Cinnamon Teal	**pale kangaroo mouse**
Long-billed Curlew	**dark kangaroo mouse**
Short-eared Owl	**California kangaroo rat**
Willet	**American pika**
Grasshopper Sparrow	**western jumping mouse**
Vesper Sparrow	

Forbs – foraging

Greater Sage-grouse	Broad-tailed Hummingbird
Rufous Hummingbird	Calliope Hummingbird

Shrubs – nesting structure, protection from predators, thermal cover

Loggerhead Shrike	Sage Thrasher
Green-tailed Towhee	

Loose soils – burrowing, denning

Burrowing Owl	**kit fox**
mountain pocket gopher	**long-nosed leaopard lizard**
San Antonio pocket gopher	**desert horned lizard**
Fish Spring pocket gopher	**greater short-horned lizard**
Merriam's ground squirrel	

Moist Soil – burrowing
broad-footed mole

Running water – burrowing in creek banks, foraging
mountain beaver

Generalists – using a variety of elements in multiple habitats

montane shrew	**vagrant shrew**
Preble's shrew	

Prey Populations – feeding on species in this habitat

Ferruginous Hawk	Prairie Falcon
Swainson's Hawk	

Existing Environment

Land Uses

Livestock grazing	Road development
Motorized recreation	Species Harvest
Minerals/oil/gas extraction	Wild horse/burro range
Utility rights-of-way	

Habitat Conditions

Habitat conditions vary greatly within this key habitat because the plant communities within it are so diverse in their occurrence and character. Most Great Basin wildrye stands, whether on uplands or river floodplains, are generally intact as this bunchgrass is relatively resistant to livestock grazing. Grassland types on river floodplains that are tended by irrigation are generally in good condition, but non-irrigated meadows that have been abandoned by the normal water table due to channel downcutting are less productive and vulnerable to shrub invasion (Rawlings and Neel 1989). Other upland grasslands are highly variable in occurrence and productivity and dependent on annual precipitation. Ricegrass, needlegrass, and dropseed stands can appear in profusion during wet years and nearly disappear at the same sites during drought years. Ricegrass stands in some areas of western Nevada have recovered in the last twenty years with rest from livestock grazing. Montane and subalpine meadows exist in a variety of conditions depending on management. Meadows in poor condition suffer from soil compaction, erosion, "pedestaling" of vegetation and soils, and lack of residual vegetation that provides critical cover to rodents and nesting birds. As "pedestaling" and erosion advance, water flow increases and accelerates over the meadow, leading to downcutting of the soil base and eventually leading to a significant lowering of the water table, that changes the character, productivity, and site potential of the meadow.

Problems Facing the Species and Habitats

Ungulate utilization of Grasslands and Meadows beyond a site's ability to recover results in a reduction of the necessary life history elements at that site, to species that rely predominantly on Grasslands and Meadows for sustenance. Changes in forb composition from palatable food species to less desirable species reduces meadow suitability for Greater sage-grouse brooding. Lack of residual cover reduces grassland/meadow site capability as nesting habitat. Lack of residual cover and reduction in seed production reduces site capability to support abundant, diverse rodent populations. Once removed during ore/commodity extraction activities, meadows are practically un-restorable without intense land contouring, restoration of hydrologic regime, and careful tending. Upland grasslands, on the other hand, are relatively successful in reclaiming mine tailings and recontoured mine lands.

Of species for which population trend information is available, Long-billed Curlews have declined 23 percent nationwide (Breeding Bird Survey 2005). Vesper Sparrows have declined 17 percent nationwide since 1966 (BBS). Concerns about declines in Greater Sage-Grouse populations throughout the West precipitated several listing petitions under the Endangered Species Act, and state-by-state collaborative planning was initiated to counteract the impacts listing of this species would have had.

Priority Research Needs

- Distribution and population status of Grasshopper Sparrow, western jumping mouse, California kangaroo rat, San Antonio pocket gopher, Fish Spring pocket gopher, and pygmy short-horned lizard in Nevada
- Comprehensive inventory of shrew species in Nevada
- Short-eared owl response to different meadow management strategies

Conservation Strategy

Goal: Thriving self sustaining wildlife populations in healthy plant communities maintained by natural hydrology and periodic fire events, at return intervals sufficient to preclude invasion by shrubs or conifers; prolific, diverse forb productivity; residual cover maintained to meet the life history needs of species dependent on this habitat type.

Objective: Maintain vigorous lowland riparian floodplain and basin floor grasslands in stable or increasing trend.

Action: Develop grassland/meadow wildlife objectives and best management practices; incorporate into NRCS Nevada WHIP Plan; in cooperation with NRCS, develop wildlife consultation services that provide quantified wildlife outputs for NRCS project proposals (WHIP, EQIP, Wetlands Reserve, Cultural Resources Preservation, etc).

Action: Incorporate grassland/meadow wildlife objectives and best management practices into BLM Resource Management Plans, Forest Service Forest Plans, National Wildlife Refuge Comprehensive Conservation Plans, and NDOW Wildlife Management Area Management Plans.

Action: When feasible opportunities arise, restore irrigation to desiccated floodplain grasslands through purchase and re-application of water rights to key sites with critical wildlife value.

Objective: Maintain vigorous upland grasslands in stable or increasing trend.

Action: Develop wildlife objectives and best management practices for upland grasslands; incorporate into land management planning processes (listed above).

Action: Inventory native upland grasslands and their soil site potentials; incorporate native grassland maintenance and restoration objectives to prescribed fire plans and fire rehabilitation plans.

Action: Support maintenance of wild horse and burro populations within Allotment Management Levels (AML).

Objective: Stabilize trend and improve overall statewide condition of montane/subalpine meadows in Nevada.

Action: Integrate appropriate wildlife objectives into progressive meadow grazing treatments to facilitate the mutual achievement of wildlife and livestock production objectives while retaining full annual recovery potential of meadow vegetation without significant shifts in plant composition or soil stability.

Action: Inventory meadows in need of restoration on public and private lands; prioritize restoration list to reflect contribution of site to local wildlife conservation priorities (Greater Sage-Grouse conservation; waterfowl, shorebird, or Sandhill Crane production; threatened, endangered, sensitive species ;) develop restoration projects for partnership funding and implement on a priority/opportunity basis.

Action: Develop wildlife objectives and best management practices for montane and subalpine meadows; incorporate into land management processes listed above.

Action: Develop montane/subalpine meadow wildlife objectives and best management practices; incorporate into NRCS Nevada WHIP Plan; in cooperation with NRCS, develop wildlife consultation services that provide quantified wildlife outputs for NRCS project proposals.

Action: Purchase lands from willing sellers or secure easements with willing landowners on critical meadow sites through partnerships and public funding.

Objective: Maintain thriving populations of Species of Conservation Priority in stable or increasing trend.

Action: Determine distribution and population status of Grasshopper Sparrow, western jumping mouse, California kangaroo rat, San Antonio pocket gopher, Fish Spring pocket gopher, and pygmy short-horned lizard in Nevada

Action: Design and conduct a comprehensive inventory of shrew species in Nevada.

Action: Incorporate Short-eared Owl life history needs into progressive meadow grazing strategies that allow build-up of residual cover for nesting and rodent production and expose rodent populations through forage utilization during post-fledging period.

Action: Adapt Partners In Flight (PIF) North American Land Bird Conservation Plan species objectives and targets for Grasslands and Meadows species to Nevada scale; determine habitat capability for achievement of PIF targets; implement habitat improvement projects designed to improve habitat capability for achievement of PIF population targets; measure project efficacy using bird population parameters.

Partnerships

Land owner/manager	Percent
Bureau of Land Management	44.5
Private	44.2
U.S. Forest Service	6.2
U.S. Fish and Wildlife Service	2.0
Tribal lands	1.9
Other	1.2

Existing partnerships, plans, and programs

- Governor's Sage Grouse Conservation Plan
- Rosachi Ranch restoration project
- Argenta Marsh restoration project

Federal Agencies

- Bureau of Land Management
- Natural Resources Conservation Service/Conservation Districts
- U.S. Forest Service
- U.S. Fish and Wildlife Service
- National Park Service
- U.S. Bureau of Reclamation

State Agencies

- Nevada Department of Wildlife
- Nevada Department of Agriculture
- Nevada Division of Forestry

Bird Initiatives

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

Conservation Organizations

- National Audubon Society/Lahontan Audubon Society
- The Nature Conservancy

- Sierra Club

Other Key Partners

- Intermountain West Joint Venture
- University of Nevada (UNR, UNLV, Cooperative Extension)
- Great Basin Bird Observatory
- Sportsman's Organizations

Preliminary Focal Areas

Humboldt River	Paradise Valley
Sheldon NWR	Little Humboldt River
Quinn River	Owyhee Desert
Montana Mountains	Walker River
O'Neil Basin	Bruneau River
Buffalo/Skedaddle	Toiyabe/Monitor/Toquima Ranges
Owhee River	Spring Valley
Salmon Falls Creek	Steptoe Valley
Goose Creek	Thousand Springs Creek

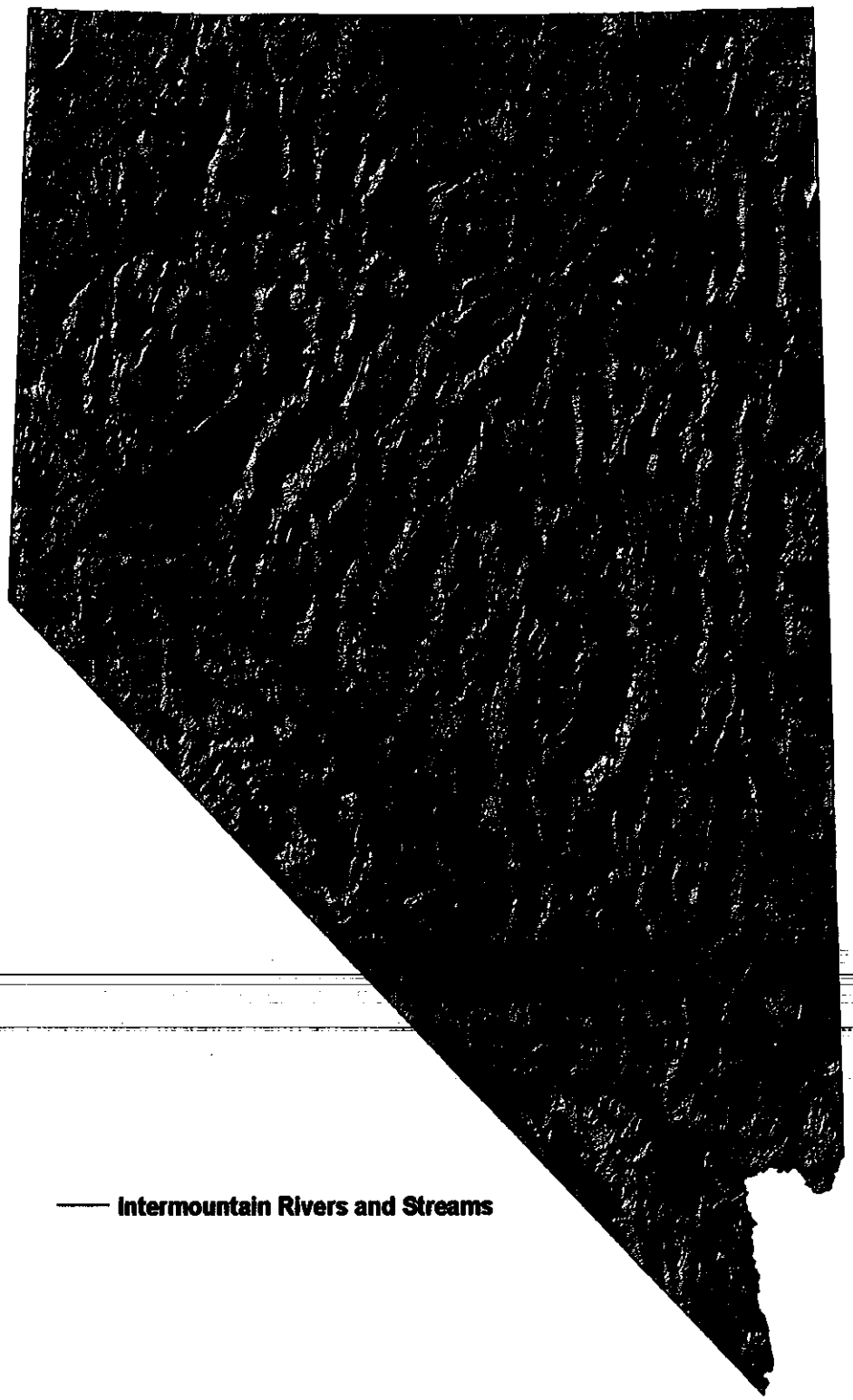


Figure 20. Distribution of Intermountain Rivers and Streams in Nevada (data source: USGS National Hydrography Dataset).

Key Habitat: Intermountain Rivers and Streams

Ecoregions

Great Basin	72,011 hectares	177,939 acres
Columbia Plateau	37,432 hectares	92,495 acres
Mojave Desert	1,141 hectares	2,820 acres
Total	110,584 hectares	273,254 acres

Ecological Systems

S091 Rocky Mountain Subalpine-Montane Riparian Shrubland
S092 Rocky Mountain Subalpine-Montane Riparian Woodland
S118 Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland
A002 Intermountain Streams
A003 Intermountain Rivers

Key Habitat Description

Riparian areas are most often associated with streams, lakes, springs, and wetlands, but may also occur on upland sites if conditions influenced by topography, elevation, and precipitation produce sufficient soil moisture to support the vegetation types. In montane riparian systems, the vegetation generally follows the saturation zone of a stream course, spring outflow, or catchment basin. Dominant tree and shrub species in these systems may include cottonwood, aspen, alder, birch, willow, wild rose, and red-osier dogwood. Mature plant heights can range from less than 2 m to 3 m (79 to 118 inches). Left undisturbed, deciduous riparian habitats attain a complex, multi-layered vertical structure with an intermittent to continuous overstory, a midstory that is often dense and impenetrable, and an understory rich in grasses and forbs.

Lowland riparian habitats are those associated with the floodplains of major river systems primarily occurring below 1,500 m (4920 ft) elevation in the northern two-thirds of the state. Lush habitat conditions supported by these lowland floodplains stand in stark contrast to the arid landscapes through which they course. With the exception of the Humboldt River, lowland riparian habitats are typically dominated by Fremont cottonwood. Several species of willow are found on river floodplains, including sandbar, arroyo, red, Goodding's and shining willow. Buffaloberry is present to varying degrees in all of the northern Nevada river systems. Many of these lowland systems have been invaded by tamarisk and Russian olive.

Meadows of grasses, sedges, and rushes predominate much of the floodplain of the Humboldt River and its tributaries, while occurring on shorter, more disjunct stretches of the other northern Nevada river floodplains. Creeping wildrye is one of the most important meadow grasses. Other plants that may occur within lowland floodplains include saltgrass, greasewood, sagebrush, and wildrye.

Floodplains of Intermountain riparian systems vary in width from a few hundred meters in the restricted canyons of the Truckee River to over 6 km (ca. 3.5 miles) in width in the Carson Valley near Minden, or on the Humboldt River near Battle Mountain. Riparian vegetation is distributed according to different plant species' affinity for water and the extent to which river flow is distributed across its floodplain. Mature plant heights can range from less than 2 m (79 inches) for greasewood to 30 m (98 ft) tall for Fremont cottonwood. Left to their own natural disturbance regimes, habitat structure in lowland riparian areas is substantively similar, though typically wider in extent than montane riparian systems. One expression of cottonwood overstory is called *gallery forest*, where the canopy closes and effectively shades out the midstory, creating a tall, high-canopy forest that can stretch across the floodplain for hundreds of meters.

Stream aquatic habitats within the Intermountain key habitat type vary considerably and can be subdivided into two core habitats assemblages -- montane and sub-montane aquatic habitats which support a species assemblage

dominated by native and introduced salmonids; and sub-montane and lowland aquatic habitats which support a variety of native and introduced fishes including, but generally not dominated by salmonid species.

For montane and sub-montane lotic systems which are dominated by salmonid species assemblages, streams and rivers should be narrow and deep with clear cold water with an average summer temperature of less than 22°C, a pool to riffle ratio of 1:1, with a high percentage of quality pools which are greater than average stream width and depth. When streams and rivers exhibit these qualities along with healthy riparian vegetation to provide cover and stabilize banks, fish densities reach their highest possible levels, provided that water flows remain adequate.

Sub-montane and lowland stream aquatic systems within the Intermountain Rivers and Streams Key Habitat type that support Species of Conservation Priority vary tremendously. Some of these stream systems represent primary order stream reaches within terminal drainage systems or disjunct segments of larger drainage systems isolated by naturally or artificially de-watered reaches, such as upper Meadow Valley Wash. Others are lower order segments of primarily spring fed discharge systems as in upper White River Valley. Again, the isolation and variable aquatic habitat characteristics of many of these stream systems have resulted in their support of unique aquatic species assemblages across the landscape.

Value to Wildlife

Estimates based on the National Wetlands Inventory indicate about 1.5 percent of Nevada's present surface area is vegetated wetlands or open water (E. Skudlarek, Nevada Natural Heritage Program, personal comm. 2004). Although extremely small in extent, riparian communities in this region are critical centers of wildlife diversity (Mac 1988). More than 75 percent of the species in Nevada are strongly associated with riparian vegetation (U.S. General Accounting Office 1993), including 80 percent of the birds (Dobkin 1998). Almost all of these systems provide surface water for wildlife at some point in the year, and some provide critical year-round water. Because of the presence of water either at or near the surface, riparian systems are the most productive habitats in the state. This includes production of seeds, fruits, insects, arthropods, reptiles, amphibians, and vegetation for wildlife food, and often abundant plant growth that provides nest and den sites, cavity sites, hiding cover, and thermal cover. Another critical function of riparian areas is to provide corridors for either long-distance migration (birds, bats) or short-distance wildlife movements (e.g., deer, bobcat). By facilitating such movements, riparian corridors connect populations and improve the genetic health of wildlife populations. Wetted backwaters along streams provide excellent habitat for amphibian species, provided that these areas receive adequate water during high flows in the spring.

Because of the relative scarcity of aquatic systems in Nevada's landscape, and the naturally disconnected and fragmented nature of these systems in an arid climate, individual lotic systems in this habitat type become critically important for aquatic species because of the unique species and species assemblages that they support. Nevada ranks sixth nationally in species endemism and third nationally in species at risk (NatureServe 2002); aquatic and aquatic dependent species represent a significant proportion of these biodiversity and risk indicators. In addition to priority Species of Conservation Priority, many of these aquatic habitat species assemblages also include multiple aquatic endemic species which are at a lower level of conservation priority.

Key Elements of Intermountain Rivers and Streams Habitat of Importance to Wildlife

Montane Riparian

Herbaceous Understory – foraging

Rufous Hummingbird	**Preble's Shrew**
Virginia's Warbler	**western jumping mouse**
Broad-tailed Hummingbird	**vagrant shrew**
Calliope Hummingbird	

Willow/Shrub Midstory – nesting structure, foraging, protection from predators, thermal cover

Mountain Quail
Mountain Willow Flycatcher (*brewsteri*)
Willow Flycatcher (*adastus*)
Black-headed Grosbeak
Dusky Flycatcher
Fox Sparrow
Green-tailed Towhee
MacGillivray's Warbler
Wilson's Warbler
Yellow-breasted Chat
Inyo shrew
Montane shrew
Brush mouse

Mature Overstory – nesting structure (large stems), foraging, roosting, protection from predators

Cassin's Finch
Northern Goshawk
Swainson's Hawk
Cooper's Hawk
Northern Pygmy-owl
Orange-crowned Warbler
Red-breasted Sapsucker
Red-naped Sapsucker
Swainson's Thrush

Disturbance – fire creates suitable conditions for foraging (increased insects) and nesting (substrate for cavity excavation)

Lewis's Woodpecker

Canyon/Rocks – foraging, protection from predators, thermal cover

Sonoran mountain kingsnake
ringtail

Channel – species tied to water in the channel for some or all of their life history (e.g., foraging versus spending entire life in the water)

water shrew

Lowland Riparian

Mature Overstory – nesting structure (large stems), foraging, roosting, protection from predators

Bald Eagle
Swainson's Hawk
Snowy Egret
Cooper's Hawk
Great Blue Heron
Red-naped Sapsucker
Western Bluebird
Western Yellow-billed Cuckoo

Willow/Shrub Midstory – nesting structure, foraging, protection from predators, thermal cover

Willow Flycatcher (adastus)
Ash-throated Flycatcher
Black Phoebe
Black-headed Grosbeak
Blue Grosbeak
Yellow-breasted Chat

Meadow – foraging, burrowing

Burrowing Owl	**San Antonio pocket gopher**
Fish Springs pocket gopher	**Preble's shrew**

Channel – species tied to water in the channel for some or all of their life history (e.g., foraging versus spending entire life in the water)

Snowy Egret	**northwestern pond turtle**
Bank Swallow	**water shrew**
Great Blue Heron	**northern river otter**
Spotted Sandpiper	

Aquatic Systems

Sub-montane and Lowland Stream Aquatic Systems – physiographic grouping of aquatic species

cui-ui	**Railroad Valley tui chub**
Lahontan cutthroat trout	**California floater**
northern leopard frog	**Wall Canyon sucker**
Independence Valley speckled dace	**Warner sucker**
Independence Valley tui chub	**White River desert sucker**
Big Spring spinedace	

Montane and Sub-montane Salmonid Stream Systems – physiographic grouping of aquatic species

bull trout	Inland Columbia Basin redband trout
Lahontan cutthroat trout	Warner Valley redband trout
White River speckled dace	Yellowstone cutthroat trout
White River spinedace	**northern leopard frog**
Bonneville cutthroat trout	**Columbia spotted frog**

Existing Environment

Land Uses

Agriculture	Motorized recreation
Livestock grazing	Non-motorized recreation
Hydroelectric power production	Recreation development
Irrigation diversion	Urban/suburban development
Flood control	Road development
Groundwater development	Species harvest

Habitat Conditions

Riparian systems in Nevada are extremely important to both humans and wildlife, and the myriad demands placed on these systems have often meant an increase in value for one user at the expense of another. Every riparian

system in the state has been altered in some fashion from its condition at the time of Euro-American settlement. Alterations have not always manifested themselves in a manner that has led to declines in wildlife habitat quality or quantity, but it would be impossible to go anywhere in the state and identify a site in its natural condition. Certainly some riparian systems have been lost entirely or altered so dramatically that they no longer offer the range of habitat opportunities that they would offer if they were unmanipulated or perhaps better managed. To date no work has been done to clearly define how much of its riparian areas the state has lost. Given that California has lost about 95 percent of its wetlands (a broader category that includes riparian areas), and Utah about 90 percent, Nevada probably deviates little from this pattern.

Riparian systems in Nevada evolved in the presence of dynamic annual water cycles. Riparian sites are typically adapted to spring flooding driven by snow melt, followed by a gradual decline in surface flows. In lowland riparian systems, the river channels themselves were dynamic, shifting with floods to abandon old channels and create new waterways, all the while leaving behind regenerating forests while older habitats gave way to scouring water. Dams to control floods and regulate the distribution of water have forever altered this natural process, while groundwater pumping has also affected surface flows in some areas.

Riparian areas have also been affected by concentrated grazing, cutting for timber and firewood, residential development, river channelization, diversion, industrialization, log drives, wildfire suppression, trapping (principally beaver), exotic species (both plants and animals), unregulated recreation (both motorized and non-motorized), road building, mining, pollution, farming, channel dredging, bank armoring, and construction of dams and levees.

Invasive plants may be one of the greatest agents of change in these systems. Tamarisk is an exotic riparian tree that has invaded all of Nevada's river systems to varying degrees. Another aggressive exotic invader present on Nevada's rivers is Russian olive. These exotics have replaced the native midstory on many stretches of Nevada's rivers. Tamarisk has made considerable inroads in the Humboldt system and dominates the extensive delta of the Walker River. Russian olive is particularly prevalent on the Carson River below Dayton. Tall whitetop is another noxious weed invading riparian areas in northern Nevada. The highly invasive nature of both tamarisk and tall whitetop gives them the ability to convert entire landscapes into undesirable monotypes.

All aquatic habitat systems in Intermountain rivers and streams have been altered or modified to some degree from historic conditions, through actions such as channelization, construction of dams and diversions, regulation of flows or diversion of flows for agriculture, recreational and urban development and the introduction of nonnative aquatic species. The level of this alteration ranges from severe, on the lower Truckee River where river flows are highly regulated and substantially diverted for agriculture (at times leaving the Truckee River completely dry), to relatively minor in some montane stream drainage systems. Although many montane or sub-montane stream systems are relatively free flowing within terminal or connected basin systems, a substantial number of these systems are impacted by existing land use practices such as inappropriate livestock grazing. The construction of impoundments and reservoirs has affected some stream systems such as upper Meadow Valley Wash, where impoundment for recreation has altered seasonal flows and natural geomorphic process by complete capture of surface flows in most years, leaving downstream stream reaches dependent on spring and groundwater flow for maintenance of aquatic habitats. Extensive alteration of natural channels and diversion of flows for irrigation has resulted in fragmentation and isolation of stream habitats in the Upper White River Valley.

Problems Facing the Species and Habitats

Many of the sources of stress identified above under Habitat Conditions continue to exert pressure on riparian habitats in Nevada. As a result, riparian habitats continue to face permanent or temporary loss or modification of habitat integrity. For wildlife, this means reduced vegetation composition, structure, and cover resulting in loss of nesting cover, escape cover, and food sources. Dams and diversions continue to modify hydrologic regimes, interrupting natural flow dynamics that result in modified channel and floodplain processes, and creating barriers to fish movement and migration which fragment aquatic habitats. Pumping of surface waters and connected

aquifers alters groundwater flow and recharge patterns. Recreation, development, and grazing create disturbance to wildlife (including movements/displacement, behavior, reproductive success) and encourage habitat fragmentation. Erosion is also hastened by recreational activities, invasive plants, poorly functioning hydrological regimes, grazing, and development. Invasive plants are in places converting landscapes to monocultures of single plant types that offer far fewer habitat values for wildlife than native communities. Improper placement of roads has also led to erosion, siltation, disturbance to wildlife, and habitat fragmentation.

Priority Research Needs

- Habitat restoration needs and approaches for species of conservation priority
- Effective methods for control and eradication of invasive species, including plants, aquatic plants, and aquatic animals.
- Methods of management of riparian systems to mimic natural cycles addressing the life history needs of riparian and aquatic wildlife
- Information on wildlife/habitat relationships correlated to riparian habitat successional stages
- Distribution, population demography, and genetic analysis of willow flycatcher subspecies (*adastus, brewsteri*)
- Distribution and population demography for western jumping mouse and western red bat.
- Status, distribution, and habitat use of Western Yellow-billed Cuckoo on the Carson River
- Comprehensive species investigation for Sonoran Mountain kingsnake, including distribution, genetic analysis, and population viability analysis.
- Delineate occurrence, distribution, genetic analysis, and population viability analysis for San Antonio pocket gopher and Fish Spring pocket gopher.
- Identify and survey potential northern leopard frog sites to better determine current distribution.

Conservation Strategy

Goal: Healthy, self-sustaining wildlife populations in diverse native plant communities free of non-native, invasive species on floodplains hydrologically connected to associated channels; thriving mature cottonwood or aspen overstory with healthy prospect of regeneration on appropriate sites; willow/tall woody shrub mid-story under cottonwood/aspen or overstory where those species are absent; thriving herbaceous understory and meadows.

Objective: Increase total hectares of fully functioning lowland riparian and linear kilometers of montane riparian terrestrial habitat on Intermountain Rivers and Streams by 2015.

Action: Define and describe fully-functioning riparian terrestrial wildlife habitats beyond Proper Functioning Condition; integrate CWCS Species of Conservation Priority riparian habitat objectives and actions into pertinent land use plans.

Action: Develop riparian wildlife objectives and best management practices; incorporate into NRCS Nevada WHIP Plan; in cooperation with NRCS, develop wildlife consultation services that provide quantified wildlife outputs for NRCS project proposals (WHIP, EQIP, Wetlands Reserve Program, Cultural Resources Preservation, etc).

Action: Restore fully-functioning riparian terrestrial wildlife habitats through progressive livestock grazing strategy design, riparian fencing, restoration of hydrologic function through channel modification and water table raising techniques, and planting of riparian vegetation.

Action: Restore riparian plant communities invaded by tamarisk, whitetop, and other non-native plants through aggressive removal of invasives and active restoration of native vegetation.

Objective: Maintain healthy populations of terrestrial Species of Conservation Priority at stable or increasing trend.

Action: Adapt PIF species objectives and targets for Intermountain Rivers and Streams species to Nevada scale; determine habitat capability for achievement of PIF targets; implement habitat improvement projects designed to improve habitat capability for achievement of PIF population targets; measure project efficacy using bird population parameters.

Action: Conduct a comprehensive species investigation for Sonoran Mountain kingsnake, including distribution, genetic analysis, and population viability analysis.

Action: Delineate distribution and population demography for the *brewsteri* and *adastus* subspecies of Willow Flycatcher.

Action: Delineate distribution and population demography for western jumping mouse and western red bat.

Action: Delineate occurrence, distribution, genetic analysis, and population viability analysis for San Antonio pocket gopher and Fish Spring pocket gopher.

Action: Periodically monitor population status of Yellow-billed Cuckoo in the Carson River between Weeks Bridge and Lahontan Reservoir.

Goal: Fully functioning aquatic habitat ecosystems which support diverse natural species assemblages; maintenance of natural geomorphic stream channel functions with dynamic interaction of riparian and aquatic habitats within constraints of human need and existing infrastructure development; reduced impacts on aquatic habitats from invasive plant and animal species.

Objective: Increase total linear kilometers of fully functioning riparian aquatic habitat on Intermountain rivers and streams by 2015

Action: Work cooperatively with land management partners to implement strategies to improve stream system functions exceeding BLM PFC standards, where appropriate achieving riparian community associations at PNC.

Action: Develop new and implement existing strategies to address and eliminate potential movement barriers to reconnect fragmented stream habitat complexes.

Objective: Maintain healthy populations of aquatic Species of Conservation Priority at stable or increasing trend

Action: Develop new and implement private landowner cooperative agreements and programmatic Safe Harbor Agreements and similar programs to restore or maintain aquatic habitats for Lahontan cutthroat trout and other priority aquatic species.

Action: Continue implementation of recovery implementation planning for upper White River Valley native fishes including action items identified through the cooperative RIT process.

Action: Implement cooperative conservation strategies for Columbia spotted frog in the Toiyabe Range and Northeastern Nevada as identified in the Columbia Spotted Frog Conservation Agreements and Strategies.

Action: Develop new and implement existing strategies to address and eliminate potential movement barriers to reconnect fragmented stream habitat complexes.

Action: Support actions by land management partners and local governments to control invasive and noxious plants and weeds, especially tamarisk and emergent plant species which directly impact functioning of lotic aquatic habitats

Action: Actively pursue strategies for prevention of introduction of nuisance aquatic plant and animal species, including educational campaigns targeted at pet stores, water gardens, classrooms, researchers, biologists, etc.

Action: Identify priority conservation actions and develop a recovery implementation process for Independence Valley tui chub and Independence Valley and Clover Valley speckled dace.

Action: Continue implementation of recovery processes for Big Spring spinedace including action items identified in the species recovery implementation plan.

Action: Implement management and conservation actions for Railroad Valley tui chub and other isolated tui chub subspecies as identified in the species management plan.

Action: Continue implementation of recovery processes for Lahontan cutthroat trout, including action items identified in the species recovery implementation plans and species management plans.

Action: Continue implementation of conservation team processes for Bonneville and Yellowstone cutthroat trout and the Redband rainbow trout including action items identified in the species conservation and species management plans.

Action: Continue implementation of conservation team processes for Wall Canyon sucker, including action items identified in the draft species management plans.

Action: Establish a conservation team for the northern leopard frog to identify priority conservation actions and implement them.

Action: Identify and survey potential northern leopard frog, Columbia spotted frog, and mountain yellow-legged frog sites to better determine current distribution.

Action: Continue implementation of recovery processes for Lahontan cutthroat trout, including action items identified in the species recovery implementation plans.

Action: Implement actions identified in all aquatic conservation plans and/or by conservation teams.

Action: Establish a northern leopard frog working group to set and implement goals, objectives, and strategies.

Partnerships

Land owner/manager	Percent
Private	56.7
Bureau of Land Management	18.6
U.S. Forest Service	18.6
Tribal	3.8
Other	2.3

Existing partnerships, plans, and programs

Species Teams, Recovery Plans, and Conservation Agreements

- Lahontan Cutthroat Trout Recovery Teams
- Nevada Bonneville Cutthroat Trout Conservation Team.
- Yellowstone Cutthroat Trout Interstate Work Group
- Soldier Meadows Working Group
- Columbia Spotted Frog Technical Teams
- Wall Canyon sucker conservation team

- White River Recovery Implementation Team
- Railroad Valley Recovery Implementation Team
- Big Spring Spinedace Recovery Implementation Team
- Draft Bull Trout Recovery Plan
- Bull Trout SMP
- LCT SMP for the Quinn River/Black Rock Basins and North Fork Little Humboldt River Sub-Basin
- LCT SMP for the Upper Humboldt River Drainage Basin
- Cui-ui Recovery Plan
- Draft Recovery Plan for the Endangered Speckled Dace of Clover and Independence Valleys
- Recovery Plan for the Rare Species of Soldier Meadows
- Big Spring Spinedace Recovery Plan
- Railroad Valley Springfish Recovery Plan
- Draft Recovery Plan for the Relict Leopard Frog
- Northeast Nevada Columbia Spotted Frog Conservation Agreement and Strategy
- Toiyabe Columbia Spotted Frog Conservation Agreement and Strategy

Partner-based Restoration Projects

- Lower Truckee River Restoration Advisory Committee
- McCarran Ranch – Truckee River
- River Fork Ranch – Carson River
- Silver Saddle Ranch – Carson River
- Rosachi Ranch – Walker River
- Columbia Spotted Frog Habitat Enhancement - Reese River
- Truckee River Flood Control Project
- Carson River CRMP

Federal Agencies

- U.S. Forest Service
- U.S. Fish and Wildlife Service
- Natural Resources Conservation Service/Conservation Districts
- Bureau of Land Management
- National Park Service
- U.S. Geological Survey
- U.S. Army Corps of Engineers
- Bureau of Reclamation

State Agencies

- Nevada Department of Wildlife
- Nevada Division of Forestry
- Nevada Natural Heritage Program
- Nevada Department of Agriculture

Conservation Organizations

- The Nature Conservancy
- Lahontan Audubon Society
- Trout Unlimited
- Sierra Club

Bird Conservation Initiatives

- Partners In Flight North American Land Bird Conservation Plan
- Nevada Partners In Flight
- U.S. Shorebird Conservation Plan
- North American Waterbird Conservation Plan

Other Key Partners

- Counties
- Intermountain West Joint Venture
- Great Basin Bird Observatory
- Great Basin Land and Water

Preliminary Focal Areas

Truckee River
Carson River
Walker River
Humboldt River and tributaries
Jarbidge River and tributaries
White River Valley
Quinn River
Railroad Valley/Duckwater
Montana Mountains
Owyhee River and tributaries
Bruneau River and tributaries
Bonneville Drainage (western portion)
Ruby Mountains
East Humboldt Range
Independence Mountains
Wall Canyon
Summit Lake/Mahogany Creek
Pyramid Lake
Salmon Falls Creek and tributaries
Santa Rosa Mountains
Meadow Valley Wash
Condor Canyon
Goose Creek

Key Habitat: Wet Meadows

Ecoregions

Columbia Plateau	735.3 hectares	1,816.9 acres
Sierra Nevada	340.3 hectares	841.1 acres
Mojave Desert	237.0 hectares	585.5 acres
Great Basin	160.9 hectares	397.6 acres
Total	1473.5 hectares	3,641.1acres

Ecological Systems

S103 Temperate Pacific Montane Wet Meadow
S105 Mediterranean California Subalpine-Montane Fen
S102 Rocky Mountain Alpine-Montane Wet Meadow
A010 Great Basin Sub-Montane Wetland and Wet Meadow
A011 Ephemeral Wetland and Wet Meadow Habitats

Key Habitat Description

Wet meadow ecological systems include a variety of subtlety different pocket grasslands. Though each type originates in slightly different soils and different hydrological regimes, the resulting habitat is nearly identical and can largely be discussed in a single approach for each of the systems. Montane, subalpine, and alpine wet meadows occur in open wet depressions, in basins and flats among montane and subalpine forests, and at or above tree-line in the alpine zone. Great Basin sub-montane wetland and wet meadow and ephemeral wetland and wet meadow types occur at lower elevations but in similar landscape settings. Sites are usually seasonally wet, often drying by late summer (in the case of Temperate Pacific Montane Wet Meadow and the lower elevation habitat types), and many occur in a tension zone between perennial wetlands and uplands, where water tables fluctuate in response to long-term climatic cycles. They may have surface water for part or all of the year, and depths range from no free surface water to several centimeters in the case of fens.

This key habitat often occurs as a mosaic of several plant associations with varying dominant herbaceous species that may include Camassia, various sedges, shooting star, rushes, false hellebore, and grasses. Trees occur peripherally or on elevated microsites and include lodgepole pine, Engelmann spruce, and subalpine fir, and at lower elevations may also include cottonwoods. Common shrubs may include willow and birch. Wet meadows are tightly associated with snowmelt and typically are not subjected to high disturbance events such as flooding. Some of these types occur as large meadows in montane or subalpine valleys, as narrow strips bordering ponds, lakes, and streams, and at seeps found at the toe of slopes. They are typically found on flat areas or gentle slopes, but may also occur on sub-irrigated sites with slopes up to 10 percent. Because many wet meadows in Nevada are small in surface area, the system as a whole is probably under-represented in the SWReGAP mapping effort. It is also worth noting that wet meadows are also typically small landscape elements embedded in a distinctly different habitat type. For example, at higher elevations in Nevada, wet meadows may be surrounded by montane sagebrush or encircled by an aspen stand. Consequently, it is important to recognize that wet meadows may function synergistically with surrounding habitats, adding to the wildlife value of surrounding habitats while also showing higher diversity because of the species from adjacent habitats utilizing the wet meadow.

Value to Wildlife

Though small in extent in Nevada, wet meadows add significantly to the diversity of landscapes where they do occur. Some of these sites provide free-standing water for wildlife, though as the summer season progresses free water may only be found below ground at many wet meadows. Because these small sites are typically well watered, they also provide lush vegetation for an extended period of the growing season, a resource that is valuable for game species such as deer and elk. The presence of water also fosters a ready supply of insects for a suite of bats

and for insectivorous birds and this ecological function is critically tied to the health of Mountain Willow Flycatcher populations. Finally, many species of amphibian rely heavily on wet meadows to meet their life history requirements. Wet Meadows provide critical late-summer refugia and winter hibernacula sites with cover and high soil moisture for amphibians, particularly in drier montane and sub-montane/lowland ecosystems. The drier lowland system wet meadows, often in association with springs and seeps and ephemeral wetland complexes, may provide the only permanently wetted suitable habitat other than flowing spring and springbrook areas for species such as relict leopard frog, Columbia spotted frog, and Amargosa toad.

Key Elements of Wet Meadows Habitat of Importance to Wildlife

Willow – willow communities with saturated soils provide nesting structure, foraging, protection from predators, thermal cover

Greater Sandhill Crane
Mountain Willow Flycatcher (brewsteri)
Willow Flycatcher (adastus)
Broad-tailed Hummingbird
Calliope Hummingbird
MacGillivray's Warbler
Wilson's Warbler

Forbs – foraging
Greater Sage-grouse
mule deer

Ungrazed Grass – foraging, nesting (ground-nesters)

Bobolink
Cinnamon Teal
Long-billed Curlew
Northern Pintail
Short-eared Owl
Willet
Ash Meadows montane vole
Pahranagat Valley montane vole
Inyo shrew
Merriam's shrew
montane shrew
Preble's shrew
vagrant shrew
western jumping mouse

Shrubby Ecotone – nesting structure, foraging, protection from predators, thermal cover, usually along the meadow margins where it interfaces with upland vegetation
Green-tailed Towhee

Flowing Water – burrowing in creek banks, foraging
mountain beaver

Aspen/Conifer – nesting structure, protection from predators
Mountain Bluebird
Western Bluebird

Disturbed Meadow – foraging, burrowing
San Antonio Pocket Gopher
Fish Springs Pocket Gopher
broad-footed mole

Lowland Ephemeral Wetland and Wet Meadow

Amargosa toad	**Great Plains toad**
Southwestern toad	**relict leopard frog**

Montane and Sub-montane Wetland and Wet Meadow
Columbia Spotted Frog
northern leopard frog
mountain yellow-legged frog

Existing Environment

Land and Water Uses

Agriculture	Non-motorized recreation
Livestock grazing	Recreation development
Irrigation diversion	Mineral extraction
Flood control	Urban/suburban development
Spring development	Road development
Groundwater development	Species harvest
Motorized recreation	

Habitat Conditions

Many wet meadows in active grazing allotments in Nevada receive significant grazing pressure each year. Wet meadows also tend to draw recreational activity, and those that are accessible to motorized recreation can be rapidly damaged by any use. Rutting (from motorized vehicles) or excessive trampling can alter the hydrology of these systems and cause them to dry out earlier in the growing season than they would under natural conditions, thereby reducing the value of the resource to wildlife. With the annual (or sometimes permanent) presence of water, sites where surface morphology has not been altered can be remarkably resilient.

Historic development of the spring and seep water sources of lowland wet meadow complexes for livestock watering and other purposes has affected their extent and seasonal permanence. Proposed future groundwater development has the potential to aggravate these historic perturbations where it may affect surface flow from springs and seeps maintaining these habitats. Intensive use by livestock and feral equids has negatively impacted some wet meadow habitats in lowland systems, through excess removal of emergent vegetation and trampling of water sources. Conversely, an absence of disturbance in some of these systems, by fencing or removal of grazing, has resulted in intense emergent vegetation growth which has limited the utility of sites for certain species, including endemic amphibians.

Problems Facing the Species and Habitats

As a result of disturbance, including the modification or development of water sources, wet meadows are facing permanent or temporary modification to the point of compromising habitat value for wildlife. Disturbance and degradation of these sites also leads to reduced vegetation composition, structure, and cover resulting in loss of nesting cover, escape cover, and food sources. As previously mentioned, changes in site morphology lead to altered groundwater flow and recharge patterns. Activities in wet meadows can lead to disturbance to wildlife (movements/displacement, behavior, reproductive success), erosion, and the establishment of invasive weeds. Improper placement of roads has also led to wet meadow decline, either through erosion, changes in hydrology, or direct impacts. Alteration of nearby habitat can also affect site hydrology and thereby compromise site value. At lower elevations, groundwater pumping that lowers water tables and alters shallow hydrology is also likely to be a threat to these systems. Conversely, in some wet meadow habitats the alteration of historic natural disturbance regimes can modify successional processes and intermediate seral stage maintenance, positively affecting the utility of these systems for amphibians and other aquatic-dependent species.

Priority Research Needs

- Restoration methods and techniques, particularly for heavily impacted sites
- Population status, distribution, and demography for Ash Meadows montane vole and Pahranagat Valley montane vole
- Species-habitat relationships for San Antonio pocket gopher, Fish Spring pocket gopher, and Aplodontia
- Relationship between lowland wet meadow successional stage, the role of natural disturbance in maintaining appropriate wet meadow seral stage, and use by amphibians (e.g., northern leopard frog, Amargosa toad) in various life stages
- Development of integrated management schemes to meet the various management objectives of Species of Conservation Priority while also meeting other land use objectives

Conservation Strategy

Goal: Thriving self-sustaining wildlife populations in healthy plant communities on saturated soils maintained by high water tables; residual plant cover maintained to meet the life history needs of species dependent on this habitat type.

Objective: Improve the hydrological and vegetation community condition of existing wet meadow habitats and restore hydrological and vegetation community condition to degraded wet meadows.

Action: Acquire conservation easements or fee-title to key wet meadow areas, and to adjacent habitats that are interconnected with wet meadows.

Action: Restore degraded wet meadow habitats through a combination of passive techniques (e.g., fencing out disturbance sources) and active techniques (e.g., physical recontouring of eroded or down-cut sites).

Action: Secure in-stream flows in systems functionally connected to wet meadows.

Action: Evaluate through research the role of historic disturbance in maintaining early seral stage wet meadow habitats for amphibians and implement appropriate strategies through existing conservation programs for appropriate species and habitats.

Action: Design grazing strategies on wet meadows that improve site condition and integrate specific wildlife management and livestock production objectives, including changing season of use and altering the rest-rotation cycle.

Action: Encourage OHV regulation development and enforce existing regulations to protect sensitive wet meadow habitats.

Action: Develop education and outreach materials to convey the sensitivity of wet meadow habitats to OHV users.

Objective: Maintain healthy populations of Species of Conservation Priority at stable or increasing trend.

Action: Determine population status, distribution, and demography of Ash Meadows montane vole, Pahranagat Valley montane vole, San Antonio pocket gopher and Fish Springs pocket gopher.

Action: Develop habitat suitability model for Aplodontia.

Action: Determine population status, distribution, and demography of northern leopard frog, southwestern toad, and Great Plains toad.

Action: Continue activities identified in conservation plans and technical team meetings for the Columbia spotted frog, Amargosa toad, and relict leopard frog.

Action: Actively pursue strategies for prevention of introduction of nuisance aquatic plant and animal species, including educational campaigns targeted at pet stores, water gardens, classrooms, researchers, biologists, etc.

Action: Establish a northern leopard frog working group to set and implement conservation goals, objectives, and actions.

Partnerships

Land owner/manager	Percent
Bureau of Land Management	46.7
U.S. Forest Service	25.0
Private	21.9
U.S. Fish and Wildlife Service	2.2
Other	4.2

Existing partnerships, plans, and programs

Major Programs and Partnerships

- Governor's Conservation Plan for Greater Sage-Grouse in Nevada and Eastern California

Conservation Agreements and Strategies

- Columbia Spotted Frog Conservation Agreements/Strategies
- Amargosa Toad CAS
- Relict Leopard Frog CAS (draft)

Other Conservation Teams and Plans

- Amargosa Toad Management Plan
- Amargosa Toad Working Group
- Columbia Spotted Frog Technical Teams
- Relict Leopard Frog Conservation Team
- Draft Partners in Amphibian and Reptile Conservation Amphibian & Reptile Habitat Management Guidelines

Federal Agencies

- Bureau of Land Management

- U.S. Forest Service
- Natural Resources Conservation Service/Conservation Districts
- National Park Service
- U.S. Geological Survey
- U.S. Fish and Wildlife Service

State Agencies

- Nevada Department of Wildlife
- Nevada Division of Forestry
- Nevada Natural Heritage Program

Conservation Organizations

- The Nature Conservancy
- Sierra Club
- National Audubon Society/Lahontan Audubon Society

Bird Conservation Initiatives

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

Other Key Partners

- Counties
- Intermountain West Joint Venture
- Great Basin Bird Observatory
- Tribes
- University of Nevada (UNR, UNLV, Cooperative Extension)

Preliminary Focal Areas

Sierra Nevada Range	Mary's River	Ruby Mountains
North Ruby Valley	Humboldt River	Northern Snake Range
Reese River	Montana Mountains	North Spring Valley
O'Neil Basin	San Antonio	Jarbidge Mountains
Santa Rosa Mountains	Steptoe Valley WMA	East Humboldt Range
Sheldon NWR	Toiyabe/Monitor/Toquima Ranges	Jackson Mountains
Northern Independence Mountains	White Mountains	Bruneau River
Owyhee River	Goose Creek	Salmon Falls Creek
Carson River	Walker River	

Key Habitat: Marshes

Ecoregions

Great Basin	33,297 hectares	82,277 acres
Columbia Plateau	5,780 hectares	14,284 acres
Mojave Desert	1,767 hectares	4,367 acres
Sierra Nevada	48 hectares	119 acres
Total	40,892 hectares	101,047 acres

Ecological Systems

S100 North American Arid West Emergent Marsh

Key Habitat Description

Marshes occur on soils that remain moist or saturated through a significant portion of the year. The length and extent of soil saturation or inundation influences the type of vegetation a site will express. A single site often carries the seed and root stocks to exhibit very different plant communities depending on the extent and duration of water on a site over a particular time. Water salinity also influences the particular community of plants present, with cattails and pondweed preferring fresher regimes, hardstem bulrush, alkali bulrush and sago pondweed favoring middle ranges, and salt-tolerant plants such as wigeon grass in the saltier regimes. Plants inhabiting moist soils include Baltic rush, smartweeds, sedges, and spikerushes. The depth and seasonality of standing surface water within marsh habitats can vary considerably; those marshes which hold surface water on a year-round or extended seasonal basis will support different plant communities and biotic species assemblages than those dominated by only moist soils or ephemeral surface moisture.

Importance to Wildlife

Marshes are among Nevada's most diverse and prolific wildlife habitats. The occurrence of marshes on the landscape is critical to both breeding and migratory needs of many species of birds. Nevada's marshes have astonishing capability to produce prolific populations of macro invertebrates that fuel food chains, either through being consumed first by fishes or directly by shorebirds and small water birds. Hundreds of thousands of shorebirds migrate north and south through Nevada annually and are dependent on the availability of these high-volume invertebrate stocks to restore the fat reserves critical to reaching their breeding and wintering destinations. Arctic-breeding shorebirds that depend on Nevada marshes for transitory fuel include Long-billed Dowitcher (up to 100,000), Western Sandpiper (60,000+), Red-necked Phalarope (30,000+) and Least Sandpiper (10,000+) (NDOW 1986-2004). These transient shorebird flocks are followed by migratory Peregrine Falcons en route between their wintering and Arctic breeding grounds. Over 12,000 Tundra Swans and 30,000 Snow Geese also winter or migrate through Nevada. The State's wetlands are also important breeding sites for American Avocets, Black-necked Stilts, Western Snowy Plover, Redhead, and Cinnamon Teal. Ruby Lakes NWR (Elko and White Pine counties) is one of the most important Canvasback nesting sites in the western United States. The importance of Nevada to migratory birds was recognized in 1988 with the designation of the Lahontan Valley Wetlands (Churchill County) as a Site of Hemispheric Importance in the Western Hemispheric Shorebird Reserve Network (Myers et al. 1987).

In addition, Nevada's marshes are home to not less than 56 breeding bird species, including 5,000-10,000 nesting pairs of White-faced Ibis (Earnst et al. 1998), 5,000+ pairs of American Avocets, 1,000+ pairs of Black-necked Stilts (Neel and Henry 1997), and hundreds of pairs each of Great Blue Herons, Snowy Egrets, Great Egrets, and Black-crowned Night Herons. Up to 6,500 pairs of American White Pelicans from the breeding colony on Anaho Island in Pyramid Lake depend on the fish in the shallow wetland waters of Lahontan Valley and Humboldt Sink during the peak wet years. Other Species of Conservation Priority include Least Bittern, Franklin's Gull, and Yellow-headed Blackbird. Small breeding populations of Yuma Clapper Rail (an endangered species) occur in

riverine wetlands within the Colorado River drainage, and a small colony of Tricolored Blackbirds occurs in Carson Valley (Douglas County). When these emergent stands desiccate and cure during the driest drought years, they become naturally infested with populations of voles and other rodents, providing foraging opportunities for a host of predators, notably wintering raptors such as Ferruginous Hawk, Rough-legged Hawk, Northern Harrier, and Prairie Falcon. It is during these years that Short-eared Owl nesting peaks on these dry marsh stands.

Two endemic subspecies of montane vole (Pahranagat Valley and Ash Meadows) occurring in the marshes of the Mojave Desert deserve special note as they represent completely isolated remnant populations of a species that was more widely distributed and interconnected in the wetter geologic periods following the Pleistocene glaciation. Once connected through more mesic conditions to source populations of montane voles at higher elevations, these two valley floor remnants are now completely isolated and occur as much as 161 km (100 miles) from the next nearest montane vole population. The Pahranagat Valley montane vole is known to be extant as recently as 1995 (Nevada Natural Heritage Database 2005), but the Ash Meadows montane vole has not been documented since 1933 and may in fact be extinct.

Where marsh habitats contain standing water year-round or for significant seasonality, they have a particular importance for endemic fish Species of Conservation Priority. This is particularly important where this habitat type occurs in context with areas of open water or flowing stream systems, or where associated spring seeps and groundwater flow provide enhanced water quality and depth on a continual basis. Permanent and ephemeral marshes are a critical landscape feature providing habitat for all life stages of amphibian species. More permanent marsh features are an important component of habitats supporting resident amphibians for reproduction, recruitment, adult maintenance and winter hibernacula. Ephemeral and seasonal marsh habitats serve an important role in supporting movement across arid upland habitat types for amphibians during seasonal wet periods, between more permanent marsh and flowing or standing water features that support core amphibian populations.

Key Elements of Marsh Habitat of Importance to Wildlife

Nesting and Foraging

Mat Nesters/Open Water Feeders

Clark's Grebe	**Redhead**
Western Grebe	**Forster's Tern**
Eared Grebe	**Black Tern**
Canvasback	

Island Nesters/Piscatorial (fish eating)
American White Pelican
California Gull

Lone Tule/Cattail Nesters

Least Bittern	**Short-eared Owl**
Yuma Clapper Rail	

Flooded Short Grass Nesters (colonial or single)

Black-necked Stilt	**Long-billed Curlew**
American Avocet	Spotted Sandpiper

Flooded Tall Grass Nesters

Bobolink	**Long-billed Curlew**
Greater Sandhill Crane	**Willet**

Dry/Wet Residual Vegetation Nester

Northern Pintail
Cinnamon Teal

Colonial Nesters (tule/cattail/willow)

Franklin's Gull	Black-crowned Night Heron
Snowy Egret	
Tricolored Blackbird	Yellow-headed Blackbird
White-faced Ibis	

Tree Nesters

Great Blue Heron

Barren Ground Nesters

Snowy Plover

Dry/Moist Residual Grass – foraging, burrowing, protection from predators, thermal cover

Ash Meadows montane vole
Pahranagat Valley montane vole

Prey Populations – feeding on species in this habitat

Bald Eagle	**Peregrine Falcon**
Ferruginous Hawk	Prairie Falcon

Migrants – foraging on macroinvertebrates

Least Sandpiper	Bonaparte's Gull
Long-billed Dowitcher	Dunlin
Red-necked Phalarope	Greater Yellowlegs
	Marbled Godwit
	Western Sandpiper
Black-bellied Plover	

Xeric Marsh (ephemeral/moist soil) – movements of amphibians during wet periods (connect more permanent marshes or other water sources that support amphibian populations)

Amargosa toad	northern leopard frog
Columbia spotted frog	

Mesic Marsh (permanent/semi-permanent standing water) – aquatic species tied to water source for all of their life history requirements; reproduction, recruitment, adult maintenance, and winter hibernacula for amphibians

Fish Lake Valley tui chub	Pahranagat speckled dace
Independence Valley speckled dace	Railroad Valley springfish
Independence Valley tui chub	Railroad Valley tui chub
Ash Meadows Amargosa pupfish	Amargosa toad
Moorman White River springfish	Columbia spotted frog
Oasis Valley speckled dace	northern leopard frog

Existing Environment

Land Uses

Livestock grazing
Irrigation diversion
Non-motorized recreation
Waste/hazardous material disposal (mostly historic but still influential)
Groundwater Development
Species harvest
Road development
Industrial development
Urban/suburban development

Habitat Conditions

The quality and extent of wetlands in Nevada has been greatly altered and reduced by upstream water diversions. Heavy metal contamination of wetland substrates has occurred from the leaching of crop soils naturally impregnated with elements such as selenium, boron, molybdenum, etc. In addition, historic gold mining activities discharged massive quantities of mercury into Nevada's river systems, most notably the Carson River. These mercury-laden sediments shift during flood events and when exposed, intermittently pose threats to successful reproduction of birds on some of Nevada's most important wetlands. Where water rights have been successfully secured to maintain wetlands, habitat quality is high and a variety of wetland management objectives can be met on a cyclic basis in concert with natural regional climatic cycles. In some limited locations, the abandonment or reversion of lands historically converted for agriculture has allowed restoration of former wetland and marsh habitats, although significant challenges remain because of alterations to flow and drainage patterns and loss of mesic soil types. Where artesian flow wells from abandoned land entry claims have remained operational, such as in Railroad Valley in Nye County, extensive wetland areas have been developed in locations where they were historically absent or only seasonal in extent.

Problems Facing the Species and Habitats

Without the presence of natural surface flow, or groundwater sources conveyed to the surface through spring flows, Nevada's wetlands are difficult to maintain in natural condition. Water delivery is interrupted and reduced, disrupting the emergence and progression of vegetative communities and invertebrate blooms. This in turn reduces the number and diversity of wild animals the marshes are able to support. Waters applied over the soils of many of Nevada's desert floors load up with trace heavy metals and deposit them to wetland substrates where they accumulate over time to sometimes reach effect levels that can disrupt the physiological processes of wetland wildlife, including reproduction, and can even reach toxic levels if not actively managed by flushing (dilution) and drying (which exposes surface salts to wind removal). Reduced water availability results in the reduction of diverse habitats that can be maintained; therefore the myriad of wildlife objectives associated with wetland management cannot be met in a single year. Some of Nevada's historical marshes have been lost completely (Winnemucca Lake), and are not likely to be seen again. Invasive species have made serious inroads into Nevada's marsh

communities, both plants (e.g., tamarisk and tall whitetop) and animals (e.g., common carp), and threaten to compromise marsh productivity and species integrity.

Priority Research Needs

- Continue to study the extent and effects of heavy metal contamination on wetland wildlife
- Water management and shorebird migration/staging
- Population status of Ash Meadows and Pahranagat Valley montane voles
- Effects of groundwater withdrawal on surface water levels
- Priority research needs identified in aquatic conservation plans
- Connectivity between Nevada wetland sites and other sites in the Intermountain West for coordinated regional wetland management to achieve regional bird population objectives

Conservation Strategy

Goal: Healthy, self-sustaining wildlife populations in dynamic plant communities adapted to cyclic conditions driven by climatic fluctuations; a functional mosaic of submergent, emergent, and open water marsh types supported by water regimes that are natural or mimic the natural diversity of Intermountain systems progressing from dry to fresh to saline to dry.

Objective: No net loss of wetland sites through 2015.

Action: Identify wetland sites and degree of conservation for each through the Nevada Wetlands Plan, aquatic conservation plans, and the Nevada Important Bird Areas program. Prioritize sites in need of more effective conservation status and implement a conservation designation program focusing on the most critical sites first.

Action: Use the full array of conservation tools to achieve effective conservation status for Nevada's most critical unprotected wetlands, including conservation easements, interagency agreements, and purchase of lands from willing sellers.

Action: Develop outreach programs regarding the critical importance of wetland conservation in Nevada for proper hydrologic function of Nevada ecosystems as well as for wildlife conservation.

Action: Work to restore wetlands protection through regulation at the federal level; supplement or restore weakened wetland preservation regulations through legislation and application at the State level.

Objective: No net loss of wetland acreage within the natural fluctuation of ten-year drought cycles through 2015.

Action: Purchase water rights from willing sellers for delivery and application to wetlands.

Action: Oppose and/or compensate for new proposals to divert water upstream of critical wetland sites.

Objective: Increase in wetland management potential through purchase of water rights and wetland improvement projects by 2015.

Action: Purchase water rights from willing sellers for delivery and application to wetlands.

Action: Cooperatively pursue Intermountain West Joint Venture and aquatic species conservation plan objectives for wetlands improvement and restoration in Nevada.

Action: Identify important permanent and ephemeral wetland sites on public lands for amphibian Species of Conservation Priority, and cooperatively prioritize protection and restoration actions through BLM and USFS planning processes to insure maintenance and enhancement.

Action: Encourage inclusion of active wetland restoration strategies in CCP development for FWS National Wildlife Refuge units, including ephemeral and isolated wetlands within arid habitats to preserve ecosystem diversity.

Action: Develop wetlands using urban and suburban waste water with appropriate attention to the management and removal of harmful chemical residues. Incorporate wetland design into urban waste and runoff water treatment technology as standard operating procedure for new or upgraded developments.

Action: Implement area management plans on actively managed wetland sites, including National Wildlife Refuges, State Wildlife Management Areas, and privately owned wetlands (such as gun clubs). Refresh area management plans on a 5-10 year rotation, set goals and objectives, measure implementation success and set adjusted objectives.

Action: Develop technical knowledge base for water management, including delivery timing, water level manipulation, etc. to include specific outputs and objectives for all wetland wildlife – nesting, migrating, and wintering waterfowl; nesting and migrating shorebirds; nesting and migrating fish-eating birds; colonial-nesting birds; marsh-dwelling mammals; dry-season predators; endemic amphibians; and endemic fishes.

Action: Develop an Intermountain West wetland management network that cooperatively develops Intermountain wetland population management objectives based on the differential capabilities of Intermountain wetlands as they fluctuate through their natural climatic cycles for the purpose of maintaining thriving, self-sustaining populations of wildlife at the regional and hemispheric scales.

Action: Adopt avian priority species population objectives from continental and regional bird conservation initiatives; step continental and regional objectives down to reflect Nevada's capability and set conservation action toward achievement of those objectives.

Objective: Maintain healthy populations of Species of Conservation Priority at stable or increasing trend.

Action: Implement actions identified in aquatic conservation plans and/or by conservation teams.

Action: Actively pursue strategies for prevention of introduction of nuisance aquatic plant and animal species, including educational campaigns targeted at pet stores, water gardens, classrooms, researchers, biologists, etc.

Action: Establish a northern leopard frog working group to set and implement goals, objectives, and strategies.

Partnerships

Land owner/manager	Percent
Private	37.4
Bureau of Land Management	13
U.S. Bureau of Reclamation	10.2
U.S. Fish and Wildlife Service	8.8
Tribal	2.8
Open Water	26.2
Other	1.6

Existing partnerships, plans, and programs

- Nevada Wetlands Plan
- Swan Lake Nature Study Area
- Carson Lake Transfer

- Humboldt River /Argenta Transfer
- Draft Tui Chub SMP
- Draft Recovery Plan for the Endangered Speckled Dace of Clover and Independence Valleys
- Recovery Plan for the Endangered and Threatened Species of Ash Meadows, Nevada
- Recovery Plan for the Rare Species of Soldier Meadows
- Amargosa Toad CAS
- Amargosa Toad Management Plan
- Recovery Plan for the Aquatic and Riparian Species of Pahranagat Valley
- Pahranagat Valley Native Fishes Management Plan
- Railroad Valley Springfish Recovery Plan
- Declining Amphibian Population Task Force
- Devils Hole Pupfish Recovery Team Refugium Subgroup (Warm Springs Pupfish)
- White River Valley Native Fishes RIT
- Amargosa Toad Working Group
- Pahranagat Valley Native Fishes RIT
- Railroad Valley Native Fishes RIT
- Columbia Spotted Frog Technical Teams
- Relict Leopard Frog Conservation Team
- Partners in Amphibian and Reptile Conservation Amphibian & Reptile Habitat Management Guidelines
- Northeastern Sub-population Spotted Frog Conservation Agreement/Strategy
- Toiyabe Subpopulation Spotted Frog Conservation Agreement/Strategy

Federal Agencies

- U.S. Fish and Wildlife Service
- Natural Resources Conservation Service/Conservation Districts
- Bureau of Land Management
- U.S. Geological Survey/Biological Resources Division
- U.S. Army Corps of Engineers
- U.S. Environmental Protection Agency
- Bureau of Reclamation

State Agencies

- Nevada Department of Wildlife
- Nevada Division of State Parks
- Nevada Natural Heritage Program

Counties/Cities

- Truckee-Carson Irrigation District
- Walker River Irrigation District
- Churchill County Quality of Life Plan
- Incline Village General Improvement District Sewer Treatment Wetland

Sportsman's Organizations

- Nevada Waterfowl Association
- Canvasback Gun Club
- Greenhead Hunting Club
- Ducks Unlimited

Conservation Organizations

- Nevada Wetlands Coalition
- Lahontan Audubon Society/National Audubon Society
- Desert Fishes Council
- PARC
- DAPTF

Bird Conservation Initiatives

- U.S. Shorebird Conservation Plan
- Western Hemispheric Shorebird Reserve Network
- North American Waterfowl Management Plan
- North American Waterbird Conservation Plan
- Partners In Flight
- Partners In Flight North American Land Bird Conservation Plan
- Nevada Partners In Flight

Other Key Partners

- Intermountain West Joint Venture
- Mining Industry/Nevada Mining Association
- University of Nevada
- Great Basin Bird Observatory

Preliminary Focal Areas

Pahranagat Valley	Kirch WMA
Ash Meadows	Mason Valley WMA
Carson Lake	Railroad Valley
Carson River	Sheldon NWR
Stillwater NWR	Steptoe Valley
Lahontan Valley	Overton WMA
Virgin River floodplain	Fernley
Ruby Marshes	Humboldt Sink
Franklin Lake	Argenta Marsh
Quinn River	Duck Flat
Las Vegas Wash	

Key Habitat: Desert Playas and Ephemeral Pools

Ecoregions

Great Basin ..... 617,569 hectares ... 1,526,012 acres
Mojave Desert ..... 48,046 hectares ..... 118,721 acres
Columbia Plateau .... 10,205 hectares ..... 25,216 acres
Total ..... 675.820 hectares ... 1,669,949 acres

Ecological Systems

SO15 Intermountain Basins Playa
SO22 North American Warm Desert Playa
A020 Ephemeral Pools

Key Habitat Description

This key habitat is composed of mostly barren or sparsely vegetated playas typically found on the valley bottoms in the intermountain and warm desert regions. Because of the flatness of much of the Columbia Plateau, playas can also form on the tops of its buttes and plateaus, such as can be seen on the Sheldon National Wildlife Refuge. Playas are formed by intermittent flooding and evaporation that precipitates fine soils and mineral salts onto the lowest flat depressions until an impermeable layer of sodic clay is lain down. Soil salinity varies greatly with soil moisture and greatly influences the plant species present at any particular time. Dry playas are often barren of vegetation from their center out to their outer margins, where saltgrass, pickleweed, or stunted greasewood maintain a foothold on the fresher soils. When soils are kept moist but short of saturation over several weeks or months, Baltic rush, smartweed, sedges, and spikerushes emerge, in progressive order of wetness. This plant community is usually less than 60 cm (2 ft) tall, and can become quite dense in the absence of disturbance. With prolonged saturation more substantial emergent vegetation is established, including cattails, hardstem bulrushes, and alkali bulrushes (known locally as nutgrasses). These plants range from 1 to 3 m(39 to 118 inches) tall and can grow sufficiently thick as to render a site impenetrable. Long-term inundation will facilitate establishment of a submergent plant community, typically characterized by pondweed; in more saline conditions, wigeon grass; and in fresher conditions arrowhead.

Ephemeral pools are broadly distributed across the state and range in size from small rock basins holding no more than 1-2 liters to large vernal lakes covering hundreds of hectares. By definition ephemeral pools dry up periodically, typically holding water for only a few days to months. Most pools are heterotrophic, meaning that much of the energy circulating through them comes from detritus, not direct photosynthetic production. In pools that support a wetland/terrestrial plant community, vascular plant production during the dry phase provides detritus that supports the aquatic system during the next wet phase. Some systems (e.g., rock pools and playas) lack significant vascular plant production; most of the energy in these systems derives from detritus blown in or carried into the basin from the surrounding watershed, with primary production by algae in the basin varying in significance.

Value to Wildlife

Most playas in Nevada do not have permanent sources of water; therefore the value of playas to wildlife is largely ephemeral in nature. When playas are watered for the proper period of time, they can produce not only lush growth of emergent and submergent vegetation, but also prodigious volumes of aquatic invertebrates attracting a myriad of waterfowl, shorebirds, and small water birds. Submergent plants in these systems can build to such thick mats that they finally break the water's surface and present a structure sufficient to support the nests of Black Terns, Eared Grebes, Black-necked Stilts, and American Avocets. When watered and loaded with invertebrates during spring or late summer, Nevada's ephemeral playas may contribute significantly to supporting waterfowl

and shorebird migration. However, these areas are not always consistently occupied by wildlife, and the reasons for why one filled playa is being heavily utilized by birds while another is practically bereft is unclear.

The iconic terrestrial species of Nevada's playas is the Snowy Plover, adapted to utilize some of Nevada's harshest landscapes with very few amenities. While wet playas are preferred to dry, the amount of water available does not have to be much and often Snowy Plovers use playas with only a rivulet coursing through them, or with a small wet corner, so long as they are dependably wet throughout the breeding season. Snowy Plovers thrive on brine flies and their larvae when occupying these habitats.

Occasionally a playa's "fill zone" will inundate a permanent spring that supports a small population of fish such as tui chub. At these rare times, the fish population can burgeon into the greater filled playa and becomes a windfall to foraging herons and grebes, although by-and-large, the energy cycle most often associated with ephemeral playas is a simple invertebrate-shorebird system. Although ephemeral pools have a limited role in support of purely aquatic vertebrate species, they can play a critical role in desert systems for maintaining populations of aquatic invertebrates such as brine, fairy, clam, and tadpole shrimp. Life cycles of these organisms are keyed to the seasonal boom/bust cycle of periodic inundation of playa habitats, especially during periodic wet cycles when their habitats remain wetted with standing surface water for extended periods These pool inhabitants are either aquatic opportunists, species that occupy both temporary and permanent waters, or specialists with precise adaptations for living in temporary aquatic environments. While ephemeral pool communities have a fairly simple structure, species composition of these communities varies significantly. Most pools may be populated with widespread species, but some species are endemic to particular geographic regions or pool conditions. Much of the diversity in Nevada's ephemeral pools is still undocumented.

Although the relationship is poorly understood, ephemeral pools may provide an important function to certain amphibian species during periods of seasonal precipitation and high soil moisture, when those pools fill and provide standing water. As temporary standing water features, they likely facilitate movement and migration of those species in arid land ecosystems between core habitat areas of more permanent water, and assist in periodic distribution of individual animals within larger metapopulation complexes.

Key Elements of Desert Playas and Ephemeral Pools Habitat of Importance to Wildlife

Breeding/rooding – emergent and submergent vegetation, foraging

American Avocet	**Northern Pintail**
Black-necked Stilt	**Snowy Egret**
Cinnamon Teal	**Snowy Plover**
Eared Grebe	**Willet**
Forster's Tern	California Gull
Long-billed Curlew	

Migration – foraging

Black Tern	Bonaparte's Gull
Franklin's Gull	Dunlin
Least Sandpiper	Greater Yellowlegs
Long-billed Dowitcher	Marbled Godwit
Red-necked Phalarope	Western Sandpiper
Black-bellied Plover	

Ephemeral Pools – foraging (aquatic invertebrates), facilitate movement of amphibian species between areas of more permanent water

Amargosa toad	Northern leopard frog
southwestern toad	Columbia spotted frog
Great Plains toad	Mountain yellow-legged frog
relict leopard frog	

Existing Environment

Land Uses

Motorized recreation	Military mission
Non-motorized recreation	Road development (rare)
Minerals/oil/gas extraction	Urban/suburban development

Habitat Conditions

Most playas in Nevada are currently intact, owing largely to their intractability, but occasionally proposals are made to mine them for trace minerals. Ephemeral pools also are largely intact as landscape features, but are more subject to potential alteration or disturbance because of their small size and lack of prominence within other habitat types subject to development, recreational uses, and other perturbations. Their characteristics as natural sinks for capture of runoff and surface water somewhat limits their potential for disturbance, particularly from development, because of drainage issues and higher soil moisture.

Problems Facing the Species and Habitats

Playas are really only in jeopardy when land uses threaten to alter their normal hydrologic function. Of the species that utilize playas, the Snowy Plover, Long-billed Curlew, and Snowy Egret have generated the most conservation concern in recent years. The North American Waterbird Conservation Plan (NAWCP) identifies the Snowy Egret as a Species of High Concern, citing apparent population declines and elevated vulnerability on their wintering grounds. In addition, the NAWCP identifies California Gull, Forster's Tern, Western Grebe, Bonaparte's Gull, and Franklin's Gull as species of Moderate Concern. The U.S. Shorebird Conservation Plan (USSCP) identifies Snowy Plover and Long-billed Curlew as Highly Imperiled. The USSCP also identifies Marbled Godwit and Western Sandpiper as species of High Concern. There continues to be nationwide concern over the long-term population declines of Northern Pintail, but after as much as a 57 percent decline between 1955 and 1987, Canvasback populations appear to be on the rebound after a successful period during the 1990s (NatureServe 2005).

Ephemeral pools have a higher potential for alteration because of their limited size and a poor understanding of their importance to maintenance of arid land ecosystem function. Amphibian Species of Conservation Priority including the Amargosa toad, other endemic toad species, and the relict leopard frog, may be highly dependent on these features for seasonal movement of individual animals and for metapopulation maintenance, but that relationship is poorly understood. Ephemeral pool specialists (fairy shrimp, tadpole shrimp) are not on the Species of Greatest Conservation Concern list because so little is known about them in Nevada. This habitat type is critical to their survival, but little is known about which species occur in Nevada, much less their geographic range.

Priority Research Needs

- Invertebrate species composition for most playas and ephemeral pools

- Timing of invertebrate population booms after flooding dry playas (for the purpose of creating shorebird migration habitat on managed playas)
- Life history of ephemeral pool species, including tolerance ranges for various environmental parameters, ecological interactions among species, and relationships between ephemeral pools and surrounding ecosystems
- Role of ephemeral pools in seasonal movements of amphibians

Conservation Strategy

Goal: Healthy, dynamic aquatic ecosystems within the natural fluctuating range of water quantity and chemistry progressing from dry to fresh to saline; prolific self-perpetuating aquatic invertebrate and migratory bird communities

Objective: No net loss in playa area or hydrologic function through 2015.

Action: Develop and implement a public outreach program to explain the value and function of playas.

Action: Insure playa and ephemeral pool habitats are addressed in land use planning and project development evaluations to maximize maintenance of these habitats and minimize disturbance from alteration, road construction, and recreational activities.

Objective: Maintain healthy populations of Species of Conservation Priority at stable or increasing trend.

Action: Inventory the aquatic invertebrate communities of Nevada's playas; determine timing and productive potential of invertebrate population booms; determine and develop opportunities for enhancement of bird migration and breeding.

Action: Evaluate the importance of ephemeral pool habitats for movement and population maintenance of key amphibian species and as directed by outcome, incorporate strategies to protect those habitats within conservation planning for those species.

Action: Inventory aquatic invertebrate communities of Nevada's ephemeral ponds and as directed by outcome, develop conservation strategies for those Species of Conservation Priority.

Action: Establish a northern leopard frog working group to set and implement goals, objectives, and strategies.

Action: Implement actions identified in aquatic conservation plans and/or by conservation teams.

Partnerships

Land owner/manager	Percent
Bureau of Land Management	77.9
Private	9.4
Department of Defense	3.7
U.S. Fish and Wildlife Service	2.7
Bureau of Reclamation	1.8
Tribal	1.8
Other	2.7

Existing partnerships, plans, and programs

- Amargosa Toad Working Group
- Columbia Spotted Frog Technical Teams
- Relict Leopard Frog Conservation TeamAmargosa Toad Conservation Agreement/Strategy
- Amargosa Toad Management Plan

- Columbia Spotted Frog Conservation Agreements/Strategies
- Relict Leopard Frog CAS

Federal Agencies

- Bureau of Land Management
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service

State Agencies

- Nevada Department of Wildlife
- Nevada Natural Heritage Program

Conservation Organizations

- The Nature Conservancy
- Lahontan Audubon Society (Important Bird Areas Program)
- Partners in Amphibian and Reptile Conservation
- Declining Amphibian Population Task Force, California/Nevada Chapter
- Sierra Club

Bird Conservation Initiatives

- U.S. Shorebird Conservation Plan
- Western Hemispheric Shorebird Reserve Network
- North American Waterfowl Management Plan
- North American Waterbird Conservation Plan
- Partners In Flight North American Land Bird Conservation Plan
- Nevada Partners In Flight

Sportsman's Organizations

- Nevada Waterfowl Association
- Canvasback Gun Club
- Greenhead Hunting Club
- Ducks Unlimited

Other Key Partners and Partnerships

- Nevada Wetlands Coalition
- Swan Lake Nature Study Area
- Intermountain West Joint Venture/Nevada State Steering Committee
- Great Basin Bird Observatory
- University of Nevada (UNR, UNLV)
- Counties

Preliminary Focal Areas

Franklin Lake	Railroad Valley
Smoke Creek Desert	Sheldon NWR
Black Rock Desert	Humboldt Sink
Winnemucca Lake	Fernley Sink
Massacre Lakes	Carico Lake Valley
Gridley Lake	Continental Lake
Calcutta Lake complex	Snow Water Lake

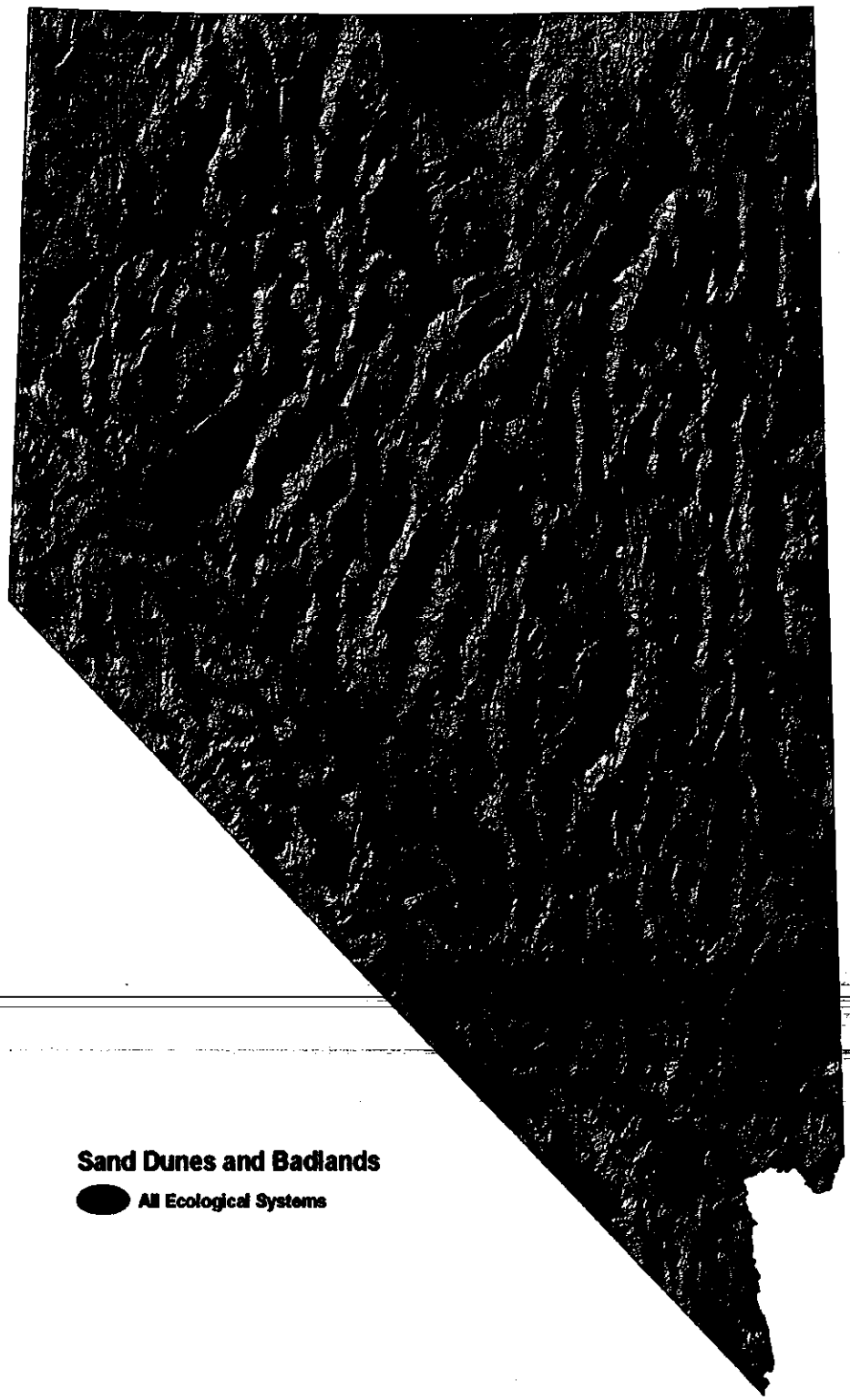


Figure 29. Distribution of Sand Dunes and Badlands in Nevada (data source NatureServe 2004).

Key Habitats: Sand Dunes and Badlands

Ecoregions

Mojave Desert	26,272 hectares	64,919 acres
Great Basin	7,875 hectares	19,461 acres
Columbia Plateau	53 hectares	131 acres
Total	34,200 hectares	84,511 acres

Ecological Systems

S012 Intermountain Basins Active and Stabilized Dune
S017 North American Warm Desert Badland
S018 North American Warm Desert Active and Stabilized Dune
S021 North American Warm Desert Pavement

Key Habitat Description

Sand dunes and badlands include ecological systems defined by substrate characteristics. They include relict bedrock outcrops, weathered soil patches, aeolian deposits (dunes), and other areas dominated by substrate rather than by vegetative cover. Sand dunes and badlands often define unique habitats and support endemic plants and animals, as well as providing habitat for generalist species (Nachlinger et al. 2001).

Nevada's sand dunes were formed during the Holocene Epoch and are unique habitats because they are rare, small, of recent origin, and spatially dynamic (Brussard et al. 1998). Sand dune habitats consist of stabilized to partially stabilized sand dunes dominated by desert sand verbena, big greasewood, dale, ricegrass, forewing saltbush, and four-part horse brush. Sand dunes occur between 320 and 1980 m (1,050 and 6,500 ft) in elevation, on young alluvium-colluvium deposits or aeolian sand. They are constantly being eroded and reformed by the prevailing wind which results in sparse plant cover in these habitats. Water is held for long periods of time just under the surface, allowing shrubs to successfully root and persist through long droughts (Nachlinger et al. 2001). Unlike many soils in desert basins, sand dunes are well-drained and non-saline. As a result, their vegetation differs considerably from the surrounding basin or bajada (MDEPT 2001). Sand dune habitats are dynamic and reliant upon large-scale patterns and ecosystem processes that include wind and sand corridors (Barrow 1996).

Badlands are found at all elevations, although most commonly on low and moderate elevations, on steep bedrock outcroppings, ridgetops, windswept barrens, or alluvial and colluvial deposits (Nachlinger et al. 2001). Vegetation on badlands is often dominated by unique plant assemblages or by non-vascular lichens and cryptogamic species. Altered andesite soils are a special case of hydrothermally-altered badlands in the western Great Basin with vegetation dominated by relictual conifer species. The conifers are able to maintain dominance over typical Great Basin shrublands and woodlands because of their competitive advantage on the nutrient poor and acidic soils (Billings 1990). Ecological services provided by badland systems may include serving as natural barriers to weed invasion and fire since they have little vegetation to burn.

Value to Wildlife

Numerous species associated with dunes and badlands are endemic to particular locales with unusual biological and physical conditions. Many sand dune systems in Nevada have a high diversity of dune invertebrates including beetles, solitary bees, crickets and ants, some of which are sand dune obligates (Nachlinger et al. 2001). Terrestrial invertebrates, specifically beetles and solitary bees, are the best studied sand dune animals and many depend on dune vegetation for adult or larval forage, mating sites, and protective cover (Brussard et al. 1998). The population assessment of a common sand dune-obligate beetle, *Eusattus muricatus,* provides insight to managing and conserving these habitats in Nevada. Dunes in smaller, isolated pluvial areas of the Great Basin and Mojave Desert may support genetically unique populations of *E. muricatus* that are not likely to be augmented or rescued

by dispersal from dunes in other pluvial basins. For obligate species, sand dunes represent unique, limited habitats that were historically connected during the Pleistocene (Britten and Rust 1996).

Conditions of sand dune habitat that affect wildlife are partially tied to annual rainfall. For example, annual seed production is positively correlated with rainfall in sand dune habitats. As a result, the diversity of seed-eating rodents and perennial shrubs in these habitats is directly tied to annual rainfall (Brown 1973). Desert kangaroo rats and kangaroo mice primarily feed on seeds in sand dune habitats but occasional foraging on insects has been documented (Best et al. 1989, Hall 1946). Desert kangaroo rats are closely restricted to areas where accumulations of wind-driven sand have reached considerable depths (Best et al. 1989), whereas edaphic factors control habitat selection by kangaroo mice and they can be found in fine, gravelly soils (O'Farrell and Blaustein 1974) or areas with fine sand supporting some plant growth (Hall 1946). Sand dune species may burrow in the sand to rest, forage, and build nests. Western banded geckos, desert night lizards, and desert horned lizards feed on insects and spiders in sand dune and badland habitats. Prey seeking species are drawn to sand dune (e.g., kit fox) and badland (e.g., Sonoran lyre snake) habitats to feed on small mammals, lizards, and other inhabitants.

Key Elements of Sand Dunes and Badlands Habitat of Importance to Wildlife

Sand Dunes – foraging, burrowing

desert kangaroo rat	**kit fox**
dark kangaroo mouse	**desert horned lizard**
pallid kangaroo mouse	**western banded gecko**

Badlands – foraging, burrowing

western banded gecko	**desert horned lizard**
desert night lizard	**Sonoran lyre snake**

Existing Environment

Land Uses

Motorized recreation – OHVs
Geothermal power production
Military mission

Habitat Conditions

Conditions of sand dune and badland habitats in Nevada are influenced mostly by OHV use, which contributes to the loss of vegetation (i.e., wildlife habitat), soil disturbance, and potential transport of noxious weeds in heavy use areas. In 2000, OHVs represented 10 percent (408,703 visitor days) of the total visitor days for all recreation activities on BLM lands in Nevada (Newmark et al. 2002), and much of this use was likely concentrated in sand dune and badland habitats. Wildlife habitat conditions in many of Nevada's dune systems have been degraded by repeated vehicle incursions, although most dunes continue to retain connectivity to their sand sources (J. Nachlinger, The Nature Conservancy of Nevada, personal comm. June 2005).

Problems Facing the Species and Habitats

Although various plans are in place to manage ongoing motorized recreation, this activity still presents significant risk to these communities. Studies in other states have documented the loss of vertebrate and invertebrate species richness, a reduction in vertebrate and invertebrate populations, and a disruption of mating behaviors in insects that depend on dune-margin vegetation (Hardy and Andrews 1979, Luckenbach and Bury 1983). Additionally,

heavy use or misuse of OHVs on sand dune and badland habitats reduces vegetative cover and sets the stage for invasive plant species invasions.

Problems facing hydrothermally altered andesites of the western Great Basin include disturbance of vegetation and soil by OHVs and permanent habitat conversion from urban development (Nachlinger et al. 2001). Geothermal power production may also affect these habitats and their species (Nachlinger et al. 2001). Finally, invertebrate species of sand dune and badland habitats that constitute the prey base for wildlife may be vulnerable to environmental and demographic stochasticity due to the small geographic distributions and disjunct nature of their populations (Brussard et al. 1998). Populations of *E. muricatus* separated by approximately 100 km (62 miles) generally exchange very few migrants and may be genetically isolated (Britten and Rust 1996).

Priority Research Needs

- The effects of sand dune spatial dynamics on sand dune biological communities
- Relationships of species to edaphic properties of badland habitats
- Ecological effects of OHV use on sand dunes and badlands
- Population status and trend of desert kangaroo rat, dark kangaroo mouse, and pale kangaroo mouse

Conservation Strategy

Goal: Preserve natural biodiversity in endemic-rich sand dune and badland habitats while continuing traditional and contemporary human uses.

Objective: Maintain disturbance in sand dune and badland habitats within levels that do not compromise the sustainability of the vegetation and wildlife communities.

Action: Encourage designated-use zones for OHVs in non-sensitive areas.

Action: Avoid or minimize disturbance to wildlife and habitat in sensitive areas.

Action: Increase public outreach regarding the value of sand dunes to wildlife, including invertebrates; develop and implement guidelines for user capacity at popular recreation sites.

Action: Develop conservation agreements that maintain biodiversity and multiple-uses (e.g., motorized recreation, military mission, geothermal development) in sensitive sand dune and badland habitats.

Objective: Maintain stable or increasing wildlife populations in representative sand dune and badland habitats in Nevada.

Action: Designate and manage high biodiversity priority dunes and badlands for conservation protection.

Action: Identify and delineate sand dune habitats within probable dispersal distances of each other, and design management that sustains unique populations of sand dune species in Nevada.

Action: Determine population status and trend for desert kangaroo rat, dark kangaroo mouse and pale kangaroo mouse. Develop conservation plans as needed based on results.

Partnerships

Land owner/manager	Percent
Bureau of Land Management	35.0
Private	23.0
National Park Service	22.0
Department of Defense	6.0
U.S. Bureau of Reclamation	4.0
Tribal Lands	4.0
State of Nevada	2.0

U.S. Fish and Wildlife Service	2.0
Other	2.0

Existing partnerships, plans, and programs

- Blowing Sands Mountains Conservation Assessment and Strategy
- Steamboat Hot Springs Conservation Agreement

Federal Agencies

- Bureau of Land Management
- National Park Service (Lake Mead National Recreation Area)
- U.S. Fish and Wildlife Service
- Department of Defense (Fallon Naval Air Station)

State Agencies

- Nevada Department of Wildlife
- Nevada Division of Forestry

Other Key Partners

- The Nature Conservancy
- Fallon Paiute Shoshone Tribe
- Walker River Paiute Tribe
- University of Nevada, Reno (Biological Resources Research Center)
- Counties

Preliminary Focal Areas

Blowsand Mountains	Black Mountains Area-Muddy River Drainage
Crescent Dunes	Las Vegas Wash
Sand Mountain	Moapa Valley
Silver State Sand Dunes	Saint Thomas Wash
Big Dune	Sheep Range

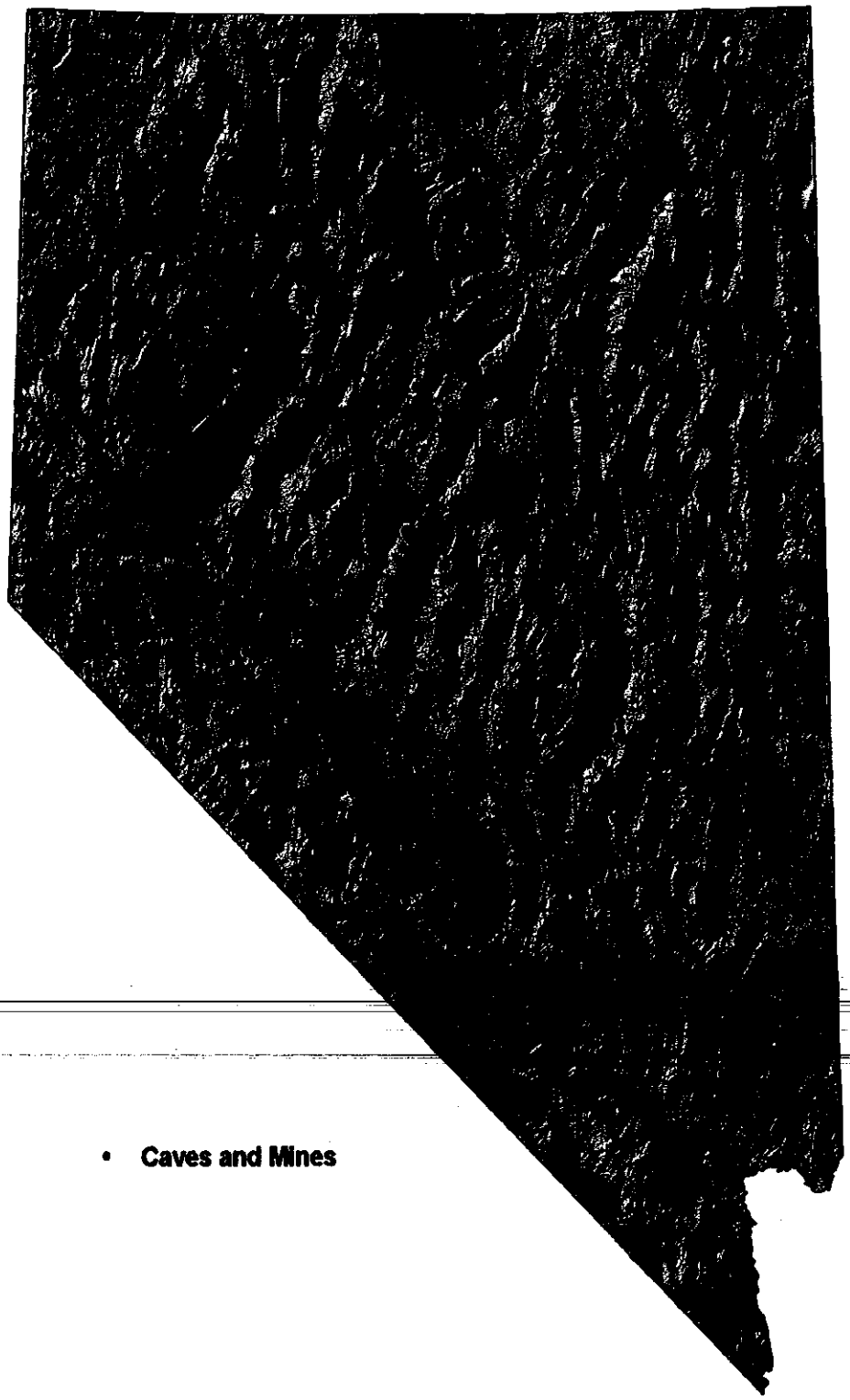


Figure 31. Distribution of Caves and Mines in Nevada (data source: Geographical Name Information System).

Key Habitat: Caves and Mines

Ecoregions

Caves and mines are found in all four 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 habitats range in elevation from 150 m (492 ft) along the Colorado River to near 4,000 m (13,123 ft) on Boundary and Wheeler peaks in northern Nevada and can be simple or complex. In complex systems, warm air traps or "bald headed raises" can vary from -7 to -1°C (20 to 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 house 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.

Cave, shaft and adit habitats range from the simple to the complex in terms of their structure and the variety of habitats they offer to wildlife. 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; J. Newmark, Nevada Natural Heritage Program, personal comm., June 2005).

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 of Importance to Wildlife

Roosting

Allen's big-eared bat	**spotted bat**
big free-tailed bat	**Townsend's big-eared bat**
California leaf-nosed bat	**western small-footed myotis**
cave myotis	**Black Rosy-finch**
fringed myotis	**Gray-crowned Rosy-finch**
little brown myotis	

Denning/Thermoregulation

ringtail	**desert tortoise**
banded Gila monster	**Sonoran lyre snake**

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). In the early 1990s, it became apparent that permanent, hard-closure techniques had been used to close shafts in Nevada with little regard to bat populations inside the structures. In the last few years, successful efforts among federal and state entities and bat scientists have increased interagency communication and the recognition that bats should be accounted for in abandoned mine closure programs (Bradley et al. 2004).

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 roost 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 waken 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.

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 leking sites.
- Population status and trend of Black Rosy-finch
- Population status, distribution, and wildlife/habitats relationships for ringtail
- Population status, distribution, and ecology of banded Gila monster

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: Maintain or manage for undisturbed wildlife nesting and roosting, including hibernacula, maternity, staging, and/or leking sites in cave and mine habitats.

Action: Properly evaluate 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 wildlife species associated with caves and mines in Nevada.

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.

Action: Adopt conservation objectives and implement actions for cave and mine species outlined in the existing Nevada Bat Conservation Plan, and adaptively manage to include future conservation planning efforts.

Partnerships

Land management/ownership breakdown 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

- 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 Agencies

- Bureau of Land Management
- U. S. Forest Service
- National Park Service

State Agencies

- Nevada Department of Wildlife
- Nevada Division of Mines
- Nevada Natural Heritage Program

Other Key Partners

- Counties

Preliminary Focal Areas

Focal areas will be developed for this key habitat type as part of Phase II implementation.

AQUATIC SPECIES

All known extant aquatic wildlife species (fish, amphibians, mollusks, crustaceans) are listed in the Plan (see Appendices B through E and H). All but insects were subject to the aquatic ranking process described in Appendix A, and most were assigned to Tiers 1 through 4 (those with minimal data were unranked). Those in Tiers 1 and 2 were classified as Species of Greatest Conservation Priority. The SGCP aquatic species are identified in each key habitat as are goals, objectives, and actions key to their conservation.

The vast majority of Nevada's federally listed species are aquatic (fishes), and these listed species naturally rise to the top as aquatic species of greatest conservation priority (ASGCP). Therefore, there are species that are not included in ASGCP that nevertheless are of conservation concern, either because of a dearth of information regarding their conservation status, or because current conservation efforts need to be continued to keep their status from deteriorating (the latter were given "Stewardship" status).

All extant native aquatic wildlife species (Tiers 1 - 4, Stewardship, and unranked) will be addressed in more detail in NDOW's Native Aquatic Wildlife Plan that is currently under development. That plan will tier off the CWCS, and will include much more detail on proposed management of Tier 3 & 4 aquatic species and those lacking enough data to be ranked. Aquatic insects, which are not under NDOW's jurisdiction, will not be addressed under that plan, but are for the most part included in area management plans (e.g. Ash Meadows species). In addition, NNHP provides location information to conservation, planning, development, land management, and research entities.

It is important to acknowledge that although many species did not get included in the two highest tiers because their conservation needs were deemed less than the listed species, by their very nature all aquatics are the most closely tied of all Nevada's wildlife to its most threatened resources, water. Most are impacted by the same factors that have caused so many Nevada fish species to become listed. Many of these species lack sufficient information to determine their true conservation need, and need further evaluation in order to minimize the potential that they will also someday be listed.

Given the current limited funding available even for Nevada's listed species, limited activities are targeted specifically to aquatic Tier 3 and 4 and unranked species. Key habitat strategies are intended to provide some level of protection for these species, but their conservation status still needs to be evaluated periodically to determine if protection is being achieved. For some of these species there is such a dearth of information that some targeted information gathering is required to even begin to determine status. Some of these species exist in habitat niches that may not be sampled during standard surveys for priority species and/or may not be easily detected using standard sampling gear and methods.

Brief descriptions of plans for acquiring information about species for which adequate abundance and/or distribution data is unavailable are included below by species group along with more detailed descriptions for species of conservation priority.

Fishes

Significant conservation planning efforts exist for fishes in Nevada, although the majority of these are focused on species which are already under Federal or State protected status. This does mesh well with the focus of priority conservation species in the CWCS effort as there is a close parallel between existing protected status and high conservation need ranking in the species evaluation process for fishes. As would be expected from the typically sporadic and isolated distribution of aquatic habitats and associated fish species assemblages in Nevada's arid environment, conservation planning for aquatic species tends to be focused on individual species or assemblages, and their discrete and spatially isolated habitats, which is in contrast to the more regional approach which can be taken for some terrestrial species groups such as land birds. Although there are significant similarities in the threats and stressors to fishes across the state, such as invasive species and habitat alteration, which has allowed some commonalities between these individual conservation planning efforts, there has been little ability or need to link these efforts into larger regional approaches because of the uniqueness of conservation requirements for each aquatic system and species assemblage. However, the majority of these efforts share key partners and participants, which has encouraged the exchange of information and strategies across species and habitats to the benefit of individual conservation efforts. An important output of the Nevada CWCS in this regard is its focus on key habitats and the need for coherent and implementable statewide partnership based strategies for habitat protection and restoration. To the extent that this strategy approach will encourage broad based benefits to aquatic habitats, existing and future individual fish conservation efforts will be enhanced.

Endemic Fishes

Setting Conservation Objectives

For the majority of fish species of conservation need, conservation objectives are defined at some level by existing recovery plans and documents, or have been developed by individual recovery teams or partnership-based recovery implementation teams (RITs). For many of these species, recovery plans produced by the FWS are outdated or do not provide a level of detail adequate to direct recovery and conservation implementation, and individual RIT teams and working groups have developed recovery implementation plans and ecosystem conservation strategies which address priority conservation needs encompassing, where feasible, the full species assemblages within aquatic habitats where the priority species occur. Some gaps do occur in this coverage of available conservation planning, primarily due to limits on existing funding to support planning efforts, but to the extent that this guidance is available the Nevada CWCS is linked to and defers to those existing efforts for species- or system-based conservation objectives. Where adequate conservation planning does not yet exist, the development of partner-based RIT and working groups and the formulation of those conservation strategies is a key action captured within the CWCS aquatic key habitat descriptions.

Project Development and Implementation

Specific conservation actions are identified in existing recovery and conservation planning for the majority of fish species of conservation need, where they are included under existing Recovery Team, RIT and conservation working group processes. An important element of these ongoing efforts has been the attempt to focus where feasible on actions and strategies to address threats and stressors affecting species assemblages and habitats on a broader system level, such as habitat fragmentation and invasive species, which will maximize benefits to a wide variety of endemic fishes rather than just select individual species of highest concern. Nevada CWCS key habitat sections for aquatic habitat types also identify important areas of focus for needed conservation actions, and in some cases identify gaps in this coverage where additional future efforts are needed to develop a structure for project definition and implementation, particularly for species or species assemblages and habitats which are not well covered by these existing conservation processes.

Monitoring, Adaptive Management and Partnerships

Monitoring programs are in place for the majority of fish species of conservation need, generally conducted as status and trend assessments on an annual or

biennial basis using methods and protocols developed by NDOW or partner working groups on an individual species or assemblage basis. Where gaps exist in this monitoring network, strategies to develop additional system-based conservation implementation teams are intended to address this deficiency. These implementation groups also serve a critical role by periodic, generally at least annual, review of conservation activities and status which provides an adaptive process to modify implementation actions and strategies for species efforts as required.

Existing partnerships for fish conservation efforts, although largely subdivided into individual working RITs and sub-groups by the unique and isolated distribution of aquatic habitats and their associated species assemblages, are significant and broad based. Although leadership for individual conservation programs varies, with FWS responsible for formal recovery team processes and RIT teams mostly under the guidance of NDOW, federal agencies including BLM, the US Forest Service, and USGS-BRD, and state and local partners including NNHP, conservation organizations and landowners play key roles on individual teams, particularly for the design and review of conservation strategies and in the implementation of conservation actions.

Nonnative Sport Fishes

Planning for important nonnative sport fisheries is similarly well advanced, although this is focused primarily on the development and implementation of Fisheries Management Plans developed for individual waters or species. These documents emphasize development of specific management actions and direction to manage important sport fisheries under a framework of management emphasis as trophy waters, general and urban fisheries, or other categories defined by fishery potential and public demand and desires. Of particular importance in Nevada is the integration of planning for native endemic and nonnative sport fish resources. Historic ignorance of the potential conflicts between these resources has significantly and negatively impacted Nevada's endemic sport and non-game fishes. Current fisheries management planning processes insure that potential conflicts will be minimized and allow more effective management of sport fish resources in companion with the aggressive implementation of essential conservation actions for endemic fish species.

Amphibians

Although interest exists for amphibian species at the continental and regional level, through efforts such as the Declining Amphibian Population Task Force and Partners in Amphibian and Reptile Conservation (PARC), these groups serve primarily as a coordination and information-sharing resource rather than as a mechanism to set guidance for conservation actions and objectives. Although some Nevada amphibian species have regional distributions which extend beyond our borders, much like fishes amphibian conservation efforts in Nevada are focused on a local level directed by the isolated distribution of their habitats and the corresponding spatial focus of conservation efforts on individual amphibian population centers. The primary tool used to date to direct and consolidate these efforts has been the development of the Conservation Agreement and Strategy, with four individual CACS documents in place (or near completion) directing individual partner working group conservation efforts for Columbia spotted frog, Amargosa toad, and the relict leopard frog. In part because of a perception of less need for aggressive conservation implementation, which is reflected somewhat in the relative priority ranking of amphibian species through this planning process, other endemic amphibian species in Nevada have received minimal attention for conservation planning. To the extent that those planning needs for additional amphibian species are not addressed in key habitat conservation strategies in this document, identification and implementation of a conservation planning structure for them will need to be developed as part of our CWCS phase II design and implementation.

Setting Conservation Objectives

The four CACS documents for Columbia spotted frog, Amargosa toad and relict leopard frog were developed through a partnership process and define conservation objectives and strategy approaches for those species in substantial detail. Other amphibian species in Nevada do not have similar guidance available other than detailed generically at the key habitat level through this process, and development of appropriate conservation objectives for them will be an important component of

our CWCS phase II process, including completion of a more detailed Native Aquatic Species Plan, and establishment of a northern leopard frog working group and conservation plan.

Project Development and Implementation

Specific conservation actions are identified in the existing CACS documents for included amphibian species, with collaborative work group processes established to direct implementation. Those CACS strategies are relatively recent in development and are undergoing periodic, annual review to determine the need to modify or develop new projects for specific species programs. For other amphibian species of concern, little effort has occurred to develop specific projects or implementation strategies to effect conservation, primarily because of the absence of active conservation processes which include them at a species-specific level. Although some efforts are anticipated addressing conservation needs for the southwestern toad through the Clark County MSHCP, identifying and prioritizing conservation needs at an action level for other conservation need species will be an important output direction from the Nevada CWCS, the Native Aquatic Species Plan (in development), the projected northern leopard frog working group and conservation plan, and subsequent phase II development of this plan.

Monitoring, Adaptive Management and Partners

Structured monitoring programs are in place for those amphibian species included in CWCS programs, but with the exception of southwestern toad through the Clark County MSHCP are limited for other amphibian species to incidental and occasional efforts. Because of this some gaps exist in distribution and status information which makes adequate assessment of conservation status for those amphibians difficult. Addressing those information needs will need to be an important focus of future efforts. Existing conservation efforts (CWCS and CCMSHCP) include a strong adaptive management component with periodic review of conservation efforts and efficacy, but this will need to be included as a component for other species through the development of more structured conservation programs. Significant partnerships already exist for those species included in the CWCS and CCMSHCP processes, including federal and local government partners. Structured monitoring programs for other amphibian species will be addressed during development of the northern leopard frog conservation plan and in the Native Aquatics Species Plan, but implementation of these activities will be dependent on funding availability.

Shellfish

Little documentation or planning currently exists for most native shellfish species in Nevada, with the exception of native aquatic gastropods.

Aquatic Gastropods

Setting Conservation Objectives

The aquatic gastropods have the most complete distribution information of all the aquatic priority conservation species (APCS), though only a fraction of potential habitats have been surveyed. The majority of the APCS gastropods are located on BLM lands. Conservation objectives for those species are defined by "A Guide to Managing, Restoring, and Conserving Springs in the Western United States"; U.S. Dept. of the Interior, BLM Technical Reference 1737-17.

Project Development and Implementation

A working group should be established to contribute expertise, pool data, and develop and implement a management plan for Nevada springs (springs already addressed under other management plans will be noted in the plan).

An inventory and biological evaluation of springs and their condition should be undertaken to provide more complete status information for management planning.

Because many key springs are in a degraded condition, one of the key projects will be to restore degraded springs and associated riparian areas. Identify factors affecting site potential and adjust land uses to allow for natural spring and springbrook recovery

Monitoring, Adaptive Management and Partnerships

These issues will be addressed once the working group is established; an implementation schedule will be developed, including monitoring progress and adapting management as needed. Partners should include at a minimum BLM (the major landowner for aquatic

gastropod habitat), Don Sada, (Nevada aquatic gastropod expert), NDOW, and the US Forest Service, another major landowner.

Bivalves

Setting Conservation Objectives

Less than a dozen records are readily available for native freshwater mussel distribution, although anecdotal and historic records indicate that approximately 6 species occur or have occurred in Nevada. The California floater has a Nevada Natural Heritage Program state ranking of Critically Imperiled and is ranked from Vulnerable to Critically Imperiled throughout its range. It is dependent on fish during an important phase in its life history, and its fate is therefore linked with that of fish and fish habitats. No targeted surveys have been documented for freshwater mussels in Nevada. Conservation objectives will be detailed in the Native Aquatics Species Plan, but the main initial objective is to better determine current distribution.

Project Development and Implementation

Conservation strategies identified for key habitats and for fish that share these habitats are the main emphasis for bivalve conservation given available funding. Other bivalve projects will be designed to improve bivalve sighting information and fish host data. The Northwest Freshwater Working Group is developing plans, educational programs, and other conservation strategies for freshwater mussels, including the 6 putative Nevada bivalve species. These tools will be used for bivalve conservation project development and implementation in Nevada where possible.

Monitoring, Adaptive Management and Partnerships

Monitoring of the effectiveness of efforts to increase knowledge of bivalve species distribution will be measured through annual assessments of documented records. This feedback will allow for better assessment of conservation status and potential need for intensified conservation planning.

Existing partnerships for bivalve conservation actions are the Northwest Freshwater Working Group. Other potential partners would include land management agencies, other governmental entities, and the general public (through outreach/reporting strategies). Many of the current partnerships for other aquatic species could be extended to include bivalves.

Crustacea

Nevada crustacea can be broken into three major taxa: the classes Malacostraca (crayfish, amphipods, scuds, etc.), Ostracoda (ostracods), and Branchiopoda (fairy, clam, and tadpole shrimp). Most crayfish species found in Nevada are non-native.

Setting Conservation Objectives

No crustacea are currently on the Aquatic Species of Conservation Priority list; there is very little information readily available for native crustacea. The first step therefore will be to learn more about what species occur in Nevada and their distribution so that their conservation status can be evaluated.

Project Development and Implementation

Species experts and potential partners will be determined in large part through literature searches and networking (listserves, etc.). Some experts have already been identified through these processes; they will be consulted to assist with providing life history information and developing a list of conservation concerns.

Monitoring, Adaptive Management and Partnerships

Partnerships will be developed as described above; monitoring and adaptive management strategies may be developed once conservation status is clarified

CWCS Adaptive Management Strategy

It should be evident from the preceding implementation and integration strategies that much of the adaptive management analysis that will occur for CWCS will occur as built-in features of existing plans into which CWCS will be integrated. This leaves only the task of discussing how CWCS itself will be updated and adjusted according to results, changing issues and conditions, and increased knowledge from implementation and research. The Nevada CWCS is designed to be a ten-year plan, so complete evaluation and revision is scheduled to occur on a ten-year

rotation.

Because issues and conditions can change so quickly in natural resource management, the Nevada CWCS Development Team believes a five-year partner review would best serve the Nevada wildlife conservation partnership need to keep its strategy current and on-track. This would likely involve the distribution of a five-year CWCS accomplishment report to the extended wildlife conservation partnership with an invitation to provide comment and feedback to NDOW or the CWCS Implementation Team. Significant changes in conservation challenges, opportunities, or species status would be noted and a directional adjustment suggested if necessary, but full revision of the existing plan would not be invited for another five years.

Since the process for determining Species of Conservation Priority has proven to be much more plastic and difficult to maintain consensus than originally perceived, it is recommended that the Species of Conservation Priority process receive an annual review with opportunity for the species expert groups to check in with new information and perspective. As part of the CWCS Implementation Team, the Nevada Natural Heritage Program would be a key partner in the species prioritization review process. It is possible that new methods for ranking species might be utilized by the process to keep it current with the science of species prioritization.

As habitat inventory and assessment techniques improve, they will be implemented into CWCS at each opportunity. Since its most recent delivery in 2004, however, the Southwest ReGAP habitat inventory is expected to maintain its currency in Nevada throughout most of the first planning period. The supplementation of Southwest ReGAP with the LANDFIRE ecological condition assessment is an exciting prospect, and will give land managers significant analytical power with which to determine appropriate conservation action.

Collaborative Structures for Guidance of CWCS Implementation

As discussed in the "Prioritization" section of this chapter, there are several models of collaborative guidance for CWCS implementation available to NDOW. The next phase of CWCS development and implementation is already on track to be performed by the current CWCS Development (Implementation)Team, and the long-term need for such a close-support team throughout the life of the plan will be assessed as part of that next phase of analysis. It is possible that the individual partners included in the Implementation Team might change from time to time as needs change through the ten-year planning period. As the Team builds support structures to the six major partner planning processes and others, new skills such as meeting facilitation might be necessary.

With regard to the facilitation of partner/stakeholder guidance into CWCS implementation over the life of the plan, agency coordination could easily take place under the auspices of the Nevada Biodiversity Initiative, which receives the participation of all the major land management and wildlife management agencies in the state. To further facilitate input and guidance from the larger partner/stakeholder community, NDOW could choose to commission a standing working group structured similarly to the Governor's Sage Grouse Conservation Team, or it could choose to convene stakeholder meetings at appropriate intervals and events through the planning period. These ultimate oversight structures will be evaluated and a model selected as part of the next phase of CWCS design.

CWCS Outreach Objectives

Nevada's tremendous population growth both strains its natural resources and creates the need for outreach to the burgeoning population. According to the U.S. Census Bureau, Clark County grew by 5.5% in 2002, and 2.6% in 2003, with an average of 6,470 new residents each month in 2003. Demographics show that 56 % of the population is white, 23% are Hispanic, and 8.6 % are African American. New approaches are necessary to communicate with these new audiences and inform them about the challenges facing wildlife and wildlife habitat in their new home state.

Benefits of outreach include:

- Increase in broad-based support for conservation efforts
- Increase in support for public funding mechanisms (including tourism)
- Increased understanding of urgent conservation and human impact issues
- Changes in behavior to preclude negative impacts to wildlife and wildlife habitat

A successfully implemented public outreach program will engender recognition of the value of wildlife as an important quality of life component, enhance public understanding of the interconnectedness of wildlife and the ecosystems upon which they rely, and engender support for wildlife and the programs that support wildlife.

Communications strategies depend upon the outreach need, and would include targeted personal outreach to key groups, mass-media outreach through print, television, and radio, and signage, among others. The following CWCS Outreach Objectives would be addressed:

Habitat Loss/Destruction. Urbanization, population growth, and increased use of Nevada's outdoors put the entire state at risk for habitat loss. As the suburbs expand outward in the northern part of the state, mule deer and black bear habitat has been converted to suburban neighborhoods with highway corridors, and schools. OHV trails in the Duck Creek Basin alone, near Ely, in Eastern Nevada, has increased 65% since 1977, with more than 225 km (140 miles) of new routes in that one area. (Jolynn Worley, personal communication.) Deer, elk, antelope and sage grouse are affected.

In Las Vegas, in the south, suburbs and a burgeoning human population create extensive networks of roads across sensitive desert habitats. Fragile sand dunes, and unique desert hot springs home to endemic fishes and aquatic species found nowhere else in the world, are threatened by development, agricultural uses, and other human activity. Mesquite-catclaw habitat in southern Nevada is disturbed during gravel excavation, affecting burrowing owls, reptiles, and desert rodents, and other wildlife.

Communications to increase understanding of these issues will help gain public support for changes in behavior, and may facilitate increased understanding of wildlife needs as part of local government planning efforts. The identified outreach goals will be:

- Increased public knowledge of the impacts specific activities have upon wildlife and wildlife habitat
- Change behavior to alter OHV use in sensitive areas
- Increased monitoring and input into local government planning processes to support planning for wildlife.

Sensitive Species. Nevada ranks third highest nationwide in the percentage of species at risk, with the fourth highest percentage of fish and third highest percentage of amphibians at risk in the U.S. Clark County, home to 70 percent of Nevada's population ranks second in the nation among US metropolitan counties in number of species imperiled by development. Many residents are completely unaware of the number of animals and lack knowledge in what can be done for these species. More educational programs to familiarize the public with the value of wildlife on the list of species of greatest conservation priority are sorely. As people learn more about the life history and habitat needs of these sensitive species, they'll be more prepared, and more likely to get involved in decisions affecting those species. People need to know the consequences of extinction and what they can do to help prevent it. The following sensitive species and ecosystem issues will be addressed in some detail in the outreach programs:

Endemic Fishes

Razorback Sucker and speckled dace, Virgin River chub and Virgin River spine dace, warm springs pupfish, White River desert sucker

- Increase public knowledge of species life history
- Increase understanding of issues human impacts, from recreation, habitat fragmentation, urbanization, and dewatering have upon the fish species
- Increase understanding of how exotic competitors, such as mosquito fish, guppies, mollies, cichlids affect native habitats and species.

Mollusks and other Aquatic Species

Volunteers and public to provide inputs on mollusk and amphibian populations

Increase awareness of Aquatic Nuisance Species and their impacts on state waters

Increase awareness of issues related to releasing pets and problems with exotic releases

Bats

Spotted bats, Allis Big-eared bat, big free-tailed bat, California leaf-nosed bat, fringed myotis

- Increase understanding and appreciation of bats
- Increase understanding of the importance of mines and caves for bat species
- Build partnerships to support bats and bat conservation in the state
- Support bat education in the schools with video and brochure.

Mesquite/Bosque Ecosystem

- Increase understanding of the value of the mesquite-catclaw environment for a number of ground dwellers including burrowing owl, western diamondback snake and desert tortoise.

Sage Brush Ecosystem

Sage sparrow, sage brush vole, Brewer's sparrow, mule deer, greater sage-grouse.

- Increase public understanding of the value and importance of the sage brush ecosystem.

Wetlands, playas and Springs Ecosystems

- Increase public understanding of the value and importance of wetlands, playas and springs in Nevada.

CWCS Wildlife Education Objectives

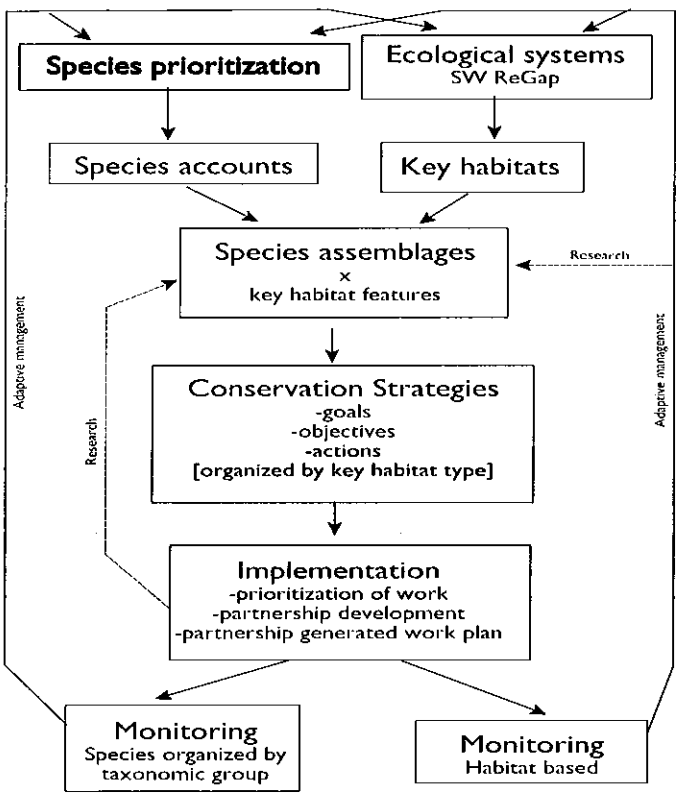
Long–range wildlife education will consist of a comprehensive K-12 public school curriculum designed to form attitudes of responsible wildlife resource stewardship. This effort must start in the primary years with continual reinforcement at each grade level. Currently there are no state statutes or funding mechanisms in place to support conservation education. An appropriate education program must be designed and aligned with the Nevada State curriculum standards, with emphasis on usability for the classroom teacher. The curriculum materials must be constructed so that teachers view it as a tool to help them meet their identified district and state standards rather than another requirement to fit into their day. The goals of this Wildlife Education program are:

- Develop life-long interest in state wildlife, and interest in stewardship ethic
- Increase student understanding of the states' wildlife species and the ecosystem where they live
- Provide opportunities for student use of hands-on wildlife kits that support the scientific method of inquiry
- Produce public school graduates prepared to understand issues and make responsible science-based wildlife management decisions.

Watchable Wildlife CWCS Objectives

A Watchable Wildlife program is a crucial element in the Nevada Department of Wildlife's efforts to inform the people of Nevada about their wildlife resources and, in turn, build support for its conservation. With the rapid influx of an average of nearly 80,000 new residents per year since 1990, according to the 2000 U.S. Census, and over 91 percent of residents living in urban areas, much of Nevada's population is unaware of the area's wildlife, ways to enjoy it, and the impacts they have on it. Therefore, there is a need to offer opportunities for viewing and learning about Nevada's natural wildlife resources. A fully equipped Watchable Wildlife program that enables the public to facilitate their own learning at interpretive trails and information kiosks and viewing platforms. In this way, NDOW could offer additional opportunities to view and enjoy

Species Accounts



This chapter contains an overview of the distribution, life history, and management concerns for each of the Nevada CWCS Species of Concservation Priority. For the most part, the information provided here is Nevada-centric and does not consider life history needs or management concerns that are more germane to species' populations outside of our borders. In a few cases, no published literature specific to a species in Nevada could be found, and so information generated in adjacent states and populations was used, and in these cases the reader will see references to Oregon, California, Utah, etc.

The reptile, amphibian, mammal, and bird accounts are presented in taxonomic order (within taxa) and start with the common name and the scientific name for the species. Fish accounts are listed in alphabetical order by common name. For mammals we followed Baker et al. (2003); for birds we adhered to AOU (2005); Stebbins (1985) provided guidance for amphibians. Order for reptiles was provided by the Nevada Natural Heritage Program, which also helped resolve conflicts in nomenclature for all taxa. The *distribution* identifies the location of the species and focuses on its distribution within the state of Nevada. A *map* is included to illustrate the distribution of each species in the state (for birds, winter range is depicted in light green and breeding range in dark green). *Status and trend* identifies the abundance of the species in the state and the trajectory of the population;

this section relies heavily on ranking approaches and codes that can be obscure to any reader, and so a key to codes follows this introductory material. The *habitat links* section ties each species account back into the ecological systems used to write conservation strategies in the CWCS. The *monitoring* section identifies on-going efforts that address the monitoring of the health of each species. The *research needs* section identifies future actions that should improve our understanding and management of each species. *Existing plans* that incorporate the conservation concerns of particular species are identified. The *approach* material outlines strategies for addressing the aforementioned monitoring, management, and research needs within the planning horizon of the CWCS (ca. 10 years). Finally, a list of references specific to this chapter (and separate from the preceding CWCS chapters) is included at the end of the species accounts.

Much of the information provided here is from NatureServe (2005), an on-line encyclopedia of North American flora and fauna. Where citations were included in NatureServe's accounts they are also incorporated here and relevant reference material listed at the end of this appendix. Appropriate citations are included for any additional reference materials that were consulted to compile this appendix. The species distribution maps were derived from NatureServe (2005) (including Ridgley et al. 2003, Patterson et al. 2003), Stebbins (2003), and Sibley (2000).

Key to Status and Trends Codes

IUCN Global Rankings

The IUCN - The World Conservation Union, through its Species Survival Commission (SSC), has for four decades been assessing the conservation status of species, subspecies, varieties and even selected subpopulations on a global scale in order to highlight taxa threatened with extinction. The IUCN Red List of Threatened Species provides taxonomic, conservation status and distribution information on taxa that have been globally evaluated using the IUCN Red List Categories and Criteria. This system is designed to determine the relative risk of extinction, and the main purpose of the IUCN Red List is to catalogue and highlight those taxa that are facing a higher risk of global extinction.

IUCN Red List categories and their definitions (IUCN 2001).	
Code	**Status**
EX	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
EW	A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
CR	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
EN	A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.
VU	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable.
NT	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
LC	A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
DD	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.
NE	A taxon is Not Evaluated when it is has not yet been evaluated against the criteria.

Federal and State Status Definitions

State Status Definitions

Nevada Department of Wildlife (NDOW) Status

Code	Status
P	Protected

E	Endangered
T	Threatened
S	Sensitive
G	Game
U	Unprotected

Nevada Natural Heritage Program (NNHP) Ranks

Listed below are definitions for interpreting NatureServe global conservation status ranks (G-ranks). These ranks reflect an assessment of the condition of the species or ecological community across its entire range. Where indicated, definitions differ for species and ecological communities.

Basic Rank	Definition
GX	**Presumed Extinct** (species)— Not located despite intensive searches and virtually no likelihood of rediscovery. **Eliminated** (ecological communities)—Eliminated throughout its range, with no restoration potential due to extinction of dominant or characteristic species.
GH	**Possibly Extinct** (species)— Missing; known from only historical occurrences but still some hope of rediscovery. **Presumed Eliminated**— (Historic, ecological communities)-Presumed eliminated throughout its range, with no or virtually no likelihood that it will be rediscovered, but with the potential for restoration, for example, American Chestnut (Forest).
G1	**Critically Imperiled**—At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
G2	**Imperiled**—At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
G3	**Vulnerable**—At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
G4	**Apparently Secure**—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5	**Secure**—Common; widespread and abundant.

Variant Rank	Definition
G#G#	**Range Rank**—A numeric range rank (e.g., G2G3) is used to indicate the range of uncertainty in the status of a species or community. Ranges cannot skip more than one rank (e.g., GU should be used rather than G1G4).
GU	**Unrankable**—Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. Whenever possible, the most likely rank is assigned and the question mark qualifier is added (e.g., G2?) to express uncertainty, or a range rank (e.g., G2G3) is used to delineate the limits (range) of uncertainty.
GNR	**Unranked**—Global rank not yet assessed.
GNA	**Not Applicable**—A conservation status rank is not applicable because the species is not a suitable target for conservation activities.

Rank Qualifiers	Definition
?	**Inexact Numeric Rank**—Denotes inexact numeric rank (e.g., G2?)
Q	**Questionable taxonomy**—Taxonomic distinctiveness of this entity at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or the inclusion of this taxon in another taxon, with the resulting

	taxon having a lower-priority conservation priority.
C	Captive or Cultivated Only–At present extant only in captivity or cultivation, or as a reintroduced population not yet established.

Infraspecific Taxon Conservation Status Ranks

Infraspecific taxa refer to subspecies, varieties and other designations below the level of the species. Infraspecific taxon status ranks (T-ranks) apply to plants and animal species only; these T-ranks do not apply to ecological communities.

Rank	Definition
T#	**Infraspecific Taxon** (trinomial)—The status of infraspecific taxa (subspecies or varieties) are indicated by a T-rank following the species' global rank. Rules for assigning T-ranks follow the same principles outlined above for global conservation status ranks. For example, the global rank of a critically imperiled subspecies of an otherwise widespread and common species would be G5T1. A T-rank cannot imply the subspecies or variety is more abundant than the species as a whole-for example, a G1T2 cannot occur. A vertebrate animal population, such as those listed as distinct population segments under under the U.S. Endangered Species Act, may be considered an infraspecific taxon and assigned a T-rank; in such cases a Q is used after the T-rank to denote the taxon's informal taxonomic status.

Subnational Conservation Status Definitions

Listed below are definitions for interpreting NatureServe conservation status ranks at the subnational (S-rank) levels. The term subnational refers to state or province-level jurisdictions (e.g., Nevada).

Assigning national and subnational conservation status ranks for species and ecological communities follows the same general principles as used in assigning global status ranks. A subnational rank, however, cannot imply that the species or community is more secure at the state/province level than it is globally (i.e., a rank of G1S3 cannot occur). Subnational ranks are assigned and maintained by state programs and conservation data centers.

National (N) and Subnational (S) Conservation Status Ranks	
Status	**Definition**
SX	**Presumed Extirpated**—Species or community is believed to be extirpated from the nation or state/province. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
SH	**Possibly Extirpated** (Historical)—Species or community occurred historically in the nation or state/province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become NH or SH without such a 20-40 year delay if the only known occurrences in a nation or state/province were destroyed or if it had been extensively and unsuccessfully looked for. The NH or SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences.
S1	**Critically Imperiled**—Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
S2	**Imperiled**—Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
S3	**Vulnerable**—Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it

	vulnerable to extirpation.
S4	**Apparently Secure**—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5	**Secure**—Common, widespread, and abundant in the nation or state/province.
SNR	**Unranked**—Nation or state/province conservation status not yet assessed.
SU	**Unrankable**—Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
SNA	**Not Applicable** —A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
S#S#	**Range Rank** —A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).
Not Provided	Species is known to occur in this nation or state/province. Contact the relevant natural heritage program for assigned conservation status.

Federal Status Definitions

U. S. Fish and Wildlife Service (**USFWS**) Categories for Listing under the Endangered Species Act (**ESA**) (**USESA**) (see also http://endangered.fws.gov/Endangered Species Program).

Code	Status
LE	Listed Endangered - in danger of extinction in all or a significant portion of its range
LT	Listed Threatened - likely to be classified as Endangered in the foreseeable future if present trends continue
PE	Proposed Endangered
PT	Proposed Threatened
(PS)	Partial Status: a subspecies or a portion of a taxon's range has listed or candidate status, but not in Nevada.
C	Candidate for listing as threatened or endangered, sufficient data on vulnerability or threats on file
XE	Essential experimental population
XN	Nonessential experimental population
_NL	Not Listed (no status) in a portion of the species' range
RA	Former Candidate or Proposed species; current information does not support proposal to list because species has proven more abundant or widespread, or to lack identifiable threats; still a "species of concern"
RI	Former Candidate or Proposed species; current information does not support proposal to list because species lacks sufficient evidence of vulnerability and threats; still a "species of concern"
xC1	Former Category-1 Candidate, now "species of concern"
xC2	Former Category-2 Candidate, now "species of concern"
_SA	Similarity of appearance species

Bureau of Land Management (BLM) Species Classification

Code	Status
S	Nevada Special Status Species - USFWS listed, proposed or candidate for listing, or protected by Nevada state law
N	Nevada Special Status Species - designated Sensitive by State Office
P	Proposed Nevada Special Status Species - designated proposed Sensitive by BLM State Office
C	BLM California Special Status Species (see definitions S and N)

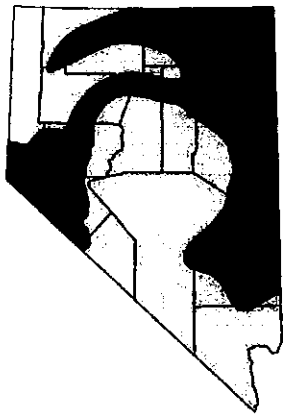
United States Forest Service (USFS) Species Classification

Code	Status
S	Region 4 (Humboldt-Toiyabe NF) sensitive species
I	Region 5 (Inyo NF) sensitive species

W	Region 5 (Inyo NF) watch species
P	Region 5 (Inyo NF or Lake Tahoe) proposed watch or sensitive species
L	Region 5 (Lake Tahoe Basin Management Unit) sensitive species
C	Region 5 sensitive species, not yet known from Inyo NF or Lake Tahoe Basin Management Unit
E	Region 4 and/or Region 5 Endangered species
T	Region 4 and/or Region 5 Threatened species

Northern leopard frog

Rana pipiens



distribution

Broadly distributed in limited and isolated habitats from NV to Northern and

status and trend

Status and trend in NV unknown.

Federal: S NNHP: No

State: Protected IUCN red list: No

habitat links

Marsh, Lakes and Reservoirs, Wet Meadow, Intermountain Rivers and Streams, Springs and Springbrooks.

life history

Inhabits springs, slow streams, marshes, bogs, ponds, canals, flood plains, reservoirs, and lakes; usually permanent water with rooted aquatic vegetation. In summer, commonly inhabits wet meadows and fields. Takes cover underwater, in damp niches, or in caves when inactive. Overwinters usually underwater.

Eggs are laid and larvae develop in shallow, still, permanent water (typically), generally in areas well exposed to sunlight. Generally eggs are attached to vegetation just below the surface of the water. The time of egg deposition varies with latitude and elevation. In NV, eggs are probably laid mainly in early spring at low elevations, in late spring in the mountains. Breeding often peaks when water temperatures reach about 10 C. At a particular site, egg deposition generally occurs within a span of about 10 days. Egg masses include several hundred to several thousand ova. Aquatic larvae usually metamorphose in summer, may overwinter in some areas. Females are sexually mature usually in two years in most areas, three years in high elevation populations. Density of egg masses often reaches a few hundred per ha in favorable habitat, sometimes >1000/ha (24,710 acres).

management concerns

Populations in NV have declined in some areas due to habitat loss and degradation, overexploitation, interactions with non-native species, and unknown causes, although little data is available to determine historic distribution and status to provide a baseline for comparison. Threats include habitat loss, commercial overexploitation, and, in some areas, probably competition and predation by bullfrogs or other introduced species. Exposure to pH 5.5 or lower increases vulnerability to bacterial infection (Simon et al. 2002).

monitoring

Humboldt-Toiyabe National Forest in partnership with NV Department of Wildlife.

research needs

Better understanding of long-term population trends is needed, as is a better understanding of the distribution of the species on all lands in the state. Additional monitoring is needed of northern leopard frog occupied and potential habitats on BLM and private lands.

existing plans

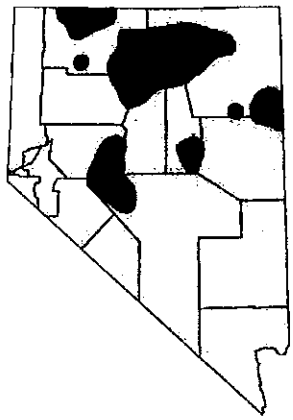
PARC A & R HMG-4.

approach

Continue to monitor primarily through Forest Service - NDOW partnership. Long-term goal should also include education, support, and mechanism for citizens to provide location records. Inventory and map suitable habitat. Develop landscape-scale conservation plan.

Columbia spotted frog

Rana luteiventris



distribution

Isolated populations in Elko, Eureka, Nye, Lander counties (Great Basin DPS), and White Pine County (West Desert DPS). NV includes two subpopulations of the Great Basin population (Northeastern Nevada and Toiyabe subpopulations). They are listed separately on tables in the appendices because of differences is management needs, but are combined in this species account.

status and trend

Status and trend in NV unknown.

habitat links

Intermountain Rivers and Streams, Wet Meadows, Springs and Springbrooks,

life history

Highly aquatic; rarely found far from permanent quiet water; usually occurs at the grassy/sedgy margins of streams, lakes, ponds, springs, and marshes. May disperse into forest, grassland, and brushland during wet weather, and may traverse uplands to reach wintering sites (Pilliod et al. 2002). Uses stream-side small mammal burrows as shelter (Blomquist and Tull 2002). Overwintering sites in the Great Basin include undercut stream banks and spring heads (K. Hatch, pers. comm., cited by Blomquist and Tull 2002). Breeds usually in shallow water in ponds or other quiet waters. In the Toiyabe Range in NV, Reaser (2000) captured 887 individuals over 3 years, with average mid-season density ranging from 2 - 24 frogs/150 m (492 ft) of habitat. Reaser (1996; in Koch et al. 1997) determined that one individual of *R. luteiventris* traveled over 5 km (3.1 miles) in a year. Though movements of up to 6.5 km (4 miles) have been recorded, these frogs generally stay in wetlands and along streams within 1 km (0.6 miles) of their breeding pond (Turner 1960, Hollenbeck 1974, Bull and Hayes 2001, Pilliod et al. 2002). Frogs in isolated ponds may not leave those sites (Bull and Hayes 2001).

management concerns

Disjunct populations in the Great Basin are declining and face major threats, including habitat loss/degradation (especially dewatering), exotic species, and possibly global climate change; the Great Basin population is a candidate for Federal listing (Federal Register, 7 May 1993, 2 April 1998). In the Toiyabe Range, demographic parameters exhibited significant spatial and temporal variation, some of which likely was due to extreme variations in annual weather patterns (Reaser 2000). Great Basin population has been adversely affected by habitat degradation resulting from mining, livestock grazing, road construction, agriculture, and direct predation by non-native wildlife including bullfrogs and fishes. In central Navada, introduction of exotic trout and amphibians, and cattle are likely the most important anthropogenic factors limiting the distribution and persistence of *R. luteiventris* (Reaser 2000). Water development could lower water tables and adversely impact spring habitats. The Conservation Agreement and Strategies identify specific threats to both the Northeast and Toiyabe subpopulations (NDOW 2003a, 2003b).

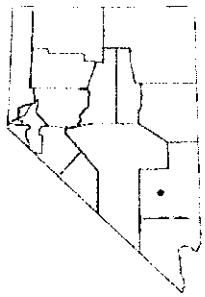
monitoring

Two separate Conservation Agreement and Strategies (CAS) have been written for the Northeast and Toiyabe subpopulations (NDOW 2003a, 2003b). Both CAS have identified developing long-term monitoring plans. A long-term monitoring plan was completed and implemented in 2004 for the Toiyabe subpopulation. Smaller efforts have been conducted in Northeast NV since 1998.

research needs

Range-wide population inventories to determine abundance and distribution, esp. in eastern NV; additional life history information especially hibernicula requirements for overwinter survival; methods for effective habitat maintenance and restoration; effects of livestock grazing. Research needs are assessed on an annual basis by the associated interagency technical teams for the northeast and Toiyabe subpopulations.

existing plans

Pahranagat roundtail chub	*Gila robusta jordani*
distribution Restricted to Ash Spring outflow, Pahranagat Valley, Lincoln County, NV.	
habitat links Mojave rivers and streams, springs and springbrooks.	
status and trend Federal: Endangered NNHP: T1QG2G3 S1 State: Endangered IUCN red list: No	

life history

Primarily eat drifting invertebrates, but also occasionally consume food off the bottom. They eat some plant material and rarely eat other fish. Spawning typically occurs in late January and peaks in early to mid-February. Water temperatures during this period range from 17-24 C (63-76 F). Areas up to 3 feet deep with gravel substrate and relatively swift flows are used. Each spawning female may be attended by a group of 2 - 10 males. Spawning occurs intermittently over several days. The eggs are broadcast and drop into spaces between the rocks. Larvae swim-up in approximately 28 days. They likely live from 3 - 5 years.

management concerns

This subspecies is restricted in distribution in the wild to a single location on private land; access for monitoring has been prohibited since 2001 so current status is unknown; managed refuge populations exist on public land in Pahranagat Valley and at Dexter NFH, New Mexico. Historically occurred in outflow systems at Hiko and Crystal springs prior to their alteration. Downstream alterations of existing habitats have restricted available habitat and distribution in the Ash Spring outflow system, thermal loading from spring discharge in summer months impacts habitat suitability, existing agricultural practices have likely negative effects on flows and temperatures in occupied habitat, competition exists from nonnative species including mollies and cichlids, potential threats from proposed future groundwater development..

monitoring

Monitoring was conducted semiannually until 2001; landowner restrictions have precluded any survey or monitoring activities since then and current status in the wild is unknown. To prevent extinction of the species, a refugium population was created on public lands in the native range of the Pahranagat Valley.

research needs

Taxonomic status needs to be clarified. Additional life history and habitat relationship information is needed to assist in restoration of historic unoccupied habitats.

existing plans

Recovery Plan for the Aquatic and Riparian Species of Pahranagat Valley; Pahranagat Valley Native Fishes Management Plan.

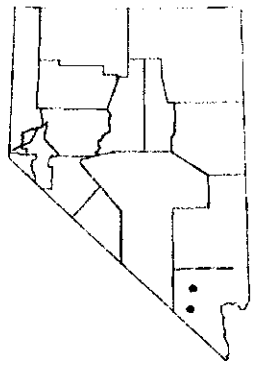
approach

Pahranagat Valley Native Fishes Recovery Implementation Team (RIT) meets semi-annually to review conservation status and actions and coordinate activities. RIT team implements Pahranagat Valley Native Fish Management Plan (NDOW 2000) which identifies key goals/objectives/actions. A refuge population was established at Key Pitman WMA in Pahranagat Valley in 2004 using captive fish from Dexter NFH. Priority actions include development of agreements with landowners to gain access to the existing wild population and allow restoration of historic unoccupied habitats.

Pahrump poolfish	*Empetrichthys latos*

distribution

Extirpated from native range in three springs in Pahrump Valley, NV; stable introduced populations now exist at three refuge sites in Clark and White Pine Counties.



habitat links

Springs and springbrooks.

status and trend

Federal: Endangered NNHP: T1G1 S1

State: Endangered IUCN red list: No

life history

Shallow warm springs (Lee et al. 1980). Alkaline mineral springs and outflow streams (Matthews and Moseley 1990). In natural habitat, larger individuals frequented more open deeper waters, young were in shallower more weedy areas (Kobetich et al. 1980). Females move to remote areas of springs during the breeding periods (Kobetich et al. 1980). Apparently spawns at any time of year, but spawning activities peak in the spring (probably March-April). In transplanted populations young appear more active during the day, adults appear more active at night (Kobetich et al. 1980). Inactive in winter and early spring (USFWS 1993).

Originally restricted to three separate springs in Pahrump Valley, southern Nye County, NV; now exists only outside the Pahrump Valley (Page and Burr 1991). Formerly occurred in Raycraft Ranch Spring (subspecies *concavus*) and Pahrump Springs (subspecies *pahrump*). Subspecies *latos*: extirpated in its native habitat at Manse Ranch Spring (dewatered). In the early 1990s, transplanted populations of subspecies *latos* occurred at three locations: Corn Creek Springs on the Desert National Wildlife Refuge, Clark County; Shoshone Springs (Ponds), Spring Valley, White Pine County (on BLM's Shoshone Ponds Natural Area); and an irrigation reservoir, fed by Sandstone Spring, at Spring Mountain State Park, Clark County (Minckley et al. 1991, USFWS 1993). All are on public lands.

management concerns

Pahrump Ranch poolfish (*E. l. pahrump*) and Raycraft Ranch poolfish (*E. l. concavus*) are now extinct due to desiccation of their native springs from groundwater pumping and modifications to springheads. Pahrump poolfish (*E. latos*) was extirpated from its natural, native habitat due to the desiccation of the springs as a result of groundwater pumping for irrigation. They now occur only in refugium populations located on public lands. The three extant refuge populations ar relatively secure but could be threatened by proposed groundwater development actions at Corn Creek Springs and Shoshone Ponds. Additional concerns include predation and competition from exotic fishes and amphibians and encroachment of vegetation at Spring Mountain Ranch and Shoshone Ponds The potential to re-establish this species within its native range is limited due to the loss or severe alteration of all historic habitats in Pahrump Valley.

monitoring

Population and status monitoring. is completed annually by NDOW at all three locations.

research needs

Additional life history information to assist in management of refuge environments.

existing plans

Recovery Plan Pahrump Killifish; Spring Mountain Ranch HCP.

approach

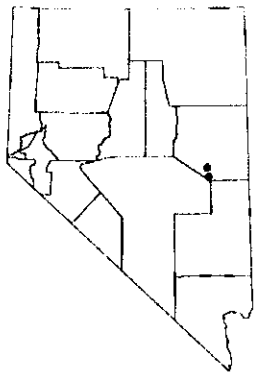
The Corn Creek refuge was reconstructed in 2003 and is managed jointly by NDOW and USFWS. Genetic management protocols have been developed and implemented for the three refuge sites. Management emphasis at the Spring Mountain Ranch and Shoshone Ponds sites is on monitoring for and control of introduced competitors and predators, and actions

to insure long-term maintenance of aquatic habitat quality.

Preston White River springfish	*Crenichthys baileyi albivallis*

distribution

Restricted to thermal spring systems in upper White River Valley, White Pine County, NV.



habitat links

Springs and springbrooks.

status and trend

Federal: None NNHP: T1G2 S1

State: Protected IUCN red list: VU D2

life history

Vegetated warm springs and their outflows and marshes (Minckley et al. 1991). Able to survive extremes in temperature and dissolved oxygen. Temperature and minimum oxygen values vary considerably among spring habitats, from 21 C (69.8 F) and 3.3 ppm oxygen at Preston Big Spring to 37 C (98.6 F) and 0.7 ppm at Mormon Spring. Spawns in warm summer months. Apparently 10-17 eggs constitute a spawning; eggs are laid and fertilized one at a time. Incubation lasts 5-7 days. This subspecies occupies the coolest headwater spring and outflow/springbrook habitats of any of the White River springfish.

management concerns

Distribution and abundance of this subpecies have declined since 1981 and it now occurs in only 4 of 6 spring systems where it historically occurred. The rangewide total population was estimated at < 5,000 individuals in 1999 (Scoppettone and Rissler 2002). Primary impacts have been from alteration, fragmentation and loss of spring and outflow habitats, loss of connectivity between these habitats, and the introduction of nonnative competitors and predators. Potential future threats exist from proposed ground and surface water development projects. The majority of locations for this subspecies are on private lands which are not included under any type of agreements or easements which would assure long-term security and protection.

monitoring

Semi-annual monitoring is conducted at Indian Spring but other locations are not included in scheduled monitoring activities

research needs

Mechanisms for restoring historic habitat while meeting existing water delivery needs and protecting existing populations need to be researched and implemented using an adaptive management approach.

existing plans

White River Native Fishes Management Plan; Indian Spring CCAA.

approach

Conservation actions are reviewed and implemented through the White River Native Fishes RIT which meets semi-annually. The White River Native Fishes Management Plan (NDOW 2001) provides management guidance. Current efforts are focused on the restoration and enhancement of habitats, control of nonnative predators/competitors, and developing agreements with private landowners to insure access to all extant populations and long-term protection and management of occupied habitats. A more comprehensive scheduled monitoring strategy is needed to gauge success of conservation efforts. (Scoppettone and Rissler 2002). NDOW is developing a Programmatic Candidate Conservation Agreement with Assurances to assist in the development of landowner agreements for private land conservation.

aquatic gastropods

Pyrgulopsis sp.

Tryonia sp.

Assiminea infima

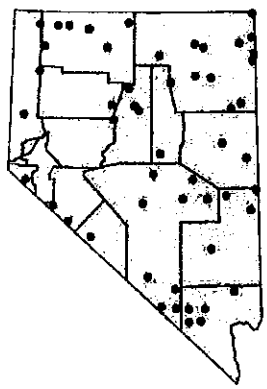
Fluminicola sp.

Juga interioris

Eremopyrgus eganensis

distribution

Highly localized across NV.



status and trend

Federal: NNHP:

State: IUCN red list:

habitat links

Springs and Springbrooks.

life history

Pyrgs are a remarkable remnant of episodes in the Great Basin's history when extensive waterways covered the area. During the past two million years, these high water stands occurred at roughly 100,000-year intervals, with the lakes and rivers rising for the last time about 13,000 years ago. Each time the region dried up, pyrgs and other aquatic species were stranded in isolated colonies, surviving only within the sharply defined boundaries of the small springs, seeps, and wetlands. When large lakes and rivers disappeared, the salts and minerals of the local soils, and the geochemistry and geothermal aspects of the surviving aquifers, concentrated their influence on the small, residual ecosystems. As the isolated springsnail populations adapted to the conditions of each inhabitable water source, an inevitable process of evolution created the multiple species being discovered continually today. (Doherty 2002). Very little is known about the life history of NV's pyrgs.

management concerns

Pyrgs are highly susceptible to extinction because the entire population of any single species is usually tied to a single spring. Such sites may be no more than a few square meters and easily destroyed by water diversion, capping, groundwater pumping, invasive or exotic species, development, or trampling by livestock.

monitoring

research needs

Additional spring surveys are needed to assess the presence or absence of pyrgs and to fully describe the taxonomy and biogeographical features of this genus. Little is known about the life history of each species, and much basic biology remains to be done.

existing plans

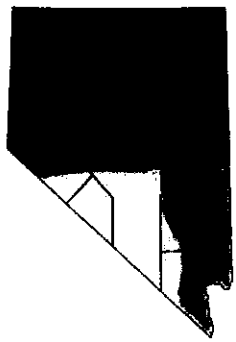
approach

In 1998, 6 federal land management and resource agencies, along with the Smithsonian Institution and The Nature Conservancy, signed a Memorandum of Understanding to work to conserve the nearly 100 species of pyrgs in habitats on federal and Nature Conservancy lands in the Great Basin. The agencies and involved scientists are working to identify

threatened habitats and raise the awareness of a broad range of springs stakeholders throughout the West. (Doherty 2002). An effort needs to be made to develop productive working relationships with private landowners and to help these landowners meet their needs while managing springs to the maximum benefit of these species.

Greater Sandhill Crane

Grus canadensis tabida



distribution

Breeds in northeastern, east-central, and western NV. Also congregates in large numbers in migration in eastern NV.

status and trend

Ca. 650 birds; trend is increasing.

Federal: None NNHP: G5T4

State: S3b IUCN red list:

habitat links

Grasslands and Meadows, Marshes, Intermountain Rivers and Streams, Agricultural Lands.

life history

Open grasslands, marshes, marshy edges of lakes and ponds, river banks (Terres 1980). Nests on the ground or in shallow water on large marshes, bogs, fens, or wet forest meadows. Exhibits high fidelity to breeding territories (see Littlefield 1995). Roosts at night along river channels or natural basin wetlands. Often feeds and rests in fields and agricultural lands.

Feeds on roots, tubers, seeds, grain, berries, small vertebrates (mice, lemmings, birds, snakes, lizards, etc.), earthworms, and insects. Forages in marshes, meadows, pastures, and fields (Terres 1980). Most food items are obtained on the surface of the ground or among low vegetation; also may use bill to dig out roots and tubers. Feeding in fields occurs primarily in non-breeding areas. Young forage for invertebrates during first few weeks of life.

Both sexes, in turn, incubate usually 2 eggs 28-30 days. Young are tended by both parents, begin flying at about 2 months, remain with parents until following year. Usually renests if clutch lost or abandoned. Usually only one chick survives to fledging. May pair as early as age 3 years, but more commonly at 5-6 years. Gregarious in winter and in migration. Migratory populations begin moving north late February to mid-March.

management concerns

Threatened by loss and degradation of wetland habitats. Collisions with power lines have been noted as a significant source of mortality in the Rocky Mountains. Breeding populations in parts of NV may be threatened by high levels of nest and chick predation by ravens, coyotes, and raccoons where security cover is lacking. Breeding populations disappear from areas of heavy human use. Some breeding sites are secure and habitat quality appears to be stable or improving, while others are threatened by development (e.g., Carson Valley) and heavy grazing pressure (e.g., Humboldt River in Eureka and Lander Counties). Hunting on wintering grounds in Arizona may disproportionately impact small NV population.

monitoring

Captured by the NV All Bird Count, also counted by some NDOW surveys.

research needs

None identified.

existing plans

Intermountain West Waterbird Conservation Plan. Nevada Partners in Flight Plan. Pacific Flyway Management Plan: Lower Colorado River Population of Greater Sandhill Cranes.

approach

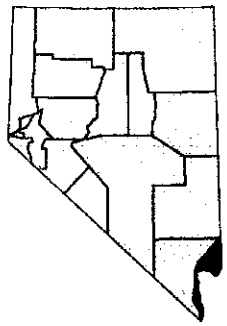
Facilitate the maintenance of open space through community planning and conservation easements where development or intensive agriculture threatens crane habitat. Work with agricultural landowners to manage and maintain nesting and staging areas, including wet meadows and pastures, and to delay haying operations until post fledging. Provide nesting/security cover in nesting areas. Eliminate hunting on the wintering grounds. Some predator control may be

Yuma Clapper Rail

Rallus longirostris yumanensis

distribution

Resident along the Colorado River and its tributaries, southern NV.



status and trend

Estimated 10 pairs; trend unknown.

Federal: E NNHP: G5T3

State: S1 IUCN red list:

habitat links

Marshes, lakes and reservoirs.

life history

Freshwater marshes containing dense stands of cattails and bulrushes (California Department of Fish and Game 1990). Prefers mature stands along margins of shallow ponds with stable water levels (Matthews and Moseley 1990). Generally in freshwater and alkali marshes dominated by stands of emergent vegetation interspersed with areas of open water and drier, upland benches (Biosystems Analysis 1989). Nests probably on dry hummocks or in small shrubs among dense cattails or bulrushes along the edges of shallow ponds in freshwater marshes with stable water levels (Ehrlich et al. 1992). Eats crayfish, small fishes, clams, isopods, and various insects. Probably probes in mud or sand in or near shallow water or picks items off substrate (Ehrlich et al. 1992).

management concerns

Threatened by loss of habitat due to human-caused river flooding, reclamation projects, and mosquito abatement activities (California Department of Fish and Game 1990). Principal threats include habitat loss caused by dredging, rip-rapping of stream banks, and high water flows on the Colorado River. Mitigation projects have negatively impacted some marsh habitats.

monitoring

Focused surveys have been conducted in southern NV under contract by the Southern NV Water Authority, and by Bureau of Reclamation biologists.

research needs

Monitoring needs include regular assessment of populations in the U.S. and Mexico (California Department of Fish and Game 1990). Development and use of a standardized call-count survey is needed.

existing plans

Yuma Clapper Rail Recovery Plan. Lower Colorado River MSCP.

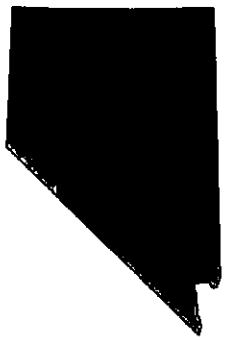
approach

Requires specialized survey technique.

Remove exotic vegetation from rail habitat. Create and enhance rail habitat on state and federal refuges. Implement other recommendations in the 1989 report by the Bureau of Reclamation (California Department of Fish and Game 1990). See also Recovery Plan (1984). Fire may destroy residual mats of vegetation used for nesting and this impact may last several years; thus fire must be used with caution as a habitat management tool.

Long-billed Curlew

Numenius americanus



distribution

Breeds throughout NV north of the Mojave Desert.

status and trend

Population size is unknown; trend is stable.

Federal: None NNHP: G5

State: S3?b IUCN red list: NT

habitat links

Wet Meadows, Agricultural Lands, Grasslands and Meadows.

life history

Arrives in northernmost breeding areas mostly in April (De Smet 1992). Most depart northern part of breeding range by early August. Breeds in grassy meadows, generally near water (AOU 1983). Nests in moist meadows. Nests on ground usually in flat area with short grass, sometimes on more irregular terrain, often near rock or other conspicuous object. In northern UT, nests tended to be in small patches of short vegetation near barren ground (Paton and Dalton 1994). On breeding grounds, activity may begin about a half hour before dawn, ends at dark as birds arrive at roost site (Allen 1980).

Fairly opportunistic. Feeds on various insects (grasshoppers, beetles, caterpillars, etc.). Eats some berries. During migration also feeds on crayfishes, crabs, snails, and toads. Grasshoppers and carabid beetles are dominant in the chick diet in ID (Redmond and Jenni 1985). May obtain insect larvae by probing into loose soil (Allen 1980). Predation on nestling birds has been observed. Picks food from ground or water, probes with bill in sand or mud in or near shallow water, plucks berries.

Clutch size is 3-5; eggs are laid over 4-7 days. Incubation lasts 28-30 days, by both sexes (Redmond and Jenni 1986). Nestlings are precocial. Young are tended by both parents, brooded at night for several days after hatching. Females usually depart when young are 2-3 weeks old; males tend young until fledging at 41-45 days. Age of first breeding probably is 2-3 years for females, 3-4 years for males. One brood per year. Does not renest if clutch is lost. Fledging success is greater for early nesters (Redmond and Jenni 1986). Annual productivity is low. See Allen (1980) for details on nesting and brooding behavior. Often nests in loose colonies. Reported breeding density up to one pair per 24 ha (59 acres); sometimes only one pair per several hundred ha.

management concerns

Reduced productivity is associated with grazing and dragging (to break up cow manure) during nesting, field fertilization, and early season grazing (Cochran and Anderson 1987). Human visitations to nests with eggs may increase probability of egg loss to predators; see Allen (1980) for discussion of responses to human disturbance.

monitoring

This species may be captured by NV All Bird Count (GBBO), but specific area searches of known high quality habitat may also be needed.

research needs

Much research is on-going through the University of Nevada–Reno.

existing plans

Nevada Partners in Flight Plan. US Shorebird Conservation Plan. Intermountain West Shorebird Plan.

approach

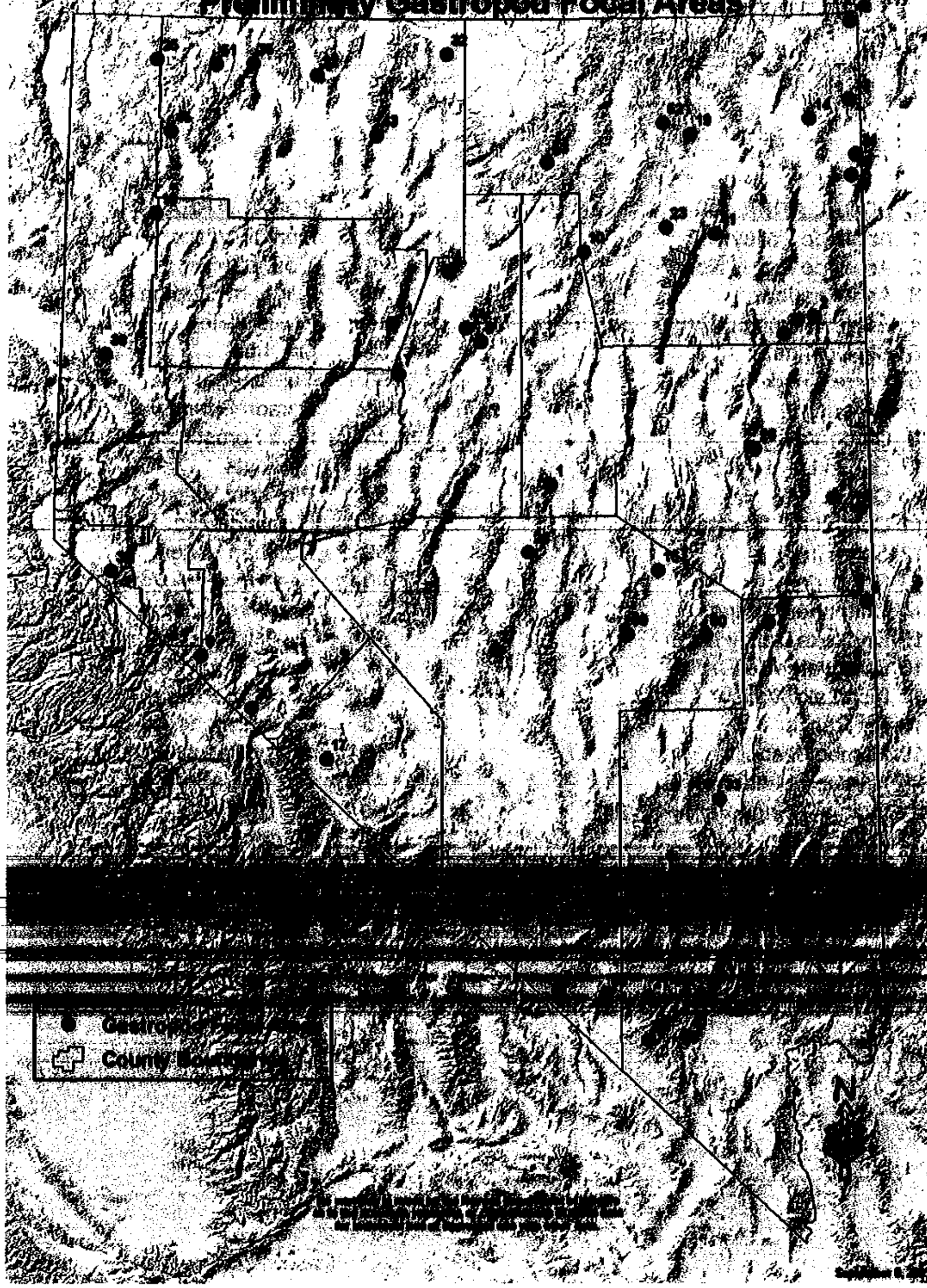
Support on-going research efforts. Work with private landowners to incorporate species' life history requirements into

private land management strategies.

Preliminary Gastropod Focal Areas
Approximate Locations

ID	FOCAL AREA
1	Antelope Valley
2	Antelope Valley North
3	Ash Meadows
4	Battle Mountain Range - South
5	Big Springs
6	Bodie Creek
7	C Spring
8	Camp Valley
9	Carico Lake
10	Carlin
11	Central NV Desert North
12	Corn Creek
13	Crittenden
14	Crittenden Springs
15	Dry Lake Valley North
16	Duckwater/BullCrk
17	Fish Lake Valley
18	Fly Ranch
19	Humboldt snails
20	Huntoon Mtns - South
21	Indian Springs Valley-South
22	Kings River
23	Lamoille Valley
24	McCuistion Spring
25	Mid-Badger Creek
26	Middle Steptoe Valley
27	Monitor - Springs
28	Monitor Valley
29	Mount Salyer
30	Northern Steptoe - Springs
31	Oasis Valley
32	Owyhee
33	Pahranagat
34	Parson Springs
35	Pine Forest Range - East
36	Pinenuts
37	Pleasant Valley
38	Pyramid Lake
39	Railroad Valley
40	Red Rock Canyon
41	Ruby Valley North
42	S. of Jay Creek
43	Santa Rosa - South
44	Shoshone Range West
45	Soldier Meadows
46	Spring Mountains
47	Spring Valley/White Pine
48	Springs Mtns
49	Upper Muddy River
50	Upper White River
51	West Creek
52	WF Beaver Crk
53	Willow Crk

Nevada Comprehensive Wildlife Conservation Strategy
Preliminary Gastropod Focal Areas



Appendix H

CWCS Species List

Taxonomic Groups

Fish		NDOW	NNHP	USFWS (ESA)
Alvord chub	*Gila alvordensis*	P	S2	
Ash Meadows Amargosa pupfish	*Cyprinodon nevadensis mionectes*	P, T	S2	E
Ash Meadows speckled dace	*Rhinichthys osculus nevadensis*	P, E	S1	E
Big Smokey Valley speckled dace	*Rhinichthys osculus lariversi*	P, S	S1	
Big Smokey Valley tui chub	*Gila bicolor ssp. (unnamed)*	P, S	S1	
Big Spring spinedace	*Lepidomeda mollispinis pratensis*	P, T	S1	T
Bonneville Cutthroat Trout	*Oncorhynchus clarkii utah*	G	S1	
Bonytail	*Gila elegans*	P, E	S1	E
Bridgelip sucker	*Catostomus columbianus*	U	S?	
Bull trout	*Salvelinus confluentus*	G	S1	T (Jarbidge Rvr. Pop.)
Chiselmouth	*Acrocheilus alutaceus*	U	S?	
Clover Valley speckled dace	*Rhinichthys osculus oligoporus*	P, E	S1	E
Colorado River speckled dace	*Rhinichthys osculus yarrowi*	U		
Cowhead Lake tui chub	*Gila bicolor vaccaceps*	U	S1	
Cui-ui	*Chasmistes cujus*	P, E	S1	E
Desert dace	*Eremichthys acros*	P, T	S1	T
Desert sucker	*Catostomus clarkii*	U		
Devils Hole pupfish	*Cyprinodon diabolis*	P, E	S1	E
Diamond Valley speckled dace	*Rhinichthys osculus ssp. (unnamed)*	U	SH	
Fish Creek Springs tui chub	*Gila bicolor euchila*	P	S1	
Fish Lake Valley tui chub	*Gila bicolor ssp. (unnamed)*	P, S	S1	
Flannelmouth sucker	*Catostomus latipinnis*	U	S1	
Hiko White River springfish	*Crenichthys baileyi grandis*	P, E	S1	E
Independence Valley speckled dace	*Rhinichthys osculus lethoporus*	P, E	S1	E
Independence Valley tui chub	*Gila bicolor isolata*	P, E	S1	
Inland Columbia Basin Redband Trout	*Oncorhynchus mykiss gairdneri*	G	S2	
Lahontan creek tui chub (Lahontan tui chub, creek form)	*Gila bicolor obesa*	U	S4	
Lahontan Cutthroat Trout - Quinn/Blackrock & Upper Humboldt DPS	*Oncorhynchus clarkii henshawi*	G	S3	T
Lahontan Cutthroat Trout - Western DPS	*Oncorhynchus clarkii henshawi*	G	S3	T
Lahontan lake tui chub (Lahontan tui chub, lake form)	*Gila bicolor pectinifer*	U	S3	
Lahontan redside	*Richardsonius egregius*	U	S5	
Lahontan speckled dace	*Rhinichthys osculus robustus*	U	S5	
Largescale sucker	*Catostomus macrocheilus*	U	S?	
Leatherside Chub	*Snyderichthys copei*	U	S1	
Little Fish Lake Valley tui chub	*Gila bicolor ssp. (unnamed)*	U	S1	
Longnose dace	*Rhinichthys cataractae*	U	SH	
Meadow Valley speckled dace	*Rhinichthys osculus ssp. (unnamed)*	U	S2	
Meadow Valley Wash desert sucker	*Catostomus clarkii ssp. (unnamed)*	P, S	S2	
Moapa dace	*Moapa coriacea*	P, E	S1	E
Moapa speckled dace	*Rhinichthys osculus moapae*	P, S	S1	
Moapa White River springfish	*Crenichthys baileyi moapae*	U	S2	
Monitor Valley speckled dace	*Rhinichthys osculus ssp. (unnamed)*	P, S	S1	
Moorman White River springfish	*Crenichthys baileyi thermophilus*	P	S1	
Mountain sucker	*Catostomus platyrhynchus*	U	S?	

Mountain whitefish	*Prosopium williamsoni*	G	S?	
Newark Valley tui chub	*Gila bicolor newarkensis*	U	S1	
Northern pikeminnow	*Ptychocheilus oregonensis*	U	S?	
Oasis Valley speckled dace	*Rhinichthys osculus ssp. (unnamed)*	P	S1	
Pahranagat roundtail chub	*Gila robusta jordani*	P, E	S1	E
Pahranagat speckled dace	*Rhinichthys osculus velifer*	U	S1	
Pahrump poolfish	*Empetrichthys latos latos*	P, E	S1	E
Paiute sculpin	*Cottus beldingii*	U	S?	
Preston White River springfish	*Crenichthys baileyi albivallis*	P	S1	
Railroad Valley springfish	*Crenichthys nevadae*	P, T	S2	T
Railroad Valley tui chub	*Gila bicolor ssp. (unnamed)*	P, S	S1	
Razorback sucker	*Xyrauchen texanus*	P, E	S1	E
Redside shiner	*Richardsonius balteatus*	U	S?	
Relict dace	*Relictus solitarius*	P, S	S2S3	
Sheldon tui chub	*Gila bicolor eurysoma*	P	S1	
Snake River speckled dace	*Rhinichthys osculus carringtoni*	U		
Speckled dace	*Rhinichthys osculus*	U		
Tahoe sucker	*Catostomus tahoensis*	U	S5	
Tui chub in Dixie Valley	*Gila bicolor ssp. (unnamed)*	U	S1	
Utah chub	*Gila atraria*	U	S?	
Utah sucker	*Catostomus ardens*	U	SU	
Virgin River chub	*Gila seminuda*	P, E	S1	E
Virgin spinedace	*Lepidomeda mollispinis mollispinis*	P, S	S1	
Wall Canyon sucker	*Catostomus sp.*	P	S1	
Warm Springs pupfish	*Cyprinodon nevadensis pectoralis*	P, E	S1	E
Warner sucker	*Catostomus warnerensis*	P	S1	T
Warner Valley Redband Trout	*Oncohrynchus mykiss pop 4*	G	S1	
White River desert sucker	*Catostomus clarkii intermedius*	P	S1S2	
White River speckled dace	*Rhinichthys osculus ssp. (unnamed)*	P	S2S3	
White River spinedace	*Lepidomeda albivallis*	P, E	S1	E
White River springfish	*Crenichthys baileyi baileyi*	P, E	S1	E
Woundfin	*Plagopterus argentissimus*	P, E	S1	E
Yellowstone Cutthroat Trout	*Oncorhynchus clarkii bouvieri*	G	S1	
AMPHIBIANS				
Amargosa Toad	*Bufo nelsoni*	P	S1S2	
Bull Frog - Introduced	*Rana catesbeiana*	U		
Great Basin Columbia Spotted Frog - NE sub-population	*Rana luteiventris pop. 3*	P	S2S3	C
Great Basin Columbia Spotted Frog - Toiyabe sub-population	*Rana luteiventris pop. 3*	P		
Great Basin Spadefoot	*Spea intermontana*	U		
Great Plains Toad	*Bufo cognatus*	U		
Mountain Yellow-Legged Frog	*Rana muscosa*	U	SH	C
Northern Leopard Frog	*Rana pipiens*	P		
Pacific Chorus Frog	*Pseudacris regilla*			
Red-legged frog - Introduced, believed extirpated	*Rana aurora*	U		
Red-spotted Toad	*Bufo punctatus*	U		
Relict Leopard Frog	*Rana onca*	P	S1	C
Southwestern Toad (aka Arizona Toad)	*Bufo microscaphus*	U	S1S2	
Tiger Salamander - Introduced	*Ambystoma tigrinum*	U		
Western Toad	*Bufo boreas*	U		
Woodhouse's Toad	*Bufo woodhousii*	U		
BIVALVES				

California floater	*Anodonta californiensis*	U	S1	
Fingernail clam	*Pisidium*	U		
Oregon floater	*Anodonta oregonensis*	U		
Western pearlshell	*Margaritifera falcata*	U		
Western ridged mussel	*Gonidea angulata*	U		
Winged floater	*Anodonta nuttalliana*	U		
GASTROPODS				
Ancylid, creeping (freshwater limpet)	*Ferrissia rivularis*	U		
Aplexa, lance	*Aplexa elongata*	U		
Fossaria, golden	*Fossaria obrussa*	U		
Fossaria, pygmy	*Fossaria parva*	U		
Gyro, Ash	*Gyraulus parvus*	U		
Hydrobe, Steptoe	*Eremopyrgus eganensis*	U	S1	
Juga, Oasis	*Juga laurae*	U		
Juga, smooth	*Juga interioris*	U	S1	
Marshsnail, mountain	*Stagnicola montanensis*	U		
Marshsnail, wrinkled	*Stagnicola caperata*	U		
Melania, red-rim (Asian snail)- Introduced	*Melanoides tuberculatus*	U		
Pebblesnail, Ash Meadows	*Pyrgulopsis erythropoma*	U	S1	
Pebblesnail, Moapa	*Pyrgulopsis avernalis*	U	S1S2	
Pebblesnail, Pahranagat	*Pyrgulopsis merriami*	U	S1	
Pebblesnail, Pyramid Lake	*Fluminicola dalli*	U	S?	
Pebblesnail, Turban	*Fluminicola turbiniformis*	U		
Pebblesnail, Virginia Mountains	*Fluminicola virginicus*	U	S1	
Physa, desert	*Physella boucardi*	U		
Physa, protean	*Physella virgata*	U		
Physa, Rocky Mountain	*Physella propinqua*	U		
Physa, tadpole	*Physella gyrina*	U		
Physa, twisted	*Physella lordi*	U		
Pondsnail, marsh	*Stagnicola elodes*	U		
Rams-horn, Great Basin	*Helisoma newberryi*	U		
Ramshorn, rough	*Planorbella subcrenata*	U		
Rams-horn, two-ridge	*Helisoma anceps*	U		
Snail, Badwater	*Assiminea infima*	U		
Springsnail, Antelope Valley	*Pyrgulopsis pellita*	U	S1	
Springsnail, bifid duct	*Pyrgulopsis peculiaris*	U	S1	
Springsnail, Big Warm Spring	*Pyrgulopsis papillata*	U	S1	
Springsnail, Butterfield	*Pyrgulopsis lata*	U	S1	
Springsnail, Camp Valley	*Pyrgulopsis montana*	U	S1	
Springsnail, carinate Duckwater	*Pyrgulopsis carinata*	U		
Springsnail, Carlin	*Pyrgulopsis bryantwalkeri*	U	S1	
Springsnail, Corn Creek	*Pyrgulopsis fausta*	U	S1	
Springsnail, Crittenden	*Pyrgulopsis lentiglans*	U	S1	
Springsnail, Crystal Spring	*Pyrgulopsis crystalis*	U	S1	
Springsnail, distal-gland	*Pyrgulopsis nanus*	U	S1	
Springsnail, Dixie Valley	*Pyrgulopsis dixensis*	U	S1	
Springsnail, Duckwater	*Pyrgulopsis aloba*	U	S1	
Springsnail, Duckwater warm springs	*Pyrgulopsis villacampae*	U	S1	
Springsnail, Elko	*Pyrgulopsis leporina*	U	S1	
Springsnail, elongate Cain Spring	*Pyrgulopsis augustae*	U	S1	
Springsnail, elongate Mud Meadows	*Pyrgulopsis notidicola*	U	S1	C
Springsnail, elongate-gland	*Pyrgulopsis isolata*	U	S1	
Springsnail, Emigrant	*Pyrgulopsis gracilis*	U	S1	

Springsnail, Fairbanks	*Pyrgulopsis fairbanksensis*	U	S1	
Springsnail, Fish Lake	*Pyrgulopsis rhinosa*	U		
Springsnail, Flag	*Pyrgulopsis breviloba*	U	S1	
Springsnail, flat-topped Steptoe	*Pyrgulopsis planulata*	U	S1	
Springsnail, Fly Ranch	*Pyrgulopsis bruesi*	U	S1	
Springsnail, Hardy	*Pyrgulopsis marcida*	U	S1	
Springsnail, Hubbs	*Pyrgulopsis hubbsi*	U	S1	
Springsnail, Humboldt	*Pyrgulopsis humboldtensis*	U	S1	
Springsnail, Kings River	*Pyrgulopsis imperialis*	U	S1	
Springsnail, Lake Valley	*Pyrgulopsis sublata*	U	S1	
Springsnail, Landyes	*Pyrgulopsis landeyi*	U	S1	
Springsnail, large gland Carico	*Pyrgulopsis basiglans*	U	S1	
Springsnail, Lockes	*Pyrgulopsis lockensis*	U	S1	
Springsnail, longitudinal gland	*Pyrgulopsis anguina*	U	S1	
Springsnail, median-gland	*Pyrgulopsis pisteri*	U	S1	
Springsnail, Moapa Valley	*Pyrgulopsis carinifera*	U	S1	
Springsnail, neritiform Steptoe Ranch	*Pyrgulopsis neritella*	U	S1	
Springsnail, northern Soldier Meadow	*Pyrgulopsis militaris*	U	S1	
Springsnail, northern Steptoe	*Pyrgulopsis serrata*	U	S1	
Springsnail, northwest Bonneville	*Pyrgulopsis variegata*	U	S1	
Springsnail, Oasis Valley springsnail	*Pyrgulopsis micrococcus*	U	S2	
Springsnail, ovate Cain Spring	*Pyrgulopsis pictilis*	U	S1	
Springsnail, Pleasant Valley	*Pyrgulopsis aurata*	U	S1	
Springsnail, Sada's	*Pyrgulopsis sadai*	U	S1S2	
Springsnail, small gland Carico	*Pyrgulopsis bifurcata*	U	S1	
Springsnail, southeast Nevada	*Pyrgulopsis turbatrix*	U	S2	
Springsnail, southern Duckwater	*Pyrgulopsis anatina*	U	S1	
Springsnail, southern Soldier Meadow	*Pyrgulopsis umbilicata*	U	S1	
Springsnail, southern Steptoe	*Pyrgulopsis sulcata*	U	S1	
Springsnail, Spring Mountains	*Pyrgulopsis deaconi*	U	S1	
Springsnail, squat Mud Meadows	*Pyrgulopsis limaria*	U	S1	
Springsnail, sterile basin	*Pyrgulopsis sterilis*	U	S1	
Springsnail, sub-globose Steptoe Ranch	*Pyrgulopsis orbiculata*	U	S1	
Springsnail, Surprise Valley	*Pyrgulopsis gibba*	U		
Springsnail, Toquerville	*Pyrgulopsis kolobensis*	U		
Springsnail, transverse gland	*Pyrgulopsis cruciglans*	U	S1	
Springsnail, Twentyone Mile	*Pyrgulopsis millenaria*	U	S1	
Springsnail, upper Thousand Spring	*Pyrgulopsis hovinghi*	U	S1	
Springsnail, Vinyard's	*Pyrgulopsis vinyardi*	U	S1	
Springsnail, western Lahontan	*Pyrgulopsis longiglans*	U	S2S3	
Springsnail, White River Valley	*Pyrgulopsis sathos*	U	S1	
Springsnail, Wong's	*Pyrgulopsis wongi*	U	S1	
Tryonia, Amargosa	*Tryonia variegata*	U	S2	
Tryonia, desert	*Tryonia porrecta*	U		
Tryonia, grated	*Tryonia clathrata*	U	S2	
Tryonia, minute	*Tryonia ericae*	U	S1	
Tryonia, Monitor	*Tryonia monitorae*	U	S1	
Tryonia, Point of Rocks	*Tryonia elata*	U	S1	
Tryonia, sportinggoods	*Tryonia angulata*	U	S1	
CRUSTACEA (unranked)				
Alkali fairy shrimp	*Branchinecta mackini* Dexter, 1956	U		
Beaver-tail fairy shrimp	*Thamnocephalus platyurus* Packard, 1877	U		
Colorado fairy shrimp	*Branchinecta coloradensis* Packard, 1874	U		

Common clam shrimp	*Eocyzicus digueti* Richards, 1895	U		
Crayfish - *Pasifastacus gambelii* - no common name	*Pasifastacus gambelii*	U		
Crayfish, *Oronectes* genus	*Oronectes sp.*	U		
Ghost or Glass shrimp	*Palaemonetes paludosus*	U		
Giant fairy shrimp	*Branchinecta gigas* Lynch, 1937	U		
Great Basin fairy shrimp	*Branchinecta dissimilis* Lynch, 1972	U		
Great Basin tadpole shrimp	*Lepidurus bilobatus* Packard, 1883	U		
Herbst's amphipod	*Stygobromus herbsti*	U		
Ligidium sp.	*Ligidium sp.*	U		
Lynch's tadpole shrimp	*Lepidurus lemmoni* Holmes, 1894	U		
Mountain fairy shrimp	*Branchinecta oriena* Belk & Rogers, 2002	U		
Myer's amphipod	*Stygobromus myersae*	U		
Opossum shrimp	*Mysis species 4 (relicta?)*	U		
Playa clam shrimp	*Leptestheria compleximanus* Packard, 1877	U		
Red swamp crayfish	*Procambarus clarkii*	U		
San Francisco brine shrimp	*Artemia franciscana* Kellogg, 1906	U		
Scud, *Gammarus* genus	*Gammarus fasciatus*	U		
Scud, *Gammarus* genus	*Gammarus* sp.	U		
Scud, *Hyalella* genus	*Hyalella sp.*	U		
Setose clam shrimp	*Cyzicus setosa* Pearse, 1912	U		
Signal crayfish	*Pacifastacus leninsculus leninsculus*	U		
Spiny-tailed fairy shrimp	*Streptocephalus sealii* Ryder, 1879	U		
Tahoe cave obligate amphipod (1)	*Stygobromus lacicolus*	U		
Tahoe cave obligate amphipod (2)	*Stygobromus taboensis*	U		
Tahoe endemic ostracod	*Candona taboensis*	U		
Texas clam shrimp	*Eulimnadia texana* Packard, 1871	U		
Trowbridge's signal crayfish	*Pacifastacus leniusculus trowbridgii*	U		
Versatile fairy shrimp	*Branchinecta lindahli* Packard, 1883	U		
Winter fairy shrimp	*Branchinecta hiberna* Rogers & Fugate, 200	U		
Reptiles				
common snapping turtle	*Chelydra serpentina serpentina*	U		
northwestern pond turtle	*Emys marmorata marmorata*	U		
painted turtle	*Chrysemys picta*	U		
Red-eared slider	*Trachemys scripta elegans*	U		
Sonoran mud turtle	*Kinosternon sonoriense*	U		
Texas spiny softshell	*Apalone spinifera hartwegi*	U		
desert tortoise (Mojave Desert pop.)	*Gopherus agassizii*			
Sierra alligator lizard	*Elgaria coerulea palmeri*	P		
southern alligator lizard	*Elgaria multicarinata*			
Panamint alligator lizard	*Elgaria panamintina*			
western banded gecko	*Coleonyx variegatus*			
Mediterranean gecko	*Hemidactylus turcicus*			
banded Gila monster	*Heloderma suspectum cinctum*			
zebra-tailed lizard	*Callisaurus draconoides*			
Great Basin collared lizard	*Crotaphytus bicinctores*			
desert iguana	*Dipsosaurus dorsalis*			
leopard lizard	*Gambelia wislizenii*			
pigmy short-horned lizard	*Phrynosoma douglasii*			
southern desert horned lizard	*Phrynosoma platyrhinos calidiarum*			
northern desert horned lizard	*Phrynosoma platyrhinos platyrhinos*			
greater short-horned lizard	*Phrynosoma hernandesi*			
common chuckwalla	*Sauromalus ater*			
northern sagebrush lizard	*Sceloporus graciosus graciosus*			

desert spiny lizard	*Sceloporus magister*			
western fence lizard	*Sceloporus occidentalis*			
eastern fence lizard	*Sceloporus undulatus*			
western brush lizard	*Urosaurus graciosus graciosus*			
ornate tree lizard	*Urosaurus ornatus*			
side-blotched lizard	*Uta stansburiana*			
western red-tailed skink	*Eumeces gilberti rubricaudatus*			
Skilton skink	*Eumeces skiltonianus skiltonianus*			
Great Basin skink	*Eumeces skiltonianus utahensis*			
western whiptail	*Aspidoscelis tigris*			
common night lizard	*Xantusia vigilis vigilis*			
rubber boa	*Charina bottae*			
glossy snake	*Arizona elegans*			
western shovel-nosed snake	*Chionactis occipitalis*			
western yellow-bellied racer	*Coluber constrictor mormon*			
ringneck snake	*Diadophis punctatus*			
night snake	*Hypsiglena torquata*			
California kingsnake	*Lampropeltis getula californiae*			
Sonoran mountain kingsnake	*Lampropeltis pyromelana*	P		
red coachwhip	*Masticophis flagellum*			
striped whipsnake	*Masticophis taeniatus*			
western leaf-nosed snake	*Phyllorhynchus decurtatus perkinsi*			
Great Basin gopher snake	*Pituophis catenifer deserticola*			
long-nosed snake	*Rhinocheilus lecontei*			
western patch-nosed snake	*Salvadora hexalepis*			
ground snake	*Sonora semiannulata*			
southwestern black-headed snake	*Tantilla hobartsmithi*			
Sierra garter snake	*Thamnophis couchii*			
western terrestrial garter snake	*Thamnophis elegans*			
Mexican garter snake	*Thamnophis eques*			
valley garter snake	*Thamnophis sirtalis fitchi*			
Sonoran lyre snake	*Trimorphodon biscutatus lambda*			
western blind snake	*Leptotyphlops humilis*			
western diamondback rattlesnake	*Crotalus atrox*			
sidewinder	*Crotalus cerastes*			
speckled rattlesnake	*Crotalus mitchellii*			
Mojave green rattlesnake	*Crotalus scutulatus scutulatus*			
Great Basin rattlesnake	*Crotalus viridis lutosus*			
Mammals				
Preble's shrew	*Sorex preblei*			
vagrant shrew	*Sorex vagrans*			
montane shrew	*Sorex monticolus*			
Inyo shrew	*Sorex tenellus*			
water shrew	*Sorex palustris*			
Trowbridge's shrew	*Sorex trowbridgii*			
Merriam's shrew	*Sorex merriami leucogenys*			
Crawford's desert shrew	*Notiosorex crawfordi*			
broad-footed mole	*Scapanus latimanus*			
California leaf-nosed bat	*Macrotus californicus*	P,S		
Mexican long-tongued bat	*Choeronycteris mexicana*			
little brown myotis	*Myotis lucifugus*			
Yuma myotis	*Myotis yumanensis*			
cave myotis	*Myotis velifer*			

long-eared myotis	*Myotis evotis*			
fringed myotis	*Myotis thysanodes*	P		
long-legged myotis	*Myotis volans*			
California myotis	*Myotis californicus*			
western small-footed myotis	*Myotis ciliolabrum*			
silver-haired bat	*Lasionycteris noctivagans*			
western pipistrelle	*Pipistrellus hesperus*			
big brown bat	*Eptesicus fuscus*			
hoary bat	*Lasiurus cinereus*			
western red bat	*Lasiurus blossevillii*	P,S		
western yellow bat	*Lasiurus xanthinus*			
spotted bat	*Euderma maculatum*	P,T		
Townsend's big-eared bat	*Corynorhinus townsendii*	P,S		
Allen's big-eared bat	*Idionycteris phyllotis*	P		
pallid bat	*Antrozous pallidus*	P		
Brazilian free-tailed bat	*Tadarida brasiliensis*	P		
greater western mastiff bat	*Eumops perotis californicus*			
big free-tailed bat	*Nyctinomops macrotis*			
American pika	*Ochotona princeps*			
Nuttall's cottontail	*Sylvilagus nuttallii*			
desert cottontail	*Sylvilagus audubonii*			
Sierra Nevada snowshoe hare	*Lepus americanus tahoensis*			
white-tailed jackrabbit	*Lepus townsendii*			
black-tailed jackrabbit	*Lepus californicus*			
pygmy rabbit	*Brachylagus idahoensis*			
Mono Basin mountain beaver	*Aplodontia rufa californica*			
least chipmunk	*Neotamias minimus*			
Humboldt yellow-pine chipmunk	*Neotamias amoenus celeris*			
Allen's chipmunk	*Neotamias senex*			
cliff chipmunk	*Neotamias dorsalis*			
long-eared chipmunk	*Neotamias quadrimaculatus*			
lodgepole chipmunk	*Neotamias speciosus*			
Panamint chipmunk	*Neotamias panamintinus*			
Hidden Forest Uinta chipmunk	*Neotamias umbrinus nevadensis*	P,S		
Palmer's chipmunk	*Neotamias palmeri*	P,S		
yellow-bellied marmot	*Marmota flaviventris*			
white-tailed antelope squirrel	*Ammospermophilus leucurus*			
Belding's ground squirrel	*Spermophilus beldingi*			
rock squirrel	*Spermophilus variegatus*			
California ground squirrel	*Spermophilus beecheyi*			
round-tailed ground squirrel	*Spermophilus tereticaudus*			
golden-mantled ground squirrel	*Spermophilus lateralis*			
Wyoming ground squirrel	*Spermophilus elegans nevadensis*			
Great Basin ground squirrel	*Spermophilus mollis*			
Colorado Plateau ground squirrel	*Spermophilus canus*			
western gray squirrel	*Sciurus griseus griseus*	P		
Douglas's squirrel	*Tamiasciurus douglasii*	P		
northern flying squirrel	*Glaucomys sabrinus*	P		
Fish Spring pocket gopher	*Thomomys bottae abstrusus*			
San Antonio pocket gopher	*Thomomys bottae curtatus*			
Townsend's pocket gopher	*Thomomys townsendii*			
northern pocket gopher	*Thomomys talpoides*			
mountain pocket gopher	*Thomomys monticola*			

little pocket mouse	*Perognathus longimembris*			
Great Basin pocket mouse	*Perognathus parvus*			
Fletcher dark kangaroo mouse	*Microdipodops megacephalus nasutus*			
Desert Valley kangaroo mouse	*Microdipodops megacephalus albiventer*			
pale kangaroo mouse	*Microdipodops pallidus*	P		
Ord's kangaroo rat	*Dipodomys ordii*			
chisel-toothed kangaroo rat	*Dipodomys microps*			
California kangaroo rat	*Dipodomys californicus*			
Panamint kangaroo rat	*Dipodomys panamintinus*			
desert kangaroo rat	*Dipodomys deserti*			
Merriam's kangaroo rat	*Dipodomys merriami*			
long-tailed pocket mouse	*Chaetodipus formosus*			
desert pocket mouse	*Chaetodipus penicillatus*			
spiny pocket mouse	*Chaetodipus spinatus*			
American beaver	*Castor canadensis*			
western harvest mouse	*Reithrodontomys megalotis*			
cactus mouse	*Peromyscus eremicus*			
deer mouse	*Peromyscus maniculatus*			
canyon mouse	*Peromyscus crinitus*			
brush mouse	*Peromyscus boylii*			
pinon mouse	*Peromyscus truei*			
northern grasshopper mouse	*Onychomys leucogaster*			
southern grasshopper mouse	*Onychomys torridus*			
Arizona cotton rat	*Sigmodon arizonae plenus*			
white-throated woodrat	*Neotoma albigula*			
desert woodrat	*Neotoma lepida*			
Arizona woodrat	*Neotoma devia*			
bushy-tailed woodrat	*Neotoma cinerea*			
black rat	*Rattus rattus*			
norway rat	*Rattus norvegicus*			
house mouse	*Mus musculus*			
heather vole	*Phenacomys intermedius*			
Ash Meadows montane vole	*Microtus montanus nevadensis*	P,S		
Pahranagat Valley montane vole	*Microtus montanus fucosus*			
long-tailed vole	*Microtus longicaudus*			
sagebrush vole	*Lemmiscus curtatus*			
common muskrat	*Ondatra zibethicus*			
western jumping mouse	*Zapus princeps oregonus*			
North American porcupine	*Erethizon dorsatum*			
nutria	*Myocastor coypus*			
coyote	*Canis latrans*			
gray wolf	*Canis lupus*			
Sierra Nevada red fox	*Vulpes vulpes necator*			
kit fox	*Vulpes macrotis*			
gray fox	*Urocyon cinereoargenteus*			
black bear	*Ursus americanus*			
grizzly bear	*Ursus arctos horribilis*			
ringtail	*Bassariscus astutus*			
raccoon	*Procyon lotor*			
American marten	*Martes americana*			
ermine	*Mustela erminea*			
long-tailed weasel	*Mustela frenata*			
American mink	*Mustela vison*			