Figure 12. Distribution of Grasslands and Meadows in Nevada.
**KEY HABITAT: GRASSLANDS AND MEADOWS**

**Things to Know....**
- Grasslands and meadows in Nevada are distributed widely throughout the state and differ from one another. Grasslands differ from wet meadows as they are found on xeric sites or sites with periods of dryness throughout the year.
- Wildlife uses depends upon the vegetation community and associated habitats. Species of Conservation Priority, such as Short-eared Owl, Prairie Falcon, and dusky shrew utilize this habitat.
- Issues that affect this habitat include excessive grazing by ungulates and loss of grass seed production.
- Climate change effects within this habitat type include conversions to shrub communities and tree encroachment.

**Ecoregions**

*Southwest ReGAP 2005*

<table>
<thead>
<tr>
<th>High Elevation Meadow</th>
<th>hectares</th>
<th>acres</th>
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<tbody>
<tr>
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<td></td>
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<tr>
<td>Columbia Plateau</td>
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<td>7,306</td>
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<td>Sierra Nevada</td>
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<tr>
<td><strong>Total</strong></td>
<td>2,959</td>
<td>7,306</td>
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<table>
<thead>
<tr>
<th>Semi-desert Grasslands</th>
<th>hectares</th>
<th>acres</th>
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<td><strong>Total</strong></td>
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**Ecological Systems**

**TNC Biophysical Setting**

<table>
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<tr>
<th>SWReGAP Ecological Systems</th>
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</thead>
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<tr>
<td>S083 Southern Rocky Mountain Montane-Subalpine Grassland</td>
</tr>
<tr>
<td>S084 Mediterranean California Subalpine Meadow</td>
</tr>
<tr>
<td>S085 Rocky Mountain Subalpine Mesic Meadow</td>
</tr>
<tr>
<td>S134 North Pacific Montane Grassland</td>
</tr>
<tr>
<td>S090 Intermountain Basins Semi-desert Grasslands</td>
</tr>
</tbody>
</table>
Key Habitat Description

This key habitat type encompasses a collection of disparately distributed grassland types that are not particularly 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. Short descriptions of each are provided below:

High Elevation Meadow

This biophysical setting occurs on gentle to moderate-gradient slopes in the subalpine zone typically above 2000 m (6,600 ft) in elevation in Nevada. The soils are fine, dominated by organic matter, and seasonally moist to saturated in the spring, but will dry out later in the growing season. The vegetation of Columbia Plateau sites is typically forb-rich, with forbs contributing more to overall herbaceous cover than graminoids. Important taxa include Erigeron, Senecio, Helianthella, Mertensia, penstemon, lupine, balsamroot, and Wyethia. Fires are primarily replacement and occur about every 40 years, entering from adjacent shrub or tree dominated sites, such as mountain big sagebrush, white fir, limber pine, and aspen. In the Sierra Nevada, this type’s analog (Mediterranean California Subalpine Meadow) is dominated by yarrow, alpine aster, and other Sierra forbs. Another Sierra Nevada meadow type (North Pacific Montane Grassland) is typically intermixed with matrix stands of red fir, lodgepole pine, and mixed conifer forests and woodlands. Dominant species include Elymus, Idaho fescue, lupine, Carex, Scirpus, and Juncus. Fire interval is similar to Columbia Plateau types.

Low Elevation Grassland

This ecological system typically occurs between 2,200-3,000 m (7,200-9,800 ft) on flat to rolling plains and dry benches in northern Nevada’s Columbia Plateau. Key bunchgrasses include Idaho fescue, Great Basin wildrye, bluebunch wheatgrass, and Sandberg’s bluegrass. In Nevada, patches are mixed with mountain shrub and mountain big sagebrush. Historic fire interval was probably 20 years.

Semi-desert Grassland

This ecological system is found at approximately 4,200-5,000 ft of elevation on xeric sandsheets, stabilized dunes, swales, playas, mesatops, plateau parks, alluvial flats, and plains in well-drained, sandy or sandy-loam soils. Sites occur on a variety of aspects and slopes ranging from flat to moderately steep. Annual precipitation is usually from 6-10 inches in the Great Basin. Grasslands within this system are typically characterized by a sparse to moderately dense herbaceous layer dominated by drought-resistant bunch grasses. These grasslands are typically dominated or codominated by Indian ricegrass and/or needle-and-thread grass, James’ galleta in the Mojave Desert, and are associated with big sagebrush, shadscale, Ephedra, snakeweed, or winterfat.

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. Stands of ricegrass, needlegrass, and James’ galleta occurring within the cold and warm desert scrub landscapes can be quite important to kangaroo mice and kangaroo rats as a primary food source. Sandy soils can be important to burrowing owls.

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 and bighorn sheep feed on the forbs in subalpine meadows. The abundant flowering plants characteristic of subalpine meadows are heavily foraged upon by hummingbirds. The mountain pocket gopher is found in the grasslands and meadows of the Sierra Nevada, often along the forest ecotone where loose soils facilitate burrowing.

Key Elements of Grasslands and Meadows Habitat Important to Wildlife

**HIGH ELEVATION MEADOWS**

**TALL FORBS** -- foraging, nesting (ground-nesters)
- Short-eared Owl
- Rufous Hummingbird
- mule deer
- bighorn sheep
- western jumping mouse
- dusky shrew

**ALPINE-SCREE ECOTONE**
- American pika
- Black Rosy-Finch
- Gray-crowned Rosy-Finch

**SIERRA NEVADA SPECIFIC**
- Sierra Nevada snowshoe hare
- montane pocket gopher

**LOW ELEVATION GRASSLAND**

**LOOSE SOILS** - burrowing
- Burrowing Owl

**PREY SPECIES** - foraging
- Prairie Falcon
- Ferruginous Hawk
- Preble’s shrew
- pygmy short-horned lizard
- greater short-horned lizard

**SEMI-DESERT GRASSLAND**

**SANDY SUBSTRATES** - burrowing
- Burrowing Owl
- pale kangaroo mouse
- dark kangaroo mouse
- desert kangaroo rat
- sidewinder
PREY SPECIES – foraging

Prairie Falcon
Ferruginous Hawk
long-nosed leopard lizard
desert horned lizard

Existing Environment

Land Uses

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

Habitat Conditions

Habitat conditions vary greatly within this key habitat because the plant communities within it are so diverse in their occurrence and character. 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 20 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

When ungulate utilization exceeds a site’s ability to recover, the result is a reduction of grasses and an increase in shrubs, especially snakeweed and rabbitbrush, therefore affecting species that rely predominantly on the herbaceous condition of these grassland types for sustenance. 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.

Predicted Effects of Climate Change

High Elevation Meadow

LANDFIRE mapping indicated 2,700 acres of high elevation meadow currently exists in the Black Rock Region, 100% in the early stage. A small total of 11 acres registered in the Eastern Sierra region, all of which was
predicted to be lost to conversion after 50 years of climate change. The Black Rock acreage was predicted to lose 53% to conversion after 50 years of climate change. Remaining acreage would transition completely out of the early class, equally into the mid-open (28%) and mid-closed (29%) classes, with 44% transition into uncharacteristic classes - 13% transitioning to Wyethia-dominant and 44% invaded by silver sage and Woods' rose. The Sierra Nevada community “Northern Pacific Montane Grassland” (2,400 acres) was not evaluated in the TNC report.

Low Elevation Grassland

LANDFIRE mapping indicated 6,900 acres of low elevation grassland in the Black Rock region and 475 in the Elko region. In the Black Rock region, 68% of this BPS occurred in the early class, 30% in the mid-open class and one percent in late-closed. Only one percent occurred in an uncharacteristic class. In the Elko region, 23% of the type occurred in the early class and 77% was tree-encroached. Climate change modeling predicted that significant transitioning away from early- to mid-open (53%) and late-closed (11%) would occur, with 33% transitioning to annual grass and early shrub classes and no increase in tree-encroached. The Elko region acreage was predicted to transition 100% to tree-encroached in 50 years.

Semi-desert Grassland

Semi-desert grasslands occurred in 12 of 13 regions evaluated in the TNC Report. This BPS was reported to be over 90% transitioned into uncharacteristic classes in all regions except Mojave and Tonopah. In both regions the BPS was currently split 50-50 between characteristic and uncharacteristic classes. In the Mojave region, the BPS was predicted to transition 96% to uncharacteristic classes in 50 years with climate change, while in the Toiyabe region 10% more was expected to transition to uncharacteristic after 50 years of climate change for a 60-40 split.

Possible Wildlife Responses to Climate Change

High Elevation Meadow

The primary impact of climate change upon wildlife using high elevation meadow was likely to come from basic loss of acreage to conversion. Mule deer, bighorn sheep, hummingbirds, and American pika foraging on tall forbs would be forced to convert to other forage or ecological systems. All other species would be negatively impacted, but none appeared to be particularly uniquely associated with the habitat type such that its viability in Nevada would be put at-risk by reduction of this BPS alone.

Low Elevation Grassland

Impacts to priority species using low elevation grassland habitats were expected to be impacted somewhat by the transition to rabbitbrush (early shrub) and annual grass. Prairie Falcons and Ferruginous Hawks do not live in the type but would be forced to shift their hunting effort away from these landscapes if prey species diversity and abundance decreased. Burrowing owls demonstrate a tolerance to site disturbance and conversion as long as the general wild nature of the habitat is preserved (i.e., remains undeveloped) and the two short-horned lizard species were not expected to be impacted if ant populations were not significantly changed or reduced. Preble’s shrew is the one species that may live in this BPS and be unable to adapt to uncharacteristic class transitions.
Semi-desert Grassland

For all but the Mojave and Tonopah regions, the almost total occurrence of this type in uncharacteristic classes has already caused whatever damage might be expected. The depleted and rabbitbrush classes have the least value to priority species dependent on native grass for food (the two kangaroo mice and desert kangaroo rat). The relative value of the shrub-annual-perennial class is not possible to assess without further knowledge of the relative extent of perennial grasses in the plant community’s composition. Regions with over 20% of the BPS in depleted/rabbitbrush classes either now or in 50 years included Calcareous, Elko, Lahontan, Mojave, and Tonopah. Priority predators and insectivores would be expected to shift their foraging effort away from this BPS if prey diversity and/or abundance was reduced significantly. Such a shift was not expected to significantly increase conservation risk for any of the predator guild.

Taking Prescriptive Action

The grassland and meadow communities featured in this chapter were not extensive enough to design prescriptive treatment to avoid the predicted effects of climate change. However, application of best management practices for livestock grazing is important to maintain the ecological integrity of meadows and grasslands.

Priority Research Needs

- Distribution and population status of western jumping mouse
- Comprehensive inventory of shrew species in Nevada
- Habitat relationships model for Preble’s shrew

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.

Objective: Maintain high elevation meadows at current distribution and condition through 2022.

Action: Target tall forb meadows for specific wildlife inventory.

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; 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 planning processes; incorporate into NRCS Nevada WHIP Plan.

Action: Purchase lands from willing sellers or secure easements with willing landowners on critical meadow sites through partnerships and conservation funding.
Objective: Prevent the increase in annual grass and rabbitbrush classes in low elevation grasslands from exceeding 10% in all regions through 2022.

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

Action: Inventory low elevation 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: Prevent the increase in annual grass and rabbitbrush classes in semi-desert grasslands from exceeding 10% in the Mojave and Tonopah regions through 2022.

Action: Investigate the feasibility of restoring semi-desert grassland habitats to characteristic classes including the restoration of a fire return interval that discourages shrub encroachment applied at very small scales under controlled conditions.

Action: Seed semi-desert grassland sites with native grasses appropriate to the site after fire.

Objective: Maintain mule deer and bighorn sheep populations utilizing high elevation meadows at stable or increasing trend through 2022.

“stable or increasing trend” – as determined by NDOW big game surveys

Action: Monitor high elevation meadows for nutritive content and preferred food forb occurrence.

Objective: Maintain high elevation meadow birds of conservation priority at detectable levels through 2022.

“high elevation meadow birds of conservation priority” – Short-eared Owl; Rufous Hummingbird; Black Rosy-Finch; Gray-crowned Rosy-Finch.

“detectable levels” – as determined by Nevada Bird Count surveys or specialized high-elevation surveys yet to be developed regularly conducted at intervals not to exceed five years.

Action: Evaluate the need to supplement the Nevada Bird Count survey transect network with specifically targeted high elevation meadow transects.

Action: Conduct specific breeding status surveys for Rufous Hummingbird in high elevation meadow habitats.
Objective: Maintain small mammals of conservation priority at detectable levels in high elevation meadow habitats through 2022.

“small mammals of conservation priority” – western jumping mouse, montane pocket gopher, Sierra Nevada snowshoe hare, American pika, dusky shrew.

“detectable levels” – as determined by live trap survey conducted at regular intervals not to exceed five years.

Action: Continue Sierra Nevada snowshoe hare investigations in Nevada.
Action: Add high elevation meadow sites to surveillance live trap survey networks.
Action: Design and conduct a comprehensive inventory of shrew species in Nevada; delineate habitat preferences and species expectation models for all shrews of conservation priority.

Objective: Maintain birds of conservation priority utilizing low elevation and semi-desert grasslands at stable or increasing trend through 2022.

“birds of conservation priority” – Burrowing Owl, Prairie Falcon; Ferruginous Hawk.

“stable or increasing trend” – as measured by NDOW raptor nest surveys conducted at regular intervals not to exceed five years.

Action: Implement a Burrowing Owl survey and inventory that establishes presence/absence on a random survey grid as well as documents specific burrow sites for future reference.
Action: Conduct surveillance aerial surveys for nesting Prairie Falcons and Ferruginous Hawks at regular intervals not to exceed five years.

Objective: Maintain Preble’s shrew populations at detectable levels in suitable habitat through 2022.

“detectable levels” – as determined through single-species research or pit trap surveillance surveys conducted at regular intervals not to exceed five years.

Action: Conduct an expanded Preble’s shrew distribution and status study across its Nevada range; determine habitat preferences, population connectivity, and conservation risk.

Objective: Maintain pygmy short-horned lizard and greater short-horned lizard populations at detectable levels through 2022.

“detectable levels” – as measured via specific discovery or status surveys conducted at regular intervals not to exceed five years.

Action: Continue investigations of distribution and population status of pygmy short-horned lizard and add greater short-horned lizard; determine habitat preferences and impacts of uncharacteristic class transitions on short-horned lizard distribution and population viability.
Objective: Maintain small mammals of conservation priority utilizing semi-desert grasslands at detectable levels through 2022.

“small mammals of conservation priority” – pale kangaroo mouse, dark kangaroo mouse, desert kangaroo rat.

“detectable levels” – as determined by live trap survey conducted at regular intervals not to exceed five years.

Action: Continue studies of kangaroo mice and desert kangaroo rats to delineate habitat preferences and management strategies for each.

Objective: Maintain long-nosed leopard lizard and desert horned lizard populations utilizing semi-desert grasslands at stable or increasing trend through 2022.

“stable or increasing trend” – as measured by surveillance ocular surveys in areas of high commercial collection activity.

Action: Implement a standardized reptile survey in areas of demonstrated high commercial collection activity.

Objective: Maintain sidewinder populations at detectable levels through 2022.

“detectable levels” – as measured by ocular surveys or nocturnal road surveys conducted regularly at intervals not to exceed five years.

Action: Conduct surveillance surveys for sidewinders and other snakes of conservation priority in prioritized habitats and locations.

Action: Implement monitoring for sidewinders and other snakes of conservation priority to determine home range, winter hibernacula, habitat preferences, and responses to vegetative community transitions toward uncharacteristic classes.

Partnerships

Land Management/Ownership

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<td>Private</td>
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<td>U.S. Forest Service</td>
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<tr>
<td>Other</td>
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Existing partnerships, plans, and programs

Multi-partner
- Governor’s Sage Grouse Conservation Plan
- Rosachi Ranch restoration project
- Argenta Marsh restoration project

Federal & State Agencies
- Bureau of Land Management
- Natural Resources Conservation Service/Conservation Districts
- U.S. Forest Service
- U.S. Fish and Wildlife Service
- U.S. Bureau of Reclamation
- Nevada Department of Wildlife
- Nevada Division of Forestry
- Nevada Department of Agriculture

Conservation Organizations
- National Audubon Society/Lahontan Audubon Society
- Sierra Club
- National Fish & Wildlife Foundation
- The Nature Conservancy

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

Other Key Partners
- Intermountain West Joint Venture
- University of Nevada (UNR, UNLV, Cooperative Extension)
- Sportsman’s Organizations

Focal Areas

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<th>Adobe Range</th>
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<th>Shoshone Range</th>
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<td>Montana Mountains</td>
<td>Simpson Park Mountains</td>
</tr>
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<td>Carson Sink</td>
<td>Owyhee Desert (South Fork Owyhee drainage)</td>
<td>Snake Mountains</td>
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<td>East Humboldt Range</td>
<td>Pie Creek drainage</td>
<td>Spring Valley</td>
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<td>Granite Range</td>
<td>Pine Forest Range</td>
<td>Steptoe Valley</td>
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<td>Railroad Valley</td>
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<td>Ruby Mountains</td>
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<td>Jarbidge Wilderness</td>
<td>Sheldon NWR</td>
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</table>
Aspen Woodlands

Figure 13. Distribution of Aspen Woodlands in Nevada.
**KEY HABITAT: ASPEN WOODLAND**

**Things to Know...**
- Aspen can form extensive stands and is one of the most widely distributed native tree species in North America. In Nevada, aspen is largely restricted to upper elevation riparian zones and high-elevation saturated soils.
- Aspen provides the most important nesting habitat in Nevada for Northern Goshawk.
- Problems contributing to the decline of aspen communities in Nevada include fire suppression, improper livestock grazing, and browsing by big game species.
- A general 10-20 percent loss of aspen statewide due to climate change would reduce the distribution and abundance of priority wildlife species, although not within the next 50 years.
- Prescriptive actions include using prescribed fire, installation of exclosures, and periodic herding of livestock away from stands.

**Ecoregions**

*Southwest ReGAP 2005*

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<tr>
<th>Ecoregion</th>
<th>Hectares</th>
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**Ecological Systems**

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<td>Aspen Woodland</td>
<td>S023 Rocky Mountain Aspen Forest and Woodland</td>
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<tr>
<td>Aspen-Mixed Conifer</td>
<td>S042 Intermountain West Aspen-Mixed Conifer Forest and Woodland Complex</td>
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**Key Habitat Description**

Aspen is one of the most widely distributed native tree species in North America. In the western United States, aspen communities are established at suitable sites on mountains and high plateaus (Jones, 1985). Aspen can form extensive stands or its distribution may be more limited and expressed as riparian stringers or disjunct patches. In the higher reaches of riparian drainages, aspen may occur in dense stands of smaller-stature trees on side slopes and snowpocket areas (Dobkin et al., 1995). In Nevada, extensive aspen communities are found in the Snake, Schell Creek, White Pine, Jarbridge, Independence, and Monitor Ranges, as well as the Santa Rosa and Ruby Mountains (Neel, 1999). Scattered stands of aspen occur as far south as the Spring Mountains near Las Vegas and in the adjacent Sheep Range (Lanner, 1984). Aspen rarely grows from seed because of its demanding seed bed requirements and high vulnerability to herbivory, and aspen clones present today have likely maintained their presence on those sites for thousands of years through vegetative regeneration. The presence of aspen indicates a long history of disturbance, primarily frequent fires. Given these characteristics, aspen condition is an excellent indicator of ecological integrity (Kay, 1997a).
Within Nevada, aspen generally occupies elevations between 6,000 and 8,000 feet (Lanner, 1984). Aspen communities are found on all aspects and grow where soil moisture is not a limiting factor. Climatic conditions vary greatly over the range which aspen occupies in the western United States, but most aspen areas receive at least 38 centimeters of precipitation per year (Jones and Debyle, 1985). Aspen is typically shade intolerant and commonly grows in even-aged stands; however, multi-aged stands are more common than expected. Climax aspen communities which persist at a site for several centuries without appreciable change occur throughout the West. When found in association with coniferous species other than pinyon or juniper, aspen communities may progress toward conifer dominance or replacement in the absence of disturbance. Grasslands and shrublands may also replace aspen communities on sites not suited for the establishment and growth of conifers (Mueggler, 1985). “Firebreak” is a common term used to describe aspen because of its difficulty to burn and tendency to diminish crown fires spreading from adjacent conifer stands. Aspen only readily burns in early spring or late fall, when the trees are leafless and understory plants are dry (Kay, 1997b). Aspen communities can be multi-layered. When present, tall shrubs form an open and intermittent layer from six to 12 feet. Shorter shrubs and tall herbs frequently form a more continuous layer at about three feet. Shrubs common in aspen stands in Nevada include snowberry and currant. Common forbs in aspen understory include meadow-rue, yarrow, columbine, lupine, and larkspur (Neel, 1999).

Value to Wildlife

Aspen communities have exceedingly high biodiversity, second only to riparian areas on western ranges (Kay, 1997b). Aspen produce forage for both wildlife and domestic livestock. Healthy aspen communities consist of developed dense multi-age structure that provides benefits to wildlife dependent upon the diverse nature of these communities. Aspen communities are particularly important to cavity nesting species in Nevada because stems attain sizes over 10 inches diameter and the wood is soft and easy to excavate. Because large diameter aspen tend to occur less often in snow pocket aspen communities, riparian aspen stands tend to be preferred by cavity nesting species (Dobkin et al., 1995). In addition to cavities and peeling bark, mature aspen communities provide larger diameter trees utilized by wildlife as forage substrate or nesting. For example, Northern Goshawks can live in and utilize high-elevation shrub-steppe habitats because stringers of large-diameter aspen trees with closed canopies in the riparian zones will support their nesting needs (Younk and Bechard, 1994). Birds and small mammals utilize mid-story structure and herbaceous/shrub understory of aspen communities for forage, nesting, and protective cover.

Downed trees in aspen habitat can create slow moving water conditions favorable to Columbia spotted frogs. In northeastern Nevada, some thriving Columbia spotted frog populations are associated with aspen stands with these types of conditions (personal communication, Genny Wilson, Forest Wildlife Biologist, Humboldt-Toiyabe National Forest, June 2005). In addition to its value to wildlife, aspen has a fundamental scenic value and local human communities benefit economically from the associated tourism.

Key Elements of Aspen Woodland Habitat Important to Wildlife

**MATURE OVERSTORY** – nesting structure (large stems), foraging, roosting, escape cover

Northern Goshawk

**MIXED ASPEN-CONIFER** – nesting structure, foraging, protection from predators

Flammulated Owl

Cassin’s Finch

silver-haired bat
hoary bat

**SHRUB AND HERBACEOUS COVER** – nesting structure, foraging, protection from predators, thermal cover
- Dusky Grouse
- Sooty Grouse
- Mountain Quail
- Rufous Hummingbird
- Inyo shrew
- Merriam’s shrew
- montane shrew
- western jumping mouse
- mule deer

**CAVITIES/PEELING BARK** – nesting, roosting, foraging (insect prey base in dying trees)
- Lewis’s Woodpecker
- fringed myotis
- little brown myotis
- long-eared myotis
- western small-footed myotis

**DOWNED WOOD** – creates favorable conditions for Columbia spotted frogs (slow moving water) as well as stores ground moisture and maintains mesic microsites (northern rubber boa).
- Columbia spotted frog
- northern rubber boa

**Existing Environment**

*Land Uses*
- Livestock grazing
- Recreation - camping
- Spring development
- Mineral exploration
- Species harvest

*Habitat Conditions*

Native Americans managed the landscape for at least 12,000 years prior to European settlement and utilized prescribed fire extensively. The resultant higher frequency low intensity fires contributed to the presence and condition of aspen today (Kay, 1997b). Aspen has declined 60 to 90% throughout the West and in Nevada. Many aspen stands containing old-age or single-age trees have not successfully regenerated for 80 years or longer (Kay, 1997b; Kay and Bartos, 2000). The decline of aspen communities has been largely attributed to declines in natural disturbances (e.g., fire suppression in the surrounding landscape) and increases in ungulate herbivores. Aspen communities that have been burned by wildfire or prescribed fire often fail to regenerate because regeneration is impeded by excessive browsing, resultantly, many aspen stands in Nevada are dominated by old-age or single-age trees (Kay, 1997b).

The Humboldt-Toiyabe National Forest has management responsibility for most aspen occurring in Nevada, and
the condition of the aspen communities on Forest lands range from very poor to good. Some aspen clones have been reduced to a single tree or are no longer present on the landscape, particularly at lower elevations. Aspen is considered by some to be among the most imperiled terrestrial habitats in Nevada and is a priority in the current Humboldt-Toiyabe Forest Plan revision.

**Problems Facing the Species and Habitats**

Problems contributing to the decline of aspen communities in Nevada include fire suppression, improper livestock grazing, and browsing by big game species. Aspen survival is enhanced by periodic disturbance events such as fire or logging which stimulates vegetative regeneration through root suckering and reduces conifer competition. Conifer encroachment is a problem for aspen communities in Nevada, particularly in the Sierra Nevada, Schell Creek, and Snake ranges, and could eventually result in the elimination of aspen clones in these areas if disturbance is not allowed to occur or is not introduced into these communities. Livestock and wild ungulate grazing alter vegetation structure and contribute to the declining condition of aspen communities. Livestock and wild ungulates consume different types of forage that are available in aspen communities. Utilization by wild ungulates tends to reduce shrubs and tall palatable forbs while favoring the growth of native grasses in aspen communities, while livestock grazing tends to reduce native grasses and promote introduced species and bare soil (Kay and Bartos, 2000). If the aspen clone is lost due to forest succession or other factors that lead to a dewatering of the site, there are no known means of aspen clone reestablishment (Kay et al., 1994). Although aspen can withstand moderate levels of grazing by livestock and wild ungulates, caution should be taken in efforts to restore aspen through prescribed burning because burning plus repeated browsing hastens the elimination of aspen clones that have weakened root reserves (Kay, 1997b).

Aspen communities in riparian areas provide many recreational and commercial uses in Nevada (Neel, 1999). People are drawn to aspen stands for camping which contributes to soil compaction and potential disturbance to wildlife. In northeastern Nevada, gold exploration in aspen communities is widespread. Directional drilling and scheduling exploration activities outside of critical wildlife seasons (e.g., nesting) can reduce some of the potential effects of mineral exploration, but complete habitat loss may occur if an aspen community is mined for gold. Spring development within and upslope of aspen woodlands is also a concern for aspen communities because of their need for the water. “Natural” problems for wildlife in aspen communities include resource competition and global climate change. Nest site availability (i.e., cavities) and competition with other individuals may limit wildlife in aspen communities (Dobkin et al., 1995). Lastly, global climate change may affect aspen communities by reducing the recharge of soil with snowmelt water during the spring (DeByle, 1985). The results of modeling climate change effects on aspen habitats in Nevada are presented in the following section.

**Predicted Effects of Climate Change**

**Aspen-Mixed Conifer**

Currently the aspen-mixed conifer BPS occurs primarily in the Black Rock, Elko, and Calcareous regions. In reference condition, the type should be distributed ~20% in the early class, ~70% in two mid-closed classes, and ~10% in the late classes. Current conditions varied widely among the three principal regions – Black Rock registered 62% in the early class; nine percent in the mid-closed classes, and 28% in the late classes; Calcareous registered 10% in the early classes, 10% in the mid-closed classes, 80% in the late classes; Elko registered 100% in late classes (Appendix C).

Modeled succession in the Black Rock tracked predictably – the bulk of early aspen transitioning to mid-closed,
mid-closed to late, and late back to early but with 12% acreage loss during this particular transition attributed to conifer encroachment, sagebrush encroachment, and excessive herbivory at the nascent A stage. In the Calcareous, late classes transitioned through the early stage into mid-closed in 50 years, mid-closed and late-open transitioned into late-closed, but there was a 20% loss of acreage in the late to early transition (same conversion processes as Black Rock). In the Elko region, roughly 20% of late classes transitioned into early and mid-closed classes in roughly equal proportions and a little (<5%) actually reached late-closed, but over 50% of the type stayed in the late-open class and 16% of it was lost in the transition back to the early class (same three processes again).

**Aspen Woodland**

The aspen woodland BPS occurs in 12 of the 13 evaluated regions, totally absent in only the Mojave, but present in the Walker Corridor as 11 acres. Currently, aspen woodland in the northern and eastern regions is heavily weighted in very late successional stages (late-open and depleted), ranging from 44% (Eureka) to 93% (Clover). The western regions (Eastern Sierra, Lahontan, Walker, Toiyabe, and Tonopah) are in much healthier condition, weighted heavily in the early closed (unfenced) class (Appendix C).

Modeled succession in the northern and eastern regions tracks toward an apparent return to conditions closer to reference, but the better distribution of classes comes at a high price – loss aspen acreage from vulnerable classes (late-succession and early-succession classes) ranging anywhere from eight (Elko) to 31% (Clover). A predicted “gain” of 21% in the Owyhee region is an anomaly of modeling precision. Succession in the western regions is predicted to occur more naturally with less aspen loss – ranging from three (Tonopah) to 19% (Lahontan), but the Walker Corridor is predicted to lose all 11 acres of its aspen woodland in 50 years with climate change. Generally speaking, all regions will be transitioning into healthier stand conditions favorable to wildlife, but valuable clones will be lost to other ecological systems (for example, mixed conifers and montane sagebrush steppe) in the transition, resulting in a net reduction in available acres of aspen woodland habitat.

**Possible Wildlife Responses to Climate Change**

**Northern Goshawk**

In high-elevation shrub steppe habitats of the Great Basin, Northern Goshawks are able to occupy the landscape by nesting in small, widely-scattered stands of mature aspen trees that grow along creeks and drainages. Younk and Bechard (1994) characterized goshawk nesting stands as primarily located on north or east-facing slopes, and described the canopy as mostly closed with open understory of very little cover. Their results appear focused on aspen woodlands more than aspen-mixed conifers, which usually do not support an open understory when encroached by dense mixed conifers in older stands. They reported average nest tree age at 60 years. Understory cover is usually reduced by livestock that use the stands for grazing and shading during the hot summer months. This description would fit the late-closed and late-open states of aspen woodland and, by extension, known conifer use by goshawk elsewhere, to the mid-closed, late-open, and late-closed states of aspen-mixed conifer.

The relation between the future, predicted dynamics of both aspen types and goshawk nesting needs is nuanced at three levels.

- For aspen woodlands, aging of the canopy from closed to depleted might allow a nesting goshawk to persist in the stand, but generally this would be considered a toleration of sub-ideal conditions.
Abandonment could be predicted as stand vigor continued to deteriorate towards permanent conversion to sagebrush steppe.

- For aspen-mixed conifer stands, aging stands that become dominated by mixed conifers, and then convert entirely to mixed conifer, can benefit goshawk because the species is known to use, even prefer, conifer-dominated forests and woodlands elsewhere in the Intermountain West.

- Eventually, aspen stands will burn or be attacked by diseases and insects. Fire activity imported from the surrounding landscape is likely to increase with climate change to the increasing cover of cheatgrass in the adjacent sagebrush steppe BPS. As modeling results indicated significant turnover of these late-succession stands into their regenerative stages, the future for Northern Goshawk nesting pairs on the Great Basin landscape is expected to be very much in a state of flux over the next 50 years. The challenge for managers will be to maintain enough late-succession stands on the landscape (particularly in the Elko region where the heart of the Northern Goshawk nesting population has resided over the last 40 years) to facilitate goshawk nesting needs through the transition such that significant population shift away from the shrub steppe landscape is minimized. It will be very difficult to restore declining aspen stands as long as a nesting pair persists in it, practically necessitating the wait for a pair to shift away from a stand before applying treatment, which in turn may conflict with a “healthy ecosystem” approach to land management. An evaluation of Younk and Bechard’s nest occupancy data suggests a 10% occupancy rate among available nests. This also corroborates with NDOW’s latest goshawk survey information (NDOW, 2010). A 10% occupancy rate may allow managers the flexibility they need to manage aspen stand health and regeneration across broader landscapes.

*More Mature Overstory and Mixed Conifer*

Several Species of Conservation Priority are associated with aspen-mixed conifer including Flammulated Owl, Cassin’s Finch, silver-haired bat, and hoary bat. Like Northern Goshawks, Flammulated Owls are associated with large-dbh conifers in other parts of their range (goshawks – closed-canopy mixed conifer; Flammulated Owls – ponderosa/Jeffery pine), but in the Great Basin, they stretch their habitat use somewhat to include aspen-mixed conifer, and it appears some occurrence of mixed conifer is rather important to occupancy (Mika and Riddle 2007). Cassin’s Finches are crown nesters found in various associations of mixed conifer, aspen, and pinyon-juniper and feed on the seeds and catkins of the trees found in all three types. They are expected to primarily nest in the three late-succession classes of aspen-mixed conifer, while utilizing the two early stages for foraging. NDOW research has documented significant use of aspen-mixed conifer in the Jarbidge (Elko Region) area, where their use of open-top snags for community roosts was determined by radio telemetry (NDOW 2010). Hoary bats are known to migrate through the area, using aspen-mixed conifer habitat among others, but if they spend any significant time in these Nevada habitats as part of their annual life cycle, it has yet to be ascertained. Snag preferences of the Flammulated Owl and the bats would suggest affinities for the late-open and late-closed classes. Other SOCP’s expected to use the type in its late-succession classes include fringed myotis, little brown myotis, long-eared myotis, and western small-footed myotis.

Lewis’s Woodpeckers are well-known as fire-facilitated conifer birds, but their use of aspen woodlands in the Great Basin and other Intermountain West shrubsteppe is only now beginning to be studied and understood. Here, Lewis’s Woodpeckers are not necessarily fire-facilitated; rather, they use aspen woodland as a surrogate for burned conifer that allow them to populate the greater shrubsteppe landscape, much like Northern Goshawk and Flammulated Owl (Newlon and Saab 2011). Their need for cavities to nest in is facilitated by aspen’s soft wood particularly when it is infected by heart rot, and a robust understory is generally considered to positively support this woodpecker’s insect-hawking feeding strategy through greater abundance of flying arthropods.
The GBBO Report indicated that 38% of the computed statewide “population estimate” of Lewis’s Woodpeckers based on Nevada Bird Count survey observations would occur in the late-open aspen woodland class, followed by 15% occurring in the early aspen Woodland class. This corroborates a perception of the Lewis’s Woodpecker as a denizen of old growth aspen (>99 years old) with soft heartwood and snags on the cusp of transitioning back to early as well as a colonizer of early aspen Woodland stands (most likely as per fire event). In over 200 points surveyed over a 10-year span, Lewis’s Woodpecker was never observed in aspen-mixed conifer during Nevada Bird Count surveys.

Shrub Mid-story and Herbaceous Understory

Several Species of Conservation Priority are associated with aspen types because the mesic environment is also conducive for lush growth of montane shrubs, grasses and flowering forbs. Several important game species, including mule deer, Dusky and Sooty Grouse, and Mountain Quail, feed on the leaves, new stems, and fruits of mountain snowberry, gooseberry, and other associated montane shrubs. The three SOCP shrews rely on thick understory not only for their own protective cover but for the provision of diverse, abundant arthropod populations for food. Western jumping mice are associated with tall, ungrazed grasses such as are seasonally found on mesic aspen sites and migrating Rufous Hummingbirds replenish their carbohydrate loads on the nectar of flowering forbs also found in the mesic understory. These species’ life history support is enhanced by the judicious application of grazing strategies that allow for understory growth, maturation, and reproduction prior to turn-in, and they are expected to use all aspen woodland and aspen-mixed conifer classes except depleted. Northern rubber boas and Columbia spotted frogs depend on the maintenance of the mesic character of the aspen site, which implies dense aspen canopy cover. Down woody material, shrub and herbaceous litter, and shade all work to retain moisture on the site and maintain the wetness of mesic microsites that serve these species’ thermic requirements. Loss of aspen through mismanagement of a site that causes it to lose its clone and mesic character will result in the disappearance of these species from the larger landscape.

The predictions of the climate change analysis suggest that the transition of aspen in the northern and eastern regions from late succession to early succession classes might create episodic challenges for late-successional wildlife species that require cavities (Lewis’s Woodpecker), closed canopies (Northern Goshawk), and snags (bats) for shelter and nest substrate. Conversely, in the western regions, transitioning from predominant early stages to later-successional stages would suggest improving habitat conditions for the same species. Monitoring might reveal a shift of highly-mobile species such as birds and bats in a general westward or southwestward direction. Of greater concern, however, is the predicted conversion of aspen to non-aspen types and loss of the clones which would make restoration to aspen particularly difficult. A general 10-20% loss of aspen statewide would reduce the distribution and abundance of the SOCP’s featured in this discussion, although we expect none of them to disappear from the state in at least the first 50 years.

Prescriptive Actions

For information on recommended prescriptive actions, see Appendix C.

Priority Research and Monitoring Needs

- Spatial distribution of aspen woodlands across the pre-settlement and current landscape in Nevada.
• A statewide health assessment of aspen stands and a systematic, prioritized strategy for restoration that optimizes resources and maximizes success.
• Proper rest intervals for aspen woodlands after natural disturbance or treatment.
• Individual levels of use and effects of livestock and big game in aspen communities to aid in the management of grazing allotments containing aspen communities.
• Goshawk territory models for aspen that accurately represent territory size, habitat composition and quality, alternate nest site potential, and prey base availability and productivity.
• Responses of Northern Goshawks to treatments promoting aspen regeneration and restoration across the landscape, including habitat use, nest site selection, and population demographics.
• Monitor anticipated shifts in bird and bat populations southward and westward if aspen transitions proceed as predicted.

Conservation Strategy

Goal: Thriving wildlife populations in self-sustaining, multiage aspen communities with structural complexity that provides wildlife needs.

Objective: Manage aspen woodlands and aspen-mixed conifer not to exceed 10% loss to type conversion through 2022.

Action: Assess condition of aspen woodlands in Nevada using Resource Implementation Protocol for Rapid Assessment Matrices (Humboldt-Toiyabe National Forest) or other approved protocol.

Action: Identify and prioritize aspen woodlands for restoration through management treatment(s) including prescribed fire and conifer removal.

Action: Support and conduct identified primary research needs and incorporate results in the development of the following management and conservation actions.

Action: Implement prescribed burning and/or silviculture treatments at appropriate temporal and spatial scales.

Action: In small patch aspen communities, protect recently treated (burned or logged) regenerating aspen saplings with stand exclosures.

Action: Manage grazing in aspen communities to allow for a diverse grass understory and aspen regeneration.

Action: Manage big game in aspen communities to allow for a diverse, healthy shrub and forb community and aspen regeneration.

Action: Maintain ground cover with only small bare soil openings to maintain adequate water infiltration and prevent undue erosion from intense storms.

Action: Provide public outreach through signing or other appropriate means that increases public awareness of the effects of camping in aspen stands on wildlife and their habitat.

Action: Minimize the effects of mineral exploration on aspen and wildlife communities through measures such as directional drilling or seasonal restrictions.
**Action:** Avoid spring development in and directly above aspen woodlands that withdraws water beyond sustainable levels.

**Objective:** For functional wildlife habitat, manage aspen woodland and aspen-mixed conifer stands to approximate 30-50% in mid- or late-successional stages with 20-30% in regenerating early stages through 2022.

**Action:** Protect known Northern Goshawk nesting territories from the reduction of structural complexity or complete habitat loss. Develop aspen regeneration strategies at the landscape scale with consideration for the preservation of active northern goshawk territories in project design and implementation.

**Action:** Identify and prioritize aspen woodlands where mesic microsite maintenance could improve habitat conditions for Columbia spotted frogs through impediment of water flow, retention of down woody material, etc.

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

**Objective:** Stabilize a declining trend in Northern Goshawk nest site occupancy by 2022.

“stabilize” – halt the decline to “no further loss”; “declining trend” – recent surveys have revealed significant reductions in nest site occupancy since 1995, particularly in Elko County (NDOW 2011).

**Action:** Reinitiate annual Northern Goshawk nest monitoring statewide to compute a current statewide nest site occupancy rate and breeding pair estimate to inform aspen management strategies as well as discussion of issues related to falconry take.

**Action:** Initiate nesting habitat investigations to determine cause of Northern Goshawk nest site vacancies in key portions of breeding range.

**Action:** Monitor aspen wildlife communities through statewide partner networks, such as The Nevada Bird Count, to assess the degree and extent of shift from aspen regions transitioning from into less suitable conditions to aspen regions transitioning to more favorable conditions.

**Objective:** Maintain Flammulated Owl populations at detectable levels in suitable habitats through 2022.

“detectable levels” – as determined by taped call surveys conducted at regular intervals not to exceed five years.

**Action:** Continue to monitor Flammulated Owl occupancy in historic sites while regularly surveying new potential habitats until statewide range and distribution is well-delineated.

**Action:** Investigate the relative importance of mixed conifer in aspen habitats for Flammulated Owl occupancy and adjust management strategies accordingly.
**Objective:** Maintain Lewis’s Woodpecker at stable trend through 2022.

"stable trend" – as determined by USGS Breeding Bird Survey or Nevada Bird Count results.

**Action:** Conduct an analysis on current aspen bird survey transects to determine if sample size should be increased by adding new transects.

**Action:** Update Lewis’s Woodpecker habitat suitability model through updated literature review or field collection of habitat suitability data.

**Action:** Monitor fire-related movements of Lewis’s Woodpecker between aspen stands and regions.

**Objective:** Maintain other birds of conservation priority at stable or increasing trends in aspen habitats through 2022.

"other birds of conservation priority... in aspen” – Cassin’s Finch; Dusky Grouse; Sooty Grouse; Mountain Quail; Rufous Hummingbird

**Action:** Encourage aspen stand management strategies that preserve vigorous montane shrub and herbaceous understories through critical periods in the life history cycles of grouse and Mountain Quail (e.g. nesting, early brooding).

**Action:** Survey for possible Rufous Hummingbird breeding activity in the Jarbidge Mountains, Ruby Mountains, Snake Range and Santa Rosa Mountains in aspen stands near alpine/subalpine habitats.

**Objective:** Maintain bats of conservation priority at detectable levels in aspen habitats through 2022.

"bats of conservation priority... in aspen” – silver-haired bat; hoary bat; fringed myotis; little brown myotis; long-eared myotis; western small-footed myotis

“detectable levels” – as determined by acoustic or net survey conducted regularly at intervals not to exceed five years

**Action:** Maintain standing snags and old age-class trees in aspen woodlands and aspen-mixed conifer habitats.

**Action:** Participate in regional Flammulated Owl survey efforts as coordinated through the Western Working Group of Partners In Flight.
Objective: Maintain small mammals of conservation priority at detectable levels in aspen habitats through 2022.

“small mammals of conservation priority... in aspen” – Inyo shrew; Merriam’s shrew; montane shrew; western jumping mouse

“detectable levels” – as determined by live trap or pit trap survey conducted at regular intervals not to exceed five years

Action: Include aspen habitat sites in a comprehensive statewide shrew population and distribution status assessment to develop baseline knowledge of priority species distributions and relative abundance.

Action: Conduct species population status and habitat suitability studies for western jumping mouse.

Objective: Maintain reptiles and amphibians of conservation priority at detectable levels in aspen habitats through 2022.

“reptiles and amphibians of conservation priority... in aspen” – northern rubber boa; Columbia spotted frog

“detectable levels” – as determined by pit trap or ocular survey conducted at regular intervals not to exceed five years

Action: Support aspen management strategies that encourage ground coverage and litter buildup in shaded saturated/semi-saturated soil zones.

Partnerships

Land Management/Ownership

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<thead>
<tr>
<th>Land Owner/Manager</th>
<th>Percent</th>
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<tr>
<td>Bureau of Land Management</td>
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<td>Private</td>
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<td>National Park Service</td>
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<tr>
<td>Other</td>
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Existing partnerships, plans, and programs

Federal & State Agencies
- U. S. Forest Service
- Bureau of Land Management
- National Park Service (Great Basin National Park)
- Nevada Department of Wildlife
- Nevada Division of Forestry
- Nevada Department of Agriculture
- Nevada Natural Heritage Program

Conservation Initiatives
- Partners In Flight North American Land Bird Conservation Plan
- Nevada Partners in Flight
- Nevada Bat Conservation Plan

Sportsmen's Organizations
- Mule Deer Foundation
- Rocky Mountain Elk Foundation

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

Other Key Partners
- Eastern Nevada Landscape Coalition
- Counties
- Native American Tribes
- University of Nevada
- Mining Industry/Nevada Mining Association
- Great Basin Bird Observatory
- Intermountain West Joint Venture

Focal Areas
- Black Rock Range
- Boulder Mountain
- East Humboldt Range
- Granite Range
- Hays Canyon Range
- Independence Mountains
- Jarbidge Wilderness
- Pine Forest Range
- Ruby Mountains
- Santa Rosa Range
- Sheldon NWR
- Snake Mountains
- Snake Range
- Toiyabe Range
- Tuscarora Mountains
Alpine & Tundra

Figure 14: Distribution of Alpine and Tundra in Nevada.
KEY HABITAT: ALPINE AND TUNDRA

**Things to Know....**
- Alpine and tundra habitats are found at elevations above 10,600 feet.
- Key priority species include American pika, Black Rosy-Finch and Gray-crowned Rosy-Finch. Key features include snowmelt margins, talus slopes, and cool summer temperatures.
- Habitat threats include climate change, recreation, and development resulting in habitat fragmentation and loss.
- Climate change effects analyses have projected a 22% loss within the Elko region with other regions difficult to assess due to small acreages of alpine and tundra.
- No prescriptive actions were developed for this habitat.

**Ecoregions**

*Southwest ReGAP 2005*

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<td>Columbia Plateau</td>
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<tr>
<td>Sierra Nevada</td>
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<td>291</td>
</tr>
<tr>
<td>Mojave</td>
<td>small patches (unmapped)</td>
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*LANDFIRE 1211440 Rocky Mountain Alpine Turf (TNC Alpine)* – Presented separately because this is the only primarily vegetated community in the aggregation of habitats represented by the SWReGAP ecological systems below.

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<tr>
<th>Ecoregion</th>
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<td>Mojave</td>
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<td></td>
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<tr>
<td>Sierra Nevada</td>
<td>79</td>
<td>196</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>778</td>
<td>1921</td>
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**Ecological Systems**

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<th>SWReGAP Ecological Systems</th>
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<tr>
<td></td>
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<tr>
<td></td>
<td>S003 Mediterranean California Alpine Bedrock &amp; Scree</td>
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<tr>
<td>Alpine.................................</td>
<td>S081 Rocky Mountain Dry Tundra</td>
</tr>
</tbody>
</table>

**Key Habitat Description**

Alpine and tundra habitat is restricted to the highest elevations in Nevada and ranges from 3,500 to 4,005 meters (10,600 to 13,140 feet). The alpine ecological systems are composed of barren and sparsely vegetated substrates which typically include both bedrock outcrop and scree slopes with nonvascular plant-dominated communities. Alpine habitats are exposed to desiccating winds, rocky and sometimes unstable substrates, and plant growth is limited by a short growing season. Thin biological crusts which cover the ground surface are a
common feature of pristine areas in alpine tundra which are composed of varying proportions of lichens, mosses, cyanobacteria, and fungi, depending upon the environment and degree of crust development. These “cryptogamic” crusts vary in thickness from just a few millimeters to more than a few centimeters, and enhance the nutrient status of the soil, retard erosion by wind and water, help retain soil moisture, and enhance seedling establishment. Forbs, grasses, lichens, and low shrubs are sparsely distributed in alpine habitats. Dominant herbaceous species include shrubby cinquefoil, tufted hairgrass, Shasta sedge, spring sedge, alpine timothy, alpine avens, and cushion phlox.

Rocky Mountain dry tundra occurs on gentle to moderate slopes, flat ridges, valleys, and basins, where the soil has become relatively stabilized and the water supply is more or less constant. Snow retention, wind desiccation, permafrost, and a short growing season influence vegetation in these areas. A dense cover of low-growing, perennial grasses and forbs characterize these tundra habitats. Rhizomatous, sod-forming sedges are the dominant grasses, and prostrate and mat-forming plants with thick rootstocks or taproots characterize the forbs (NatureServe, 2004).

Value to Wildlife

Seeds, insects, and emergent vegetation are important food sources for wildlife in alpine and tundra habitats. In addition, special features of these habitats provide wildlife foraging microhabitats for resident and migratory species. For example, Black Rosy Finches forage on snowfield surfaces and on wet soil and meadow edges of snowbanks, where receding snow drops insects and seeds and uncovers other previously concealed food items. Black Rosy Finches concentrate foraging activity in snow patches, rocky meadows, and fell fields with some occasional use of shrubs, trees, and grassy meadows. In the winter, Black Rosy Finches feed in alpine tundra habitats during fair weather when the ground is blown free of snow (Johnson, 2002). Another alpine species, Gray-crowned Rosy Finch, usually forages on open ground, among rocks on talus, and on open snow fields and glaciers in alpine habitats (MacDougall-Shackleton et al., 2000).

Alpine and tundra habitats are valuable to wildlife seeking special features such as wet areas on the tundra, talus slopes, or animal prey. Some mammal species that occur in these habitats have limited to no capability of dispersal between mountain ranges because of the isolating nature of the intervening valleys. As a result, these populations may be genetically unique and specially adapted to local conditions.

Key Elements of Alpine and Tundra Habitat Important to Wildlife

**CONIFER ECOTONE** – foraging, protection from predators and nesting (edge conditions resulting in denser cover)
- Dusky Grouse
- Sooty Grouse

**FORAGING** – food sources include seeds, insects, and emergent vegetation
- Black Rosy-Finch
- Gray-crowned Rosy-Finch
- Rufous Hummingbird
- bighorn sheep
- mule deer
- dusky shrew
TALUS SLOPES – foraging, protection from predators, thermal cover
   American pika

PREY POPULATIONS – feeding on species in this habitat
   Golden Eagle
   Prairie Falcon

Existing Environment

Land Uses
   • Motorized recreation – OHVs, snowmobiles
   • Non-motorized recreation – hiking, skiing, snowboarding
   • Recreation development – ski areas
   • Livestock grazing
   • Communication sites
   • Wind energy development

Habitat Conditions

Alpine and tundra communities have been receding during the warm and dry conditions of the last 10,000 years. Since the passage of the Nevada Wilderness Protection Act of 1989, many alpine and tundra areas have received special designations that restrict certain uses and this largely benefits alpine and tundra habitats and wildlife species. Due to their remoteness and difficulty of access, alpine and tundra habitats in Nevada are generally in good condition.

Problems Facing the Species and Habitats

Global climate change and recreation have been identified as the primary problems facing alpine and tundra communities in Nevada (personal communication, Humboldt-Toiyabe National Forest personnel, December 2004). Warmer temperatures resulting from climate change may have long-term impacts on alpine habitats and their species through the fragmentation and loss of habitat. Many high elevation habitats in Nevada are within established Wilderness Areas or other undeveloped areas where non-motorized recreation is the most common use. OHV use is typically concentrated at the lower elevations but incursion of OHVs and snowmobiles into alpine areas can disturb wildlife or damage alpine vegetation, which is slow to recover. Ski area development and operation has localized effects on alpine habitat and the associated species in the Carson Range and Spring Mountains. Development of communication sites on mountain tops results in habitat loss, fragmentation, and disturbance to wildlife. Bighorn sheep using alpine and tundra sites are vulnerable to diseases carried by domestic sheep if contact between the two is made.

Predicted Effects of Climate Change

Alpine vegetation was mapped by LANDFIRE and evaluated by the TNC climate change analysis but acreages were very small. Two regions – Eastern Sierra and Elko – registered acreages large enough to analyze. This does not mean that alpine is absent elsewhere; the south Snake Range in the calcareous region harbors alpine vegetation but LANDFIRE appears to have classified alpine as “barren.” Reference conditions for the biophysical setting are one percent early and 99% late-closed. A total of 143 acres in the Eastern Sierra was classified 100% late-closed, basically reference condition. A total of 818 acres was inventoried in the Elko region, 60% of which
was classified in the early stage, 40% in the late-closed stage. With 50 years of climate change, the Elko region was modeled to transition to 90% late-closed with a 22% loss to conversion. In the Eastern Sierra, conditions were modeled to remain unchanged and a 46% increase in acreage was predicted; therefore, this result was treated as an anomaly of working with very small acreages within the modeling technique.

**Possible Wildlife Responses to Climate Change**

Transitioning from one class to another was not expected to negatively impact any priority species dependent on alpine vegetation, but a 22% loss, if validated, would likely result in negative responses by American pika which would suffer resource loss and loss of living space. Because the acreages are so small and the directional trends were conflicting between the two regions, definitive statements about the fate of the alpine vegetation type should be avoided.

**Taking Prescriptive Action**

No prescriptive management was designed for alpine vegetation. Although restoration techniques for disturbed sites do exist (Krautzer and Wittmann, 2006), if environmental conditions are significantly altered by climate change to the point that alpine communities can no longer persist on a site, the wisdom of attempting restoration through conventional agronomy would have to be intensely scrutinized. Other than unmanageable air temperature, the next greatest transformation of the alpine is encroachment by subalpine conifers as thermal conditions improve for trees (Salzer et al., 2009). Therefore, chainsaw removal of young trees is, theoretically, a method to preserve the alpine.

**Priority Research Needs**

- Long-term responses of alpine and tundra communities to global climate change.
- Wildlife species that measurably respond to stresses in alpine and tundra habitats (e.g., Gray-crowned Rosy-Finch, Black Rosy-Finch, American pika).
- Effects of recreation on alpine and tundra vegetation and wildlife species.
- Minimum viable population size of disjunct populations of Species of Conservation Priority in alpine and tundra habitats (e.g., bighorn sheep, American pika).
- Population demographics of American pikas and model viability of individual populations.
- Factors contributing to American pika extirpation in Nevada that partition natural variability more clearly from anthropogenic influence (Beever et al., 2003)
- Refined population trend estimates and factors determining population status of Black Rosy-Finches.

**Conservation Strategy**

*Goal: Thriving self-sustaining wildlife populations in environmentally resilient alpine and tundra habitats that remain intact while supporting human uses.*
Objective: Prevent the loss of the alpine BpS from exceeding five % in all regions through 2022.

**Action:** Design and implement priority research projects to facilitate the development of effective conservation and management guidelines for alpine and tundra habitats.

**Action:** Implement guidelines for recreation in alpine and tundra habitats that prevent damage to vegetation and biological crusts and minimize wildlife disturbance during crucial seasons (i.e., nesting, migration).

**Action:** Support and expand public outreach and education efforts (e.g., leave no trace messages) to minimize disturbance or habitat modification in key alpine and tundra habitats.

**Action:** Support public outreach that increases public awareness of the potential effects of global climate change. Incorporate research results of how global climate change affects wildlife and their habitats as they become available.

**Action:** Recommend alpine and tundra areas for special management (i.e., Special Interest Areas or Special Management Areas) for inclusion in the Humboldt-Toiyabe National Forest revised management plan and allotment management plan.

**Action:** Review and provide comments on the final proposed areas for special management that include alpine and tundra habitats in the Humboldt-Toiyabe National Forest Plan Revision and allotment management plan.

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

“current range and distribution” — no extinction of pika at any currently known occupied site as determined by specialized surveys scheduled regularly at intervals not to exceed five years.

**Action:** Initiate American pika occupancy surveys scheduled to inventory all known occupied sites at least every five years.

**Action:** Maintain structural components of alpine and tundra habitats important to wildlife, including scree, rockfalls, and subnivean microhabitats.

**Action:** Inventory historically-occupied sites where American pika have become extinct for suitability of habitat; investigate the appropriateness and feasibility of reintroducing American pika to vacant historic range.

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Objective: Maintain birds of conservation priority at current status and trend in alpine habitats through 2022.

“current status and trend” — as determined by Nevada Bird Count, USGS Breeding Bird Survey, or NDOW raptor nesting survey.

**Action:** Determine breeding status of Rufous Hummingbird in Nevada.

**Action:** Supplement Nevada Bird Count transect network with targeted alpine transects.

**Action:** Initiate research of Black Rosy-Finch breeding and wintering ecology and population demography.
Objective: Maintain mule deer and bighorn sheep at current population levels in alpine habitats through 2022.

“current population levels” – as determined by NDOW big game surveys.

Action: Prevent or minimize contact between extant bighorn sheep herds and domestic sheep in alpine habitats.

Objective: Maintain dusky shrew at detectable levels in alpine habitats through 2022.

“detectable levels” – as determined by live trap or pit trap survey conducted at regular intervals not to exceed five years.

Action: Add alpine sites to small mammal surveillance monitoring coverage.

Action: Initiate a statewide shrew distribution and ecology study with emphasis on conservation priority species.

Partnerships

Land Management/Ownership

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<thead>
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<th>Land Owner/Manager</th>
<th>Percent</th>
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<tr>
<td>U.S. Forest Service</td>
<td>84</td>
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<tr>
<td>National Park Service</td>
<td>11</td>
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<tr>
<td>Department of Defense</td>
<td>3</td>
</tr>
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<td>Other</td>
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Existing partnerships, plans, and programs

- Spring Mountains National Recreation Area Conservation Agreement
- Mount Grant Initial Conservation Assessment

Federal & State Agencies

- U. S. Forest Service
- U.S. Fish and Wildlife Service
- National Park Service (Great Basin National Park)
- Department of Defense (Hawthorne Army Munitions Depot)
- Nevada Department of Wildlife
- Nevada Division of Forestry
- Nevada Natural Heritage Program

Bird Initiatives

- Partners In Flight North American Land Bird Conservation Plan
- Nevada Partners in Flight
Sportsmen’s Organizations
- Nevada Bighorns Unlimited
- Fraternity of the Desert Bighorn

Conservation Organizations
- The Nature Conservancy
- National Audubon Society/Lahontan Audubon Society/Red Rock Audubon Society
- Sierra Club
- Nevada Wilderness Coalition (Friends of Nevada Wilderness, Nevada Wilderness Project)

Other Key Partners
- University of Nevada
- Counties
- Intermountain West Joint Venture
- Great Basin Bird Observatory

Focal Areas
East Humboldt Range
Independence Mountains
Jarbidge Wilderness
Ruby Mountains
Snake Range
Toiyabe Range
Toquima Range
Wassuk Range
Figure 15: Distribution of Intermountain Rivers and Streams in Nevada.
**Key Habitat: Intermountain Rivers and Streams**

### Things to Know....
- Intermountain rivers and streams include riparian areas, floodplains, and wetlands adjacent to streams and rivers.
- Riparian areas are critical areas of diversity with more than 75% of Nevada’s species associated with riparian vegetation.
- Habitat threats include non-native invasive plants, habitat loss or alteration, and hydromodifications.
- Climate change effects will likely increase desertification (entrenchment) and expansion or new invasion of invasive plants.
- Recommended prescriptive actions include weed monitoring and treatment and streambank stabilization, such as rip-rap installation.

### Ecoregions

*Southwest ReGAP 2005*

<table>
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<tr>
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<td>Columbia Plateau</td>
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<td>Mojave</td>
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<td><strong>Total</strong></td>
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<td><strong>273,254</strong></td>
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</table>

### Ecological Systems*

*SWReGAP 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

*No TNC Biophysical Settings were developed*

### Key Habitat Description

Riparian areas are most often associated with streams, lakes, 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 two meters to three meters. 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. Riparian floodplain vegetation is typically heterogeneous.
Lowland riparian habitats are those associated with the floodplains of major river systems primarily occurring below 1,500 meters 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 six kilometers 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 two meters for greasewood to 30 meters 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 must be narrow and deep with a pool to riffle ratio of 50:50. Pools will vary from less than the average stream width to wider than the average stream width and depth. When streams and rivers exhibit these qualities, along with a healthy riparian 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 concern 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, pers. comm. 2004). Although extremely small in extent, riparian communities are critical centers of wildlife diversity (Mac, 1988).
More than 75% of the species in Nevada are strongly associated with riparian vegetation (U.S. General Accounting Office, 1993), including 80% 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 (e.g., 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 concern, 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 Important to Wildlife

**MONTANE RIPARIAN**

**MATURE OVERSTORY** – nesting structure (large stems), foraging, roosting, protection from predators

- Cassin’s Finch
- Northern Goshawk

**WILLOW/SHRUB MIDSTORY** – nesting structure, foraging, protection from predators, thermal cover

- Mountain Quail
- Mountain Willow Flycatcher (*brewsteri*)
- Willow Flycatcher (*adastus*)
- Inyo shrew
- Montane shrew

**HERBACEOUS UNDERSTORY** – foraging

- Rufous Hummingbird
- Virginia’s Warbler
- Preble’s Shrew
- western jumping mouse

**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
**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)

- Bank Swallow
- water shrew
- northern river otter
- northwestern pond turtle

**LOWLAND RIPARIAN**

**MATURE OVERSTORY** – nesting structure (large stems), foraging, roosting, protection from predators

- Bald Eagle
- Western Yellow-billed Cuckoo

**WILLOW/SHRUB MIDSTORY** – nesting structure, foraging, protection from predators, thermal cover

- Willow Flycatcher (adastus)

**MEADOW** – foraging, burrowing

- Burrowing Owl
- Botta pocket gopher
- Preble’s shrew

**SUB-MONTANE AND LOWLAND STREAM AQUATIC SYSTEMS** – physiographic grouping of aquatic species

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

**MONTANE AND SUB-MONTANE SALMONID STREAM SYSTEMS** – physiographic grouping of aquatic species

- bull trout
- Lahontan cutthroat trout
- White River speckled dace
- White River spinedace
- Inland Columbia Basin redband trout
- Warner Valley redband trout
- Yellowstone cutthroat trout
- mountain whitefish
- northern leopard frog
- Columbia spotted frog
Existing Environment

Land Uses
- Agriculture
- Livestock grazing
- Hydroelectric power production
- Irrigation diversion
- Flood control
- Groundwater development
- Motorized recreation
- Non-motorized recreation
- Recreation development
- Urban/suburban development
- Road 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% of its wetlands (a broader category that includes riparian areas), and Utah about 90%, 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 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 non-native 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 including Wall Canyon and 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, 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. Finally, as wildlife concentrates in riparian habitat, so too do those who pursue illegal activities such as poaching and illegal collection.

**Predicted Climate Change Effects**

*Riparian habitats*

Three major problems affect riparian habitats in Nevada: The invasion of exotic forbs and trees such as tall whitetop, noxious thistles, Russian olive, and tamarisk; the entrenchment of flow channels; and the loss of perennial flow in non-carbonate waterways (i.e., conversion to desert washes). Characteristic classes for intermountain riparian vegetative systems are early (0-50% native cover 0-5 yrs old), mid-open (31-100% native cover 5-20 yrs old), and late closed 31-100% cover >20 yrs old). Reference conditions indicate roughly an equal three-way split between the three characteristic classes in good health. Uncharacteristic classes include exotic forb and tree species (>5 percent exotic forb and tree cover), desertified (entrenched with 10-50% upland shrubs), pasture (haymeadow tended for agriculture with or without introduction of palatable grasses), and shrub-forb-encroached (10-50% cover unpalatable shrubs such as Woods’ rose and sumac). Loss of perennial
flow results in a conversion to desert washes.

**Non-carbonate**

Current conditions of non-carbonate riparian systems statewide are unfavorable – only three regions in the state (Eastern Sierra, Toiyabe, and Tonopah) currently have over 60% of their extent in characteristic classes. The other 10 regions have over 40% of their riparian systems in entrenchment or exotic species invasion, ranging from a low of 43% in the Elko region to a high of 88% in the Clover region. Considerable variation exists between regions as to whether the systems are predominantly entrenched or weed-invaded— five regions each. Of the 10 regions, the western/southern ones tended to be primarily weed-invaded while the eastern/northern ones tended to be primarily entrenched. Fifty years of climate change are predicted to increase the percentages in uncharacteristic classes even more, usually at the expense of the early-succession class. Not surprisingly, the regions that will change the least in 50 years (less than 10% increase) are the ones that are currently the most deviated – the remaining increment from 80 to 100% being much less than say, from 50%. The remaining regions of the “10 most deviated” were predicted to increase 12 to 15% in uncharacteristic class percentages. The three regions under 40% deviation were predicted to increase a little more, between 17 and 24%. All would then be over 50% deviated from characteristic classes. The most unfavorable result is the permanent conversion of perennial waterways into desert washes in all regions due to increased evapotranspiration. Regional differences exist in conversion to desert washes: the highest losses between 9% and 13% are predicted in the Eastern Sierra, Eureka, Humboldt, Tonopah, Toiyabe, and Walker regions; intermediate losses between 3 and <9% are predicted for the Black Rock, Elko, Lahontan, and Mojave regions; and losses <3% are found in the Clover and Owyhee regions.

**Carbonate**

Carbonate-based riparian systems occur in three regions in Nevada – Calcareous, Clover, and Mojave. These systems are already over 50% entrenched in all three regions. The percentages of classes invaded by exotic species vary from four percent in the Mojave, nine percent in the Calcareous Ranges, to 19% in the Clover Valley region. Entrenchment is not predicted to increase more than one or two percent for any of the three regions with 50 years of climate change. Exotic species invasion will increase from three to nine percent and the resulting total percentage of vegetation weed-invaded will range from 15 to 22% among the three regions. No conversion to desert washes occurs on carbonate geology due to the buffering of the aquifer.

**Aquatic habitats**

Potential climate change effects on intermountain river and stream aquatic habitats are driven by predicted changes in two key interlinked components of climate, precipitation and air temperature. Interannual increases in average air temperature are well documented and this trend is expected to continue or accelerate through 2050 across Nevada particularly in summer through late winter periods in northern and central areas of the state. Although most available precipitation models suggest a substantive increase in fall and winter precipitation and hence available snowpack especially in northeastern and north-central Nevada during the same time period, interaction with increasing air temperatures is likely to offset much of the benefit of that precipitation in maintaining seasonal streamflows and aquatic habitat quality in many intermountain river and stream systems. Observed trends under current conditions across the Great Basin already support substantially earlier timing of spring runoff conditions in many lotic systems and this trend is likely to accelerate. This likely trend towards reduced snowpack duration and increased precipitation as rain particularly in lower elevation and more southerly watershed basins can be expected to particularly, and negatively impact recharge of local and non-carbonate aquifer systems supporting the quality and quantity of aquatic system base flows especially in...
lower elevation and hydrographically isolated stream and river reaches. Available models also suggest that the most substantial decreases in average precipitation can be expected in the March through August periods, and for air temperature the most significant increases in June through September. When coupled with early onset of annual runoff events, these changes are likely to significantly impact many flowing aquatic systems with reduced average summer and fall base flows, and increases in in-channel water temperatures. Although some, particularly smaller, isolated or higher elevation streams will be influenced by local variation in year-to-year conditions that may mitigate some of these effects, the likely general trend for intermountain river and stream conditions will be towards earlier onset of spring runoff with the potential for, periodically, higher intensity and shorter duration runoff events, and longer periods of low seasonal base flows during the summer and fall particularly for lower elevation reaches.

**Possible Wildlife Responses to Climate Change**

Desertified (entrenched) riparian systems are practically uninhabitable by species that specialize in “riparian” vegetation (e.g., willows, cottonwoods, birch, alder, etc.). Increases in riparian desertification predicted for the non-carbonate systems in several regions will result in displacement of cottonwood-willow-alder associated species. The impacts of exotic species invasion are much more difficult to assess and predict, because a system invaded by exotic species by five percent (but not desertified) is probably still providing traditional riparian habitat, while a system invaded 100% with exotics is expected to provide little or no habitat for “riparian-associated” species. One would expect a gradual reduction in native plant density and occupation until riparian vegetation had been replaced to an extent it could no longer function as traditional riparian wildlife habitat. The rate of species dropout under such a scenario is not well-studied and will need to be understood and monitored through the life of this Plan.

*Meadow Species*

- Bobolink
- Sandhill Crane
- Long-billed Curlew
- Short-eared Owl

Of 31 terrestrial Species of Conservation Priority considered to be significantly associated with intermountain riparian habitats in Nevada, four are predominantly associated with open meadow habitats with some willow occurrence – Bobolink, Long-billed Curlew, Sandhill Crane, and Short-eared Owl. Bobolink and Long-billed Curlew use tall, unmowed meadow grasses with Bobolink more dependent on flooding to protect nests from predators and the curlew more impacted by flooding if fluctuations are frequent and wide in amplitude. Sandhill Cranes and Short-eared Owls are more tolerant of willow growth in the meadow, but still prefer open meadow and shun tree (black willow-cottonwood) overstory. Succession analysis indicates that most of the transitions to weed-invaded classes will come from the early (A) riparian class in non-carbonate systems. All four of these species are northerly distributed in the state and stand to be most impacted by weed invasion, which at its extreme extent could conceivably render habitats unsuitable for their use at local scales. Studies are lacking, but incremental impacts could begin at around 30-35% exotic forb coverage. Beyond that, emigration away from the impacted habitat could be expected to accelerate to eventually zero occupation.

Losses of early-class riparian habitat in the Elko and Humboldt regions ranging from 15 to 30% could have a measurable impact on the distribution of all four species without the ameliorative effect of managed pasture. Pastures managed for quality grass hay (assuming active weed management on private lands) and left uncut through most of the breeding season can serve as functional surrogates for natural early class meadows, thus highlighting the importance of private lands to these species.
Shrub Mid-Story Species

- Common Nighthawk
- Mountain Quail
- Rufous Hummingbird
- Virginia’s Warbler
- Willow Flycatcher
- Preble’s shrew
- Mountain beaver

Seven intermountain riparian Species of Conservation Priority are generally considered to need some kind of shrub midstory to provide nesting substrate, escape/thermal cover, or both. Of these, two breeding birds (Virginia’s Warbler, Willow Flycatcher) are the least flexible in their preference for dense shrub cover, even though Virginia’s Warbler is a ground-nesting species. The other five – Mountain Quail, Rufous Hummingbird, Common Nighthawk, Preble’s shrew, and mountain beaver – exhibit more flexibility in their use of mixed riparian habitats consisting of meadow grasses, willow-alder midstory, and cottonwood overstory, but are not expected to be particularly facilitated by the maintenance of managed haymeadow (pasture). Reductions in percentages of mid- and late-succession classes of intermountain riparian (carbonate and non-carbonate) were predicted to remain below 10% in nine of the 13 regions. Regions with reductions greater than 10% included Humboldt (11%), Calcareous non-carbonate (13%), Toiyabe (19%) and Mojave non-carbonate (23%). Reductions in shrub midstory at these higher levels might differentially target Virginia’s Warbler and Willow Flycatcher in these regions, although no regions are expected to lose any of the shrub-associated species completely.

Meadow-Shrub-Tree-Pasture Species

- Botta pocket gopher
- Inyo shrew
- Merriam’s shrew
- montane shrew
- mountain pocket gopher
- Pahranagat Valley montane vole
- northern river otter
- water shrew
- western jumping mouse
- ring-necked snake

Ten species are considered to utilize riparian habitats in a variety of their native forms, can also use managed pasture, but are expected to be impacted by desertification and/or exotic forb invasion in its heavier expressions. All but two of these 10 species are grass/forb understory –associated but with tolerances for shrub-tree overstories. The expectation that these species will also use managed pasture without shrub-tree overstory separates them from the previous grouping. The heaviest transitions from characteristic to non-chaaracteristic classes are predicted in the southwest-central regions (Eastern Sierra, Walker Corridor, Toiyabe, Tonopah, and the high-elevation Mojave), possibly singling out the Botta pocket gopher complex for targeted impacts since the species and its network of geographically isolated subspecies are concentrated in that general region.

Northern river otter and water shrew are two mammals most closely associated with the river channel itself, but are sensitive to water quality and prefer escape cover along the banks, thus they thrive where native riparian vegetation populates and armors streambanks against erosion and the resultant streamflow siltation. The river otter is most abundant in the Humboldt River and its largest connected tributaries (the Little Humboldt is connected to the mainstem by subsurface flow). The Elko, Eureka, and Humboldt Ranges are predicted to experience 12-15% increases in uncharacteristic classes (primarily exotic forb invasion) over the next 50 years, but it is hard to predict whether those changes will occur primarily in the mountain streams (no otters) or the lowland mainstem channels, so while some deterioration of otter habitat suitability is expected, it is not possible to quantify. The same uncertainty exists for water shrew, but it is distributed over both mountain streams and valley mainstems and could experience habitat deterioration at either.
Mature Cottonwood Overstory Species

- Lewis’s Woodpecker
- Cassin’s Finch
- Western Yellow-billed Cuckoo
- red bat

Four species are considered to require mature cottonwood overstory to satisfy critical life-history needs in riparian habitats – Lewis’s Woodpecker, Yellow-billed Cuckoo, Cassin’s Finch, and red bat. Lewis’s Woodpecker’s use of mature trees in riparian/aspen has already been discussed in the Aspen chapter. Lewis’s Woodpeckers are not great excavators and require soft or weakened tree phloem for excavation of new nest cavities or adaptation of existing ones. In the western states, the Yellow-billed Cuckoo is an increasingly rare summer resident of lowland mainstem river systems supporting extensive “gallery” cottonwood forests. In Nevada’s Great Basin, only the Carson River above Lahontan Reservoir has been regularly occupied by Yellow-billed Cuckoos during the last 25 years. The Truckee River has undergone significant habitat restoration under the leadership of The Nature Conservancy over the last 20 years and could be on track to support suitable cuckoo habitat in the next decade or so. Red bats share the same preference for lowland gallery cottonwood forests as cuckoos. The Cassin’s Finch resides in the highest elevations of the cottonwood zone in riparian habitats within pinyon-juniper uplands or coniferous forest.

The bulk of lowland mainstem riparian typically supporting gallery cottonwood forest occurs in the Eastern Sierra region where late-closed “montane riparian” is expected to remain constant over the next 50 years (Appendix C), but conversions from early and mid-open classes to exotic forbs could negatively impact the maintenance of late-closed canopies over the following 50 years (post-2022) if action to stem the advance of exotic species invasion is not taken.

Similar predictions are made for the Black Rock region where isolated populations of Lewis’s Woodpeckers live in the cottonwood forests of the Santa Rosa Mountains. Late-closed percentages would remain stable through 2022, but loss of early and mid-open classes to exotic forb invasion could impact replacement of mature cottonwood into the next 50-year interval post-2022. In the Elko region, desertification has already impacted 40% of riparian habitats, and a five percent decrease in late-closed is predicted to occur along with the loss of early/mid-open classes to exotic forb invasion. The response of Lewis’s Woodpeckers to these trends likely would warrant monitoring, especially if continental population trends for the woodpecker continue to decline or fail to recover.

Other Species

- Bank Swallow
- northwestern pond turtle
- mule deer
- northern rubber boa
- Western red-tailed skink

A small group of species seemed to be associated to riparian habitats for a variety of reasons that did not seem to be impacted heavily by ecological departure. Of these the most conspicuous and surprising might be mule deer, a species that benefits from the high productivity of riparian meadows and shrub mid-stories, but also will use tall whitetop for thermal and protective cover, particularly for day-use prior to moving into open meadows to graze at night.

Bank swallows excavate nest holes in cut banks and nest in colonies of a few pairs up to 2,000 pairs or more.
(Garrison, 1999), so it would seem this would not be a species one would use to represent functional riparian habitat health, but the species continues to demonstrate continental and regional population declines worthy of monitoring and possibly yet to be understood in other terms of its life history needs. Western red-tailed skink and northern rubber boa are considered riparian-associated because they are often found in the moister habitats provided by rivers and streams and their floodplains. Western red-tailed skink primarily occurs in the Mojave region, where it would be found in “montane riparian” habitats at the higher elevations above what would be known as “warm desert riparian” (in which it is also found). The northwestern pond turtle is dependent on channel flow and no particular sensitivity to the presence or quality of bank vegetation has been reported. The species may in fact be more connected to submergent aquatic vegetation in the main channel and open backwaters than it is to riparian terrestrial vegetation.

Aquatic priority species

Predicted changes in temperature and precipitation on intermountain river and stream systems, in general, will impact resident priority aquatic species in several specific ways, with the understanding that effects are likely to vary substantially dependent on local watershed and snowpack conditions that are anticipated to be highly variable from year to year. Climate change effects on total snowpack accumulation in specific watersheds is difficult to predict, but expected changes in snowmelt timing as characterized by earlier spring onset will functionally result in changes in the timing, magnitude and duration of seasonal stream flows. These changes in timing and characteristics of peak flows have implications for habitat quality to the extent that they modify current processes essential for maintaining channel characteristics, sediment deposition and the maintenance of instream habitats for spawning, juvenile recruitment and summer maintenance of all age classes of native fishes. Lower summer base flows driven by reduced summer through early fall precipitation, in combination with summer period temperature rise, can be expected to result in increased water temperatures particularly in smaller, isolated and lower elevation stream and river systems with a more frequent occurrence of individual stream and river segments approaching or exceeding thermal maxima for resident fishes, particularly native salmonids. Even where individual stream reaches may stay wetted, reductions in suitable habitat can be expected with resultant contraction of available range for many species. For more broadly distributed fishes the implications include an increased potential for loss of connectivity and range fragmentation, reductions in population sizes and possibly local extinctions associated with thermal regimes and habitat availability. For all native fish species associated with these systems, these processes will act on individuals as well with potential negative effects on survivorship and mortality, condition and growth associated with changes in stream food webs and energy balance, and microhabitat changes within individual stream segments affecting habitat characteristics for critical life stages and behaviors, the availability of low-flow thermal refuges and exposure to predators and competitors. The potential exists in many systems as well for changes in species assemblages because of range shifts by co-existing species and the enhanced opportunity for invasive, non-native species persistence under warmer and more variable flow conditions.

Sub-Montane and Lowland Stream Aquatic Systems

| cui-ui | Northern leopard frog |
| Lahontan Cutthroat trout | Alvord chub |
| Independence Valley speckled dace | Independence Valley tui chub |
| Big Spring spinedace | Railroad Valley tui chub |
| California floater | Wall Canyon sucker |
| Warner sucker | White River desert sucker |
Several priority aquatic species have a particular dependence on lower elevation intermountain river and stream systems for all or part of their life cycles. Predicted trends for temperature are similar across northern Nevada, but some models suggest more severe reductions in average precipitation in western areas of the state and those drainages associated with the Sierra front particularly in the spring through early fall periods. Species associated with larger sub-montane river systems including cui-ui and Lahontan cutthroat trout will face particular challenges given the likelihood of reductions in base flows during summer low-flow periods with resultant affects on habitat quality and instream thermal characteristics as described previously. Although effects to species associated with isolated drainage systems such as tui chub are more difficult to predict because of the lack of certainty of short-term changes on individual watersheds, impacts during summer season low flow conditions in the future are likely to be similar with the potential for contractions in available range and increased thermal stress in areas of occupied habitats. The possible exception to this scenario is Big Spring spinedace; occupied habitat for that species although stream-based is more dependent on base flow from spring systems associated with carbonate regional aquifers and potential impacts are associated with the potential for increased monsoonal summer storm events and increased unpredictability in the frequency and magnitude of peak flow events altering habitat quality and characteristics.

**Montane and Sub-Montane Salmonid Stream Systems**

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

Predicted changes as previously described are anticipated to have the most significant effect on salmonid species inhabiting these moderate to higher elevation stream and small river systems, with those effects more prevalent in northeastern and north-central Nevada systems. Although across much of this part of the state total winter precipitation is expected to increase, predicted changes in air temperatures are likely to continue trends towards earlier spring onset. Associated effects will include changes in annual timing and intensity of spring runoff events, followed by likely reductions in late spring through summer base flows. Similar to effects on salmonid species in other sub-montane and lowland stream systems, reduced warm season base flows associated with both earlier spring runoff and predicted reductions in summer period precipitation have a high potential to alter thermal characteristics of lower elevation salmonid habitats, with at least some systems having an increased likelihood of exceeding thermal maxima and loss of habitat suitability for native salmonid species periodically dependent on individual years’ conditions. Although all native salmonid species face potentially significant range contraction and loss of connectivity for existing populations, the highest risk for impacts is to bull trout; the occupied range for this species is severely constrained in Nevada because of thermal characteristics under existing conditions and substantive additional range contraction would be likely. Non-salmonid White River native fishes, although utilizing higher elevation stream systems, also occur in lower-elevation spring-based outflow systems dependent, in some cases, on regional carbonate aquifer groundwater systems likely less subject to near-term effects from predicted air temperature and precipitation changes. Even within occupied stream reaches, effects would be less than that anticipated for native salmonids and little short term effect is anticipated in these habitats for those species through 2022.
Taking Prescriptive Action

During our consultation with restoration experts, three simple prescriptions were selected as most effective for restoring departed montane riparian systems – weed inventory (spot control) for small streams, exotic species control for larger floodplains, and rock riffle installation in entrenched streams. Exotic weed control costs varied significantly with respect to the tasks involved. Where spraying was all that was needed, costs ran $40-50 per acre, but if tamarisk cutting and painting was involved, costs jumped to $250-350 per acre. In the Calcareous region, treatment using a combination of all three treatments reduced entrenchment by five percent and prevented exotic weed invasion by 66% over 50 years. Exotic weed control modeled in the Lahontan and Walker regions reduced exotic weed invasion by 33% and reduced by 20% in the Mojave region (TNC, 2011). The benefits to wildlife were expected to be best realized in recruitment into the mid-open and late-closed classes after 2022.

Priority Research Needs

- Species of conservation priority responses to incremental exotic weed invasion – tolerance thresholds.
- Effective methods for control and eradication of invasive aquatic species
- Methods of management of riparian systems to mimic natural cycles addressing the life history needs of riparian and aquatic wildlife
- Distribution, population demography, and genetic analysis of willow flycatcher subspecies (adastus, brewsteri)
- Distribution and habitat preference of western jumping mouse and western red bat.
- Status, distribution, and habitat use of Western Yellow-billed Cuckoo on the Carson River
- Update distribution, genetic analysis, and population viability analysis for Botta pocket gopher.
- Identify and survey potential northern leopard frog sites to better determine current distribution.
- Identify cost-effective low technology actions to slow conversion of montane riparian streams into desert washes.

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:** Limit the increase in weed-invaded and/or entrenched riparian systems to less than 10% through 2022.

**Action:** Define and describe fully-functioning riparian terrestrial wildlife habitats beyond Proper Functioning Condition; integrate WAP Species of Conservation Priority riparian habitat objectives and actions into BLM Resource Management Plans, Forest Service Forest Plans, National Wildlife Refuge Comprehensive Conservation Plans, and other 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 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: Delineate distribution and population demography for the brewsteri and adastus subspecies of Willow Flycatcher.

Action: Delineate distribution, status and trend for western jumping mouse and western red bat.

Action: Update distribution, genetic analysis, and population viability analysis for Botta 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 2022.

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: 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:** 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 the recovery implementation processes for upper White River Valley native fishes.

**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:** Continue cooperative efforts to identify fish passage barriers and incorporate data into the Nevada Fish Passage database.

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

**Action:** Work with private water right holders to manage water diversions with the goal of maximizing low-flow period base flows and where feasible restoring natural flow regimes.

**Action:** Identify stream and river reaches where there is a need to apply for in-stream flow water rights for SOCP and pursue acquisition of those rights where feasible.

**Action:** Identify locations where screening is needed to prevent fish loss/entrainment in water diversions and implement corrective actions in cooperation with owners or operators.

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

**Action:** Continue implementation of recovery processes for Big Spring spinedace including restoration of riparian function and stream channel dynamics in 4 km of Condor Canyon.

**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, Redband, and Yellowstone cutthroat 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 active control of invasive aquatic species and other action items identified in the draft species management plans.

**Action:** Develop a comprehensive statewide database of historic and current northern leopard frog records.

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

**Action:** Identify appropriate survey methods and implement status monitoring for northern leopard frog at historic and potential locations to better determine current distribution.

### Partnerships

**Land management/ownership**

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**Existing partnerships, plans, and programs**

- Lahontan Cutthroat Trout Recovery
  - Distinct Population Segment Recovery Teams
  - Quinn/Black Rock
  - Upper Humboldt
  - Western
- Bull Trout Recovery Plan

**Recovery Implementation Teams (RIT)**

- White River
- Railroad Valley
- Big Spring Spinedace

**Conservation Agreements**

- Northeast Columbia Spotted Frog
- Toiyabe Columbia Spotted Frog

**Federal & State Agencies**

- Nevada Department of Wildlife
- Bureau of Land Management
- U.S. Forest Service
• U.S. Fish & Wildlife Service
• Bureau of Reclamation

Counties
• Northeast and Toiyabe Columbia Spotted Frog Conservation Agreements
• Truckee-Carson Irrigation District
• Walker River Irrigation District
• County Resource Plans
• Churchill County Quality of Life Plan
• Lower Truckee River Restoration Advisory Committee

Conservation Organizations
• The Nature Conservancy
  o Truckee River Project
  o Carson River Project
• National Audubon Society/Lahontan Audubon Society/Red Rock Audubon Society Important Bird Areas Program
• Sierra Club

Bird Conservation Initiatives
• Partners In Flight
• Partners In Flight North American Land Bird Conservation Plan
• Nevada Partners In Flight & Nevada Bird Conservation Plan
• U.S. Shorebird Conservation Plan
• Intermountain West Regional Report
• North American Waterbird Conservation Plan
• Intermountain West Waterbird Conservation Plan

Other Key Partners
• Intermountain West Joint Venture/Nevada State Steering Committee

Focal Areas
Adobe Range Jarbidge Wilderness Salmon Falls Creek Area
Black Rock Desert Wash Mary's River Salmon River Range
Bruneau River Montana Mountains Santa Rosa Range
Carson Range O'Neil Basin Snake Mountains
Carson Sink Owyhee Desert (South Fork Owayhee Drainage) Truckee Meadows
Carson Valley Owyhee River Area Tuscarora Mountains
East Humboldt Range Pahranagat Valley Wall Canyon
Goose Creek Pyramid Lake Valley Wassuk Range
Huntington Valley Railroad Valley West Fork Beaver Creek
Independence Mountains Ruby Mountains White River Valley

Also:
Carson River Humboldt River and tributaries Pyramid Lake
Carson River Jarbidge River and tributaries Truckee River