Antelope & North Spring Valleys, Steptoe Valley & Uplands, Newark Valley Extended Watershed, and Meadow Valley Wash & Uplands Conservation Area Assessment Executive Summary

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Egan Range from Steptoe Valley salt desert shrubland near Steptoe Ranch
Photo: Louis Provencher, TNC, 2002

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Abstract

The Nature Conservancy of Nevada hosted a series of conservation area assessment workshops for Antelope and North Spring Valleys, Steptoe Valley and Uplands, Newark Valley Extended Watershed, and Meadow Valley Wash and Uplands from September 2002 to February 2003 in Ely, Nevada. Approximately 40 experts representing federal and state agencies, non-governmental conservation organizations, tribal governments, ranchers, citizens, academia, and state extension services, comprised multi-partner teams of 7-12 experts assigned to each area. The four areas total approximately 3 million acres (1,214,574 ha). The assessment followed The Nature Conservancy's 5-S methodology that encourages experts to identify **systems** (conservation targets), **stresses** to the systems, **sources** of those stresses, **strategies** to abate high-ranked sources of stress, and measures of **success**. High priority systems and species, both those that are particularly rare and those that are particularly threatened, were identified. The teams developed common strategies for five systems that share the same ecological characteristics and sources of stress across all four sites: sagebrush-grass-pinyon-juniper mosaic, "historic" pinyon-juniper ecological sites, montane woodlands, springs and creeks, and salt desert shrublands. At all four sites, teams independently identified the following critical sources of stress: fire suppression, grazing management of wild horses, non-native invasive species, construction of ditches and drainage systems, climate change, grazing management of livestock, elk use (no elk in Newark Valley), and recreational vehicle use. Multi-site strategies included using targeted fuels reduction in dense pinyon-juniper stands, aspen stands, and around springs, addressing policy barriers to the use of prescribed fire, fostering a native seed industry, improving NEPA documentation, strategically targeting control of invasive species, faithfully implementing grazing management plans for livestock, wild horses, and elk, and managing springs and outflow creeks to reduce mechanical damage by livestock, wild horse, elk, and recreational users. In addition, each team developed strategies to abate sources of stress affecting local area systems. Implementation of the strategies will require both internal efforts from the Bureau of Land Management and the United States Forest Service and help from non-governmental organizations, especially members of the Eastern Nevada Landscape Coalition. It is hoped that this document will help guide future management of the biologically rich lands of the Great Basin and Mojave Desert in eastern Nevada.

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1. The Efroymson Process

Efroymson workshops were designed to involve conservation partners in The Nature Conservancy's (TNC) initial site assessments to develop effective strategies for conserving functional landscapes. The participatory process elicited and produced clear conservation goals, obstacles to goals, strategies for success, and draft implementation steps. This method is the product of over 20 years of experimentation, innovation, and thought by TNC staff at many landscapes. This Efroymson workshop series consisted of four teams, each one focused at a separate conservation area. Greg Low of TNC was the moderator for the workshops. Each team involved six to twelve individuals who brought a breadth and depth of knowledge about the conservation needs and opportunities at a site. Participants from each site followed assessment exercises and entered key information into a specially-programmed spreadsheet. The user-friendly spreadsheets have been developed and tested extensively over the past years for use in conservation area planning and measures. Teams worked concurrently, and periodically gathered to present their plans to the whole group (~40 people total). The larger group reviewed and critiqued each team's product, which resulted in improved outcomes.

Efroymson workshop participants in the burned and reseeded pinyon-juniper expansion area of the Robinson Pass wildfire in the Egan Range
Photo: Greg Low, The Nature Conservancy, 2002

Assessment areas were chosen as a compromise between TNC's identification of ecologically important sites in the Great Basin and Mojave Desert ecoregional plans (TNC 2000; Nachlinger et al. 2001) and Bureau of Land Management's (BLM) need to analyze watersheds. Also,

priority was given to northern watersheds were BLM had more information available, however TNC, the Eastern Nevada Landscape Coalition, and the BLM felt that it was important to include the biologically important southern watersheds of Meadow Valley Wash. Finally, watersheds needed to be sufficiently large to be meaningful to managers and to sustain ecological processes. Therefore, the lower extent of these assessment areas was 500,000 acres (202,429 ha) and each contained several TNC portfolio sites.

Team members were recruited from an extensive list produced by the Eastern Nevada Landscape Coalition, BLM, Tribal contacts, and local residents. We attempted to include people from federal agencies, state agencies, academia, tribal governments, local governments, the ranching community, the livestock industry, non-governmental environmental organizations, and expert citizens with either local biological knowledge or land management experience. Team members were people who could participate in a conservation assessment based on their expert knowledge of local land management and the ecology of natural resources. Teams consisted of the following members.

ANTELOPE AND NORTH SPRING Valleys (hereafter Antelope)
Jeffrey Brower, Ely BLM;
Cody Coombs, Ely BLM;
Bruce Eldridge, Rancher;
Duane Erickson, Independent;
Milton Hooper, Goshute Shoshone Tribe;
Gene Kolkman, Ely BLM;
Roberta Moore, Sierra Club;
Jan Nachlinger, TNC NV (facilitator);
Dave Sharp, Independent and Sierra Club;
Barbara Walker, Ely USFS.

STEPTOE VALLEY AND UPLANDS (hereafter Steptoe)
Larry Barngrover, Ely BLM
Neil Darby, Great Basin NP;
Alan Holt, TNC Northwest Division, WA (facilitator);
Becky Mills, Former Superintendent of Great Basin NP;
Bridgett Nielsen, USFWS;
Louis Provencher, TNC NV (co-facilitator);
Jenny Scanland, Nevada Division of Forestry;
Steve Schacht; Ely USFS;
Sherman Swanson, UNR Cooperative Extension;
Tim Thiesen, Ely BLM;
Bob Wilson, UNR Cooperative Extension.

NEWARK VALLEY EXTENDED WATERSHED (hereafter Newark)
Gary Back, SRK Consulting, Engineers & Scientists;
Loretta Cartner, Ely USFS;
Johanna Garrett, Independent;
Gary Medlyn, Ely BLM;
William Morrill, ENLC and Consulting (facilitator);
Tina Nappe, Sierra Club;
Ryan Pitts, Ely BLM;
Warren Scoppetone, Hay Farmer.

MEADOW VALLEY WASH AND UPLANDS (hereafter Meadow Valley)
Leslie Argo, Utah State University;
John Hiatt, ENLC and Red Rock Audubon;
Jeri Krueger, USFWS;
Bob Lewis, Rancher;
Bevan Lister, Rancher;
James Potts, NRCS Caliente;
Louis Provencher, TNC NV (facilitator);
Alan Shepherd, Ely BLM;
Kyle Teel, Ely BLM.

During 2002-2003, team members met during two workshops (17-19 September 2002 and 7-8 January 2003), several homework sessions, and at least one field trip per site. In addition, team facilitators interviewed team members, residents, and agency staff, and synthesized Nevada Natural Heritage Program data for rare species (NatureServe Explorer 2001) and data from the Bird Conservation Plan of Nevada Partners-in-Flight. Results presented here follow from these efforts.

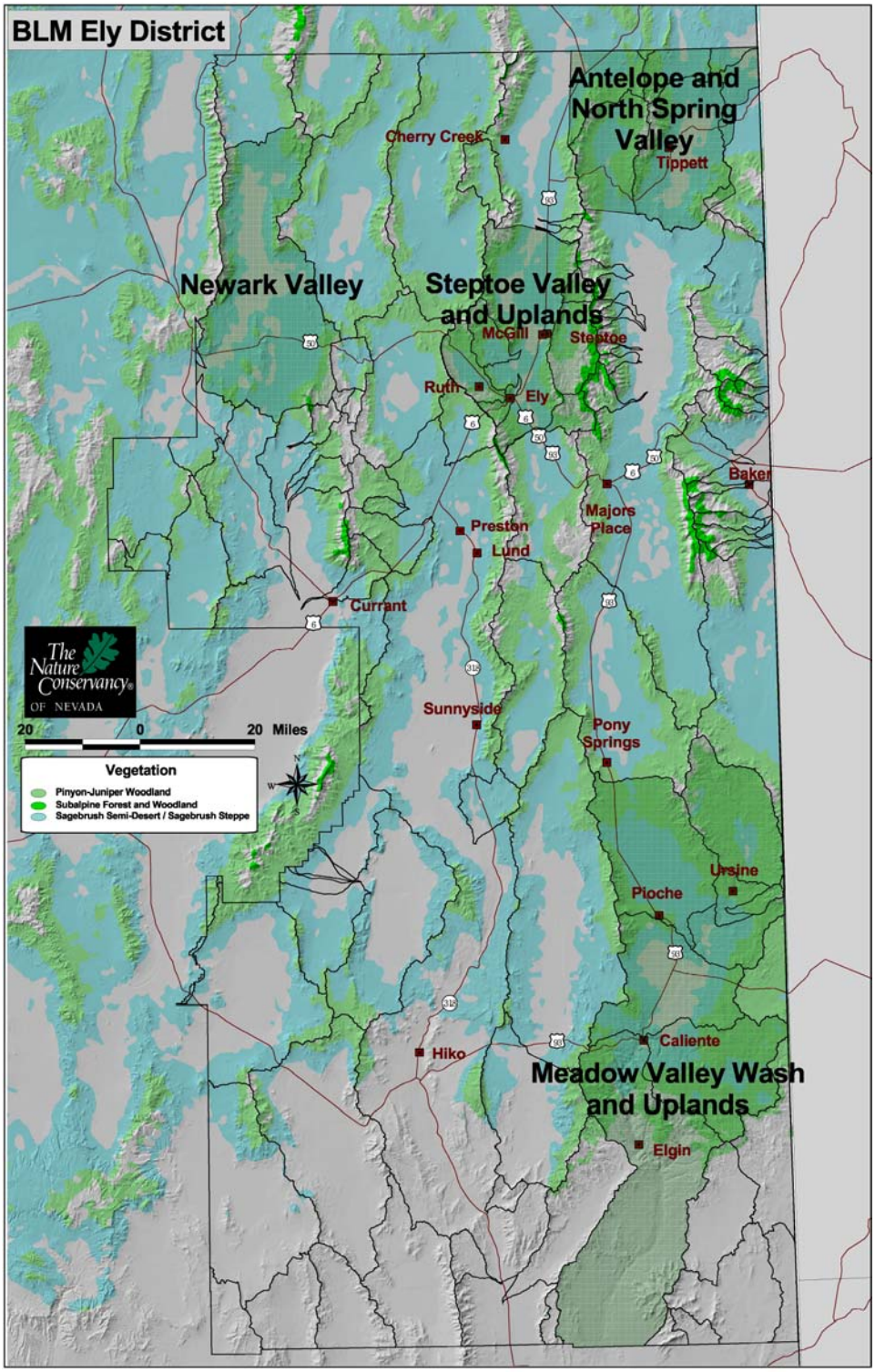

Fig.1. The four Efroymson assessment areas for eastern Nevada are shaded: Antelope and North Spring Valleys, Steptoe Valley and Uplands, Newark Valley Extended Watershed, and Meadow Valley Wash and Uplands. Subalpine conifer is in bright green; pinyon and juniper in light green; sagebrush shrublands are in blue; and the gray background represents non-fire dependent systems.

The Efroymson process is based on TNC's 5-S methodology and software. The five "S's represent s**ystems**, s**tresses**, s**ources** of stress, s**trategies**, and s**uccess**. In this executive summary, we will summarize systems, stresses, sources of stress, and strategies for each site. The larger Efroymson group decided that a third workshop, explicitly about measures of success, may need to wait because BLM's unfolding watershed assessment methodology in part addresses this topic. Many Efroymson participants will be in a position to inform the watershed assessments through the input of the Eastern Nevada Landscape Coalition science committee.

For the purpose of this summary, we have organized the discussion by systems to avoid reviewing the remaining 4-S's consecutively. Therefore, we first describe each area, explain the general assessment methodology, then provide initial assessments for multi-site and local conservation targets.

2. The Four Assessment Areas

2.1. Antelope

Location

The **Antelope** area is in the northeastern part of the BLM Ely District (Fig. 2). It is centered around Tippett and is in the northeastern portion of the district. The **Antelope** area is about 536,000 acres (216,912 ha) and includes portions of the Schell Creek Range, Spring Valley, Antelope Range, Antelope Valley, Red Hills, Kern Mountains, South Mountains, Spring Creek Flat, and The Badlands. These features are primarily in White Pine County, where this assessment is restricted, but they extend north into Elko County (Elko BLM District) and east into Tooele and Juab counties, Utah (Salt Lake City and Fillmore BLM Districts). The area lies mostly east of State Highway 93. The boundary to the east is a mix of watershed and conservation area boundaries, while the boundaries to the west and south are a mix of watershed and political boundaries. The northern boundary is the political Ely District line. Isolated ranches and the Goshute Indian Reservation are included within the region, but no towns occur in the area. Lages Station, at the junction of Highway 93, and Alternate Highway 93 is a gas stop in the northwest area. The small communities of Schellbourne and Ibapah lie to the west and east, respectively.

Ownership and Management

The **Antelope** area is primarily public land with 91% managed by the BLM and an additional 2% managed by the USFS. The Goshute Shoshone Tribe owns about 5% and the remaining 2% land is privately owned.

The Ely District uses two older (soon to be revised) Land Use Plans (LUP) and the Caliente Management Framework Plan to manage the field area. The **Antelope** area is managed

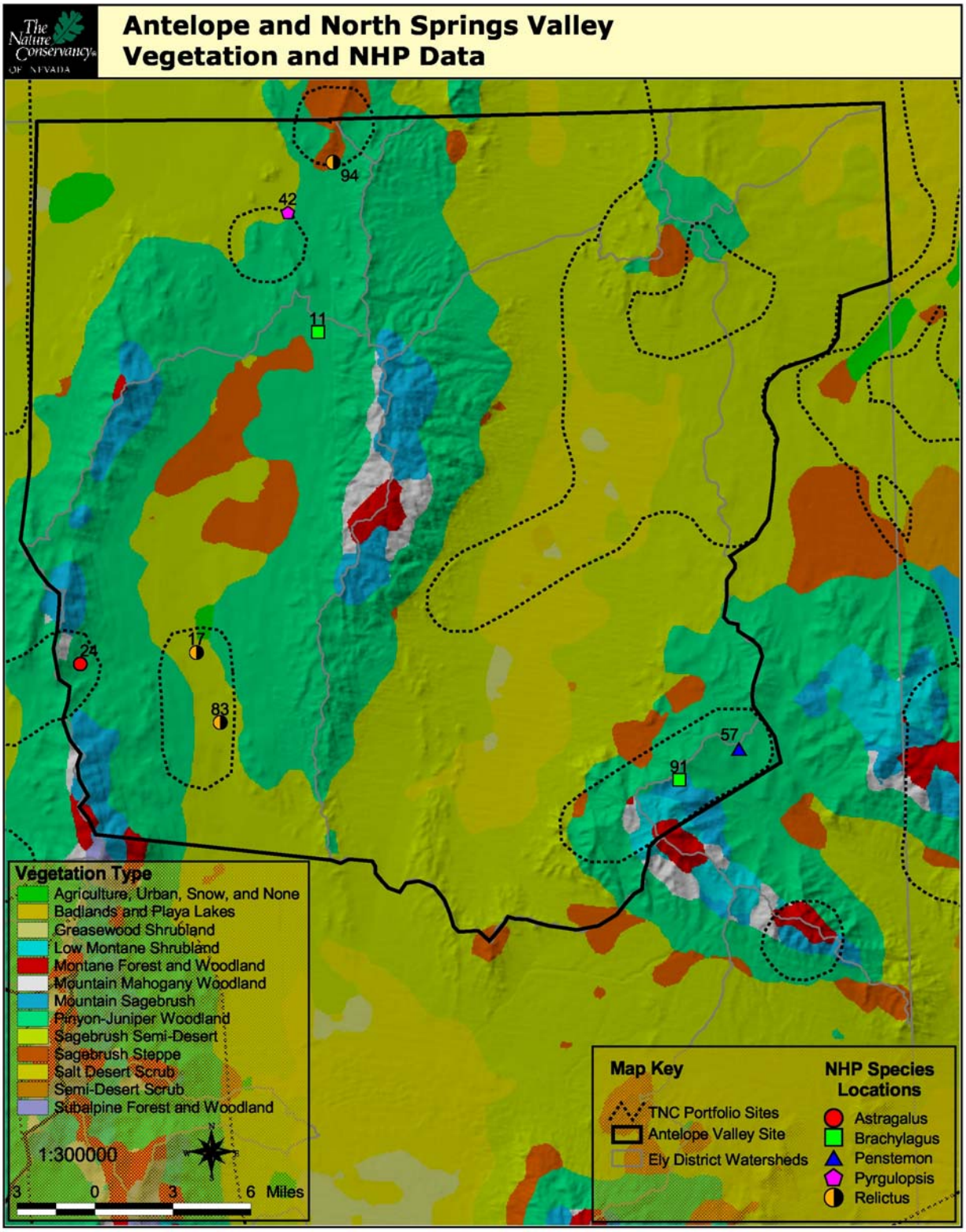

Fig.2. Antelope and North Spring Valleys assessment area.

by one of the LUPs for multiple uses. A recent fire management plan was published in November 2000 (USDI-BLM 2000),which allows for prescribed natural fire. In the Antelope area there are grazing allotments, one Wild Horse Herd Management Area (Antelope HMA), and no wilderness study areas.

Natural Communities and Species

The **Antelope** area includes both representative and unusual basin and range topography of the central Great Basin. Valley floors typically lie at about 5,600 to 6,500 feet (1706.9-1981.2 m) in elevation and the mountain ranges typically rise to over 9,600 feet (2926.1 m) in the Kern Mountains and 10,000 feet (3048 m) in the northern Schell Creek Range.

The geology of the area is varied. Basin floors are comprised of Quaternary alluvium with playa and sand dune deposits present. The higher mountain ranges include mixes of older limestones, dolomites, shales, quartzites, and siltstones with younger granitics, rhyolitic flows, and shallow intrusives. The light-colored rolling hills of The Badlands are comprised of tuffaceous sedimentary rocks and andesitic flows and breccias.

Just a couple of perennial streams flow at lower elevations, including Spring Valley Creek and Spring Creek. The ranges have several higher gradient streams while the northern Schell Creek Range, Antelope Range, and Kern Mountains contain numerous springs.

Thirteen broad ecological system types occur in the **Antelope** area. The nine zonal upland types include salt desert scrub, sagebrush semidesert, badlands, sagebrush steppe, low montane shrubland, pinyon-juniper woodland, mountain mahogany woodland, mountain sagebrush, and montane forest and woodland. The four azonal mesic ecological systems include desert riparian shrubland, montane riparian shrubland, freshwater marsh, and meadows.

Matrix vegetation in the area is comprised primarily of mosaics of sagebrush shrublands and pinyon woodlands. Several sagebrush communities are found throughout the area depending on elevation, soil types, and soil depths. They may be dominated by black sagebrush (*Artemisia nova*), basin big sagebrush (*Artemisia tridentata* ssp *tridentata*), Wyoming sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), or mountain sagebrush (*Artemisia tridentata* ssp. *vaseyana*). In areas with deeper soils, herbaceous cover of bunchgrasses and herbs increase in importance and define sagebrush steppe communities. Woodlands are dominated by pinyon pine (*Pinus monophylla*), juniper (*Juniperus osteosperma*), or a combination of the two.

In addition to these two matrix vegetation types, smaller patches of the following communities may be found: 1) white sage dwarf shrubland (*Krascheninnikovia lanata*), 2) Gardner saltbush dwarf shrubland (*Atriplex gardneri*), 3) big greasewood shrubland (*Sarcobatus vermiculatus*), 4) sand dunes, 5) juniper barrens (in The Badlands), 6) mountain mahogany stands (*Cercocarpus ledifolius* var. *intermontanus*); 7) limber pine-white fir woodland (*Pinus flexilis-Abies concolor* var. *concolor*) 8) sedge meadows (*Carex* spp.); 9) bulrush or cattail emergent marsh (*Scirpus* and *Typha* spp.) and 10) willow riparian stands (*Salix* spp.).

Eleven rare species, all Great Basin endemics and listed as sensitive by the Nevada Natural Heritage Program, are known to occur in the **Antelope** area. Additionally, two birds within the **Antelope** area are on the Federal Threatened and Endangered Species List and several birds that are on sensitive species lists, are thought to be declining in their overall distributions, or have been identified as priority species by Nevada Partners in Flight are known to occur here. All of these species, along with nested communities, are listed in the Appendix.

Historic and Current Land Uses
Mining in the area started in the 1850s, and even though there are numerous isolated prospect pits scattered throughout the area, there is little activity today. Domestic livestock have been grazing in the area since ranches were established in the late 1800s. Historically, primary use was by large nomadic bands of sheep even though both cattle and sheep grazed here. During the 1950s most of the livestock operators converted from sheep to cattle. Nevertheless, some sheep grazing still occurs today. Fishing is a historic and current land use. Some wood cutting occurs today, primarily in the north end of the Antelope Range, which is a designated commercial woodcutting area. Recreation activities are fairly limited although increasing. The primary activities are mostly hunting and trapping, but there is some off-highway vehicle use, horse riding, hiking, and camping in the area. Much of the area is managed for wildlife habitat.

2.2. Steptoe Valley
Location
The **Steptoe** area (468,944 acres or 198.855 ha) is situated in east-central NV (Fig. 3). The towns of Ely and McGill reside in the lower third of the planning area, and Ruth is in the west. Four BLM watersheds, which roughly correspond to Middle Steptoe Valley, Ruth, Duck Creek Range, and Ward Mountain, encompass the area. The site extends from the Telegraph Peak boundary to Ward Mountain and is bordered by the Egan and Schell Creek Ranges. Highways 93, 50, and 6 and the Union Pacific Railroad cross the area. Elevations vary from approximately 6,000+ ft (1,829+ m) in Steptoe Slough to 10,100+ ft (3,078+ m) on the Egan and Schell Creek Ranges.

Ownership and Management
The **Steptoe** site is primarily managed by the BLM (73.2%) and the USFS (10.4%). State lands account for 0.06%. The remaining land is privately owned (16.3%), mostly around Ely, McGill, waterways, and springs. This assessment area is the ancestral home of the Ely Shoshone Tribe, who owns 99.95 acres (40.46 ha) in Ely. Several BLM and USFS plans apply to the area. The **Steptoe** area is covered by the Egan LUP and the Fire Management Plan (USDI-BLM 2000) of the Ely district. The southern end of the Butte Wild Horse HMA overlaps with the assessment area. The USFS Humbodlt-Toiyabe National Forest uses an older Forest Plan for management in the Egan Range and Ward Mountain. This plan currently is under revision.

Natural Communities and Species
In approximate decreasing order of area, the site's geology consists of Quaternary sediments in the valley bottom, Upper Paleozoic carbonate rocks, Lower Tertiary volcanic rocks, and Tertiary sedimentary rocks. The **Steptoe** site corresponds to classic basin and range geomorphology. An important feature of **Steptoe** is the abundance of spring complexes.

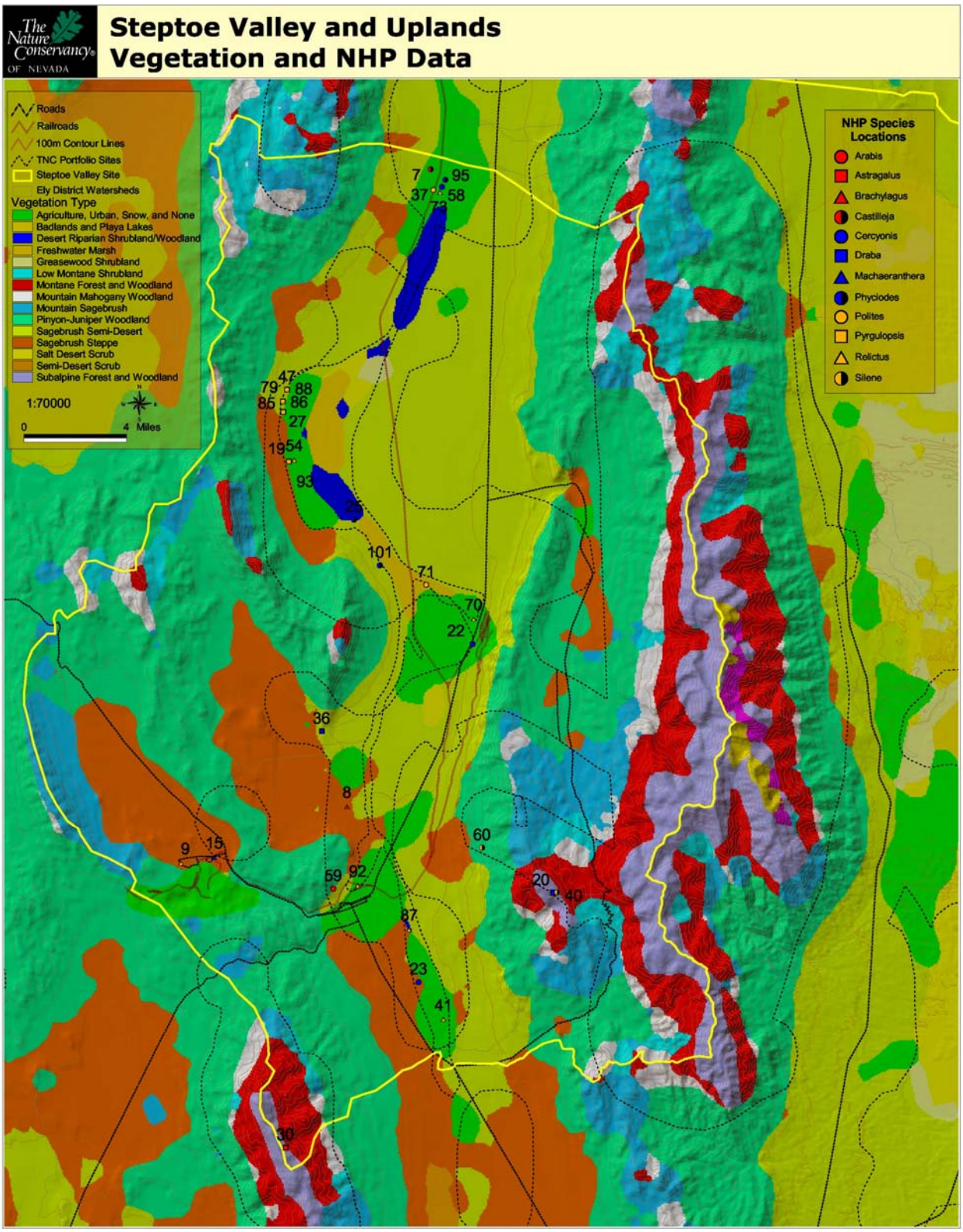

Fig.3. Steptoe Valley assessment area.

The **Steptoe** area harbors classic Great Basin vegetation with plant communities primarily zoned by elevation. Vegetation types consist of lower elevation greasewood shrubland, sagebrush semi-desert, sagebrush steppe, and pinyon-juniper woodland interspersed with desert riparian shrubland and woodland and freshwater marsh. At higher elevations, vegetation consists of montane riparian shrubland, mountain mahogany woodlands, mountain sagebrush, montane forest and woodland, and alpine herbaceous communities. Black sagebrush is dominant in the sagebrush semi-desert, which is a widespread matrix-forming community. The sagebrush zone occurs approximately between 5,550 ft (1,718 m) and 7,000 ft (2,121 m). Precipitation varies from 8 inches (3.15 cm) in the valley to 16+ inches (6.3+ cm) on mountain tops.

Rocky Mountain elk (*Cervus canadensis*), mule deer (*Odocoileus Hemionus*), pronghorn (*Antilocapra americana*), mountain lions (*Felis concolor*), coyotes (*Canis latrans*), bobcats (*Felis rufus*), and kit foxes (*Vulpes macrotis*) are observed throughout the Schell Creek Range, Steptoe Valley, and the Egan Range. The sagebrush zone on mid-elevation mountain benches is the principal habitat for mule deer, elk, wild horses, livestock, and Greater Sage Grouse (*Centrocercus urophasianu*s). The coniferous montane zone is used by mule deer, elk, and wild horses in summer for forage and shading. At least 62 species of concern are known to occur in **Steptoe**; these species and nested communities are listed in the Appendix.

Historic and Current Land Uses
Ely and McGill are synonymous with mining. Mining activity began in the 1850s. The Ruth mine is a large mine that was active until recently. Today, mining is less active. Ranching has been the traditional land use since the late 1800s. Both cattle and sheep grazed the area, however large sheep bands were the dominant grazers up until the 1950s. Since then, most ranching operations have converted to cattle. Hunting, fishing, ATV use, horse riding, sightseeing, and tourist activities around Ely are the main recreational activities.

2.3. Newark Valley
Location
The **Newark** planning area is about 521,223 acres (207,377 ha) in western White Pine County (Fig. 4). The valley runs north and south and has five BLM allotments. **Newark** is bordered by the Diamond Mountains to the west, includes the northern extension of the Pancake Range to the south, and Pogonip Ridge, Antelope Mountain, and Buck Mountain border it to the east. **Newark** reaches just north of Warm Springs Road (882) as it joins Nevada 892. The watershed contains a broad expanse of valley floor; it also reaches the summit of the Diamond Mountains, as well as including several prominent peaks, such as Pancake Summit (8,521 ft) in the central valley, Newark Mountain (8,818 ft) on the west and Mount Hamilton (10,745 ft) on the east. Elevations generally range from 5,580 feet (1,921 meters) on the valley floor to 10,603 feet (3,254 meters) on Diamond Peak in the Diamond Mountains. Nevada Highway 50 bisects the southern half of **Newark** while Nevada Highway 892 runs along the western valley floor north of Highway 50. Warm Springs Road follows the eastern edge of the Valley north of NH 50, joining NH 892 in the northern extension of **Newark**. Primitive roads traverse the valley north of Highway 50, while two roads originate from Highway 50 head south and join just to the west of Mount Hamilton.

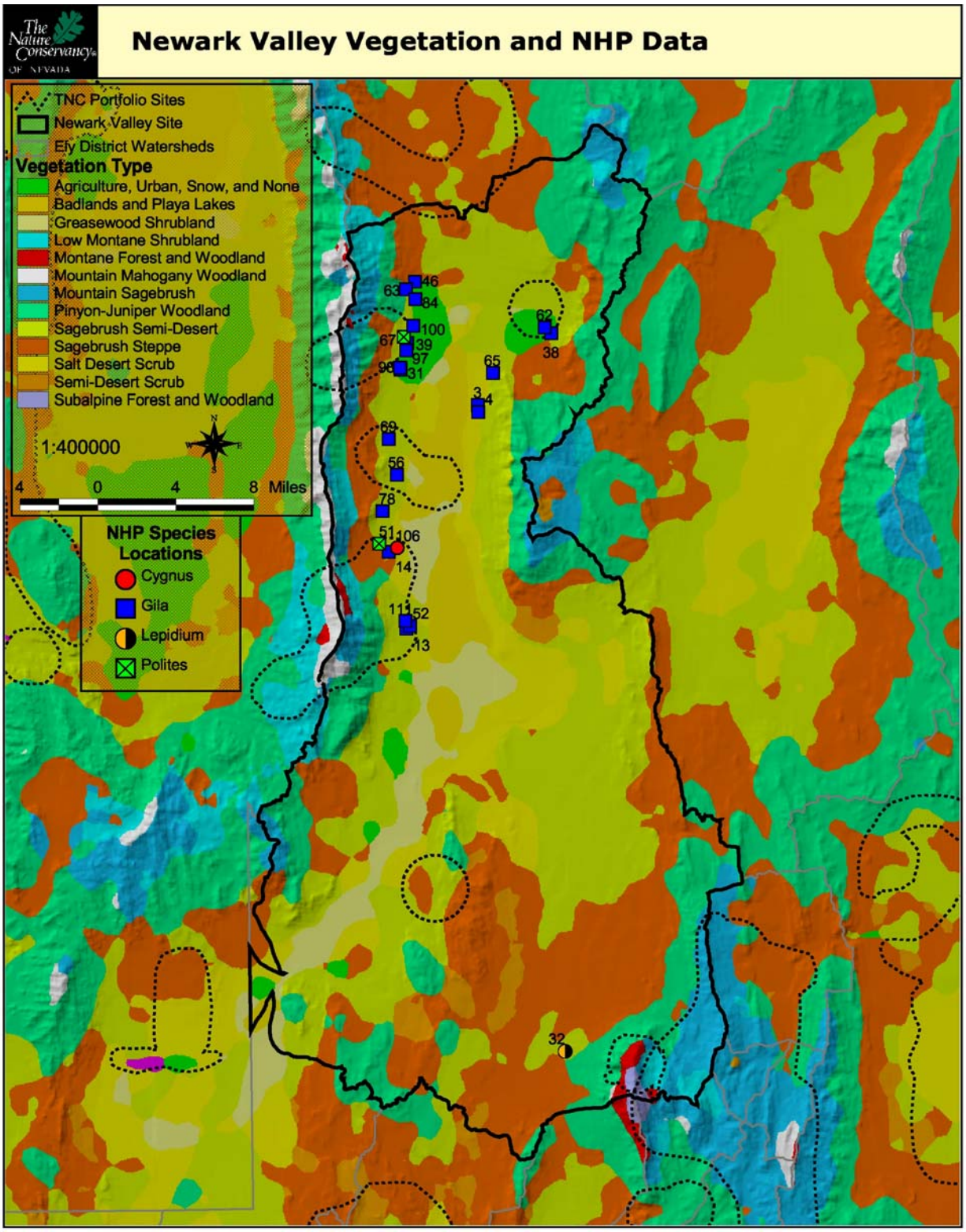

Fig.4. Newark Valley assessment area.

Ownership and Management
The **Newark** area is primarily public land managed by the BLM (92.5%) and USFS (3.5%). The remaining land (3.9%) is privately owned. There are two Wild Horse HMAs in **Newark.** (The Buck and Bald HMA covering the major portion of **Newark** and the Monte Cristo HMA bordering the southern boundary of **Newark**.)

Natural Communities and Species
In **Newark**, the two long sub-parallel, north trending mountain ranges are separated by a broad alluvial valley. The mountains (Diamonds, Buck and White Pine) are generally composed of Paleozoic sedimentary rocks (primarily limestone and shale). The soils of the valley bottom are primarily aridisols with Newark Lake being a salt playa.

There are perennial streams in **Newark**. Two perennial streams flow by Buck Station (eastern side of **Newark**, below the Buck Mountain). Mou Creek is found on the western side south of Cedar Mountain. There are other high gradient perennial streams in the watershed.

The low elevation **Newark Valley** vegetation types include: salt desert shrub matrix (including playa salt lake beds and adjacent small sand dunes), salt desert shrub, winterfat (*Ceratoides lanata*), greasewood (*Sacrobatus* spp.), shadscale (*Atriplex cenfertifolia*), basin big sagebrush, and Wyoming big sagebrush.

The mid-level montane (including the benches) is composed of black sagebrush, Wyoming big sagebrush, snowberry (*Symphoricarpos albus*), Utah serviceberry(*Amelanchier utahensis*), mountain big sagebrush, antelope bitterbrush(*Purshia tridentata*), Indian ricegrass (*Oryzopsis hymenoides*), bluebunch wheatgrass (*Pseudorogneria spicata*), Scribner needlegrass (*Stipa scribneri*), Thurber needlegrass (*Stipa thurberiana*), and needle-and-thread (*Stipa comata*) with littleleaf mountain mahogany (*Cercocarpus intricatus*) at the higher elevations.

Pinyon and juniper dominate some mid-level locations in the Diamonds and Buck Mountains and are found encroaching below this level on both sides of the valley. The higher montane regions of the Diamond Mountains to the west are characterized by mountain big sagebrush, antelope bitterbrush, Utah serviceberry, snowberry, aspen (*Populus tremuloides*), curlleaf mountain mahogany, black sagebrush, Wyoming big sagebrush, singleleaf pinyon, Utah juniper, basin big sagebrush, needle-and-thread, Indian ricegrass, bottlebrush squirreltail (*Elymus elymoides*), Thurber needlegrass, and bluebunch wheatgrass.

As elevations increase, pinyon and juniper are found in varying densities in the sagebrush type. Cheatgrass (*Bromus tectorum*) is intermixed with sagebrush in most instances. However, perennial grasses are thought to be returning to the Diamonds partly due to appropriate grazing.

In isolated pockets, small stands of willow, aspen, wild rose and chokecherry are found generally near water sources. These pockets provide significant wildlife habitat. There are four mesic ecological systems that include: alkaline playa lake, springs, streams, and desert scrub pool.

The majority of the water in **Newark** is from precipitation in the mountains. The valley receives from 9 to 12 inches (3.54 - 4.72 cm) of precipitation annually, whereas the montane areas receive almost 20 inches (7.87 cm) per year. All water except runoff originates from springs and a few wells. There are over one dozen springs in **Newark**. Fences at mesic meadows have been constructed to protect stream heads from damage by livestock and feral horses. Cold Creek Spring and its outflow channel have been fenced as have other springs and well water sources. Several guzzlers have been established for antelope, Greater Sage Grouse and mule deer in the **Newark** area.

Newark is well known for its Greater Sage Grouse habitat. Because of the good nesting and lek sites found in the southern Newark Valley, it is estimated there are over 7,000 Greater Sage Grouse on 134 known leks. Grouse move from leks to the White Pine Range, the Diamond Mountains, and Buck/Bald Mountains to raise their broods. However, some birds raise broods successfully in the alfalfa fields west of Pancake Summit. The northern portion of the Diamond, Buck, and Bald Mountains also produces substantial Greater Sage Grouse populations. Waterfowl use the impoundments created by springs found in the northern portion of the **Newark** for nesting and raising broods. In addition to Greater Sage Grouse, both the Buck Mountains and to a lesser extent the Diamonds, are host to the largest migratory mule deer herds in Nevada (about 20,000, in the Buck Mountains). South Newark Valley has a population of pronghorn antelope below historic levels (Steve Foree, NDOW, *pers. comm*.). The largest population of Ferruginous Hawks in Nevada is found yearly on Dry Mountain to the east of Newark Valley. Nested conservation targets for **Newark** are listed in the Appendix.

Historic and Current Land Uses

There were numerous mines in **Newark** starting in the mid 1850's, and the remnants of those mines remain, but there is little current mine activity in **Newark**. Probably the primary beneficiary of these deserted sites are those species that use them for habitat such as the Townsend's big eared bat (*Plecotus townsendii*) found in the Pogonip Ridge area.

Domestic livestock, initially sheep, began using the valley in the mid 1800's. Sheep remain an important livestock use, but cattle are currently a more significant component of the livestock industry. The diverse wildlife habitat is productive for mule deer, Mountain Quail, Chukar (*Alectoris chukar*) and Greater Sage Grouse. Hunting is a major recreational activity, especially in the northern range of the Diamond Mountains. Camping, horseback riding, hiking and off-highway vehicle use are other popular recreational activities.

2.4. Meadow Valley Wash

Location

The **Meadow Valley** area (1,570,241 acres or 635,468 ha) is situated in southeastern Nevada (Fig. 5). The length of the site extends from Mormon Mountain near the confluence with the Muddy River in the Mojave Desert to the divide on the Wilson Creek Range in the Great Basin. Although the site is largely the broad valley of Meadow Valley Wash, it also includes watersheds east of Meadow Valley Wash from Elgin to Pioche all the way to Utah (e.g., Clover Mountains and Cedar Range). Highways 317, 93, 319, 320, a few other roads, and Union Pacific railroads cross the area of interest. Three larger towns are found in the conservation area: Caliente, Panaca, and Pioche. Elevations vary from approximately 2,000+ ft (609+ m) at Rox Siding, to

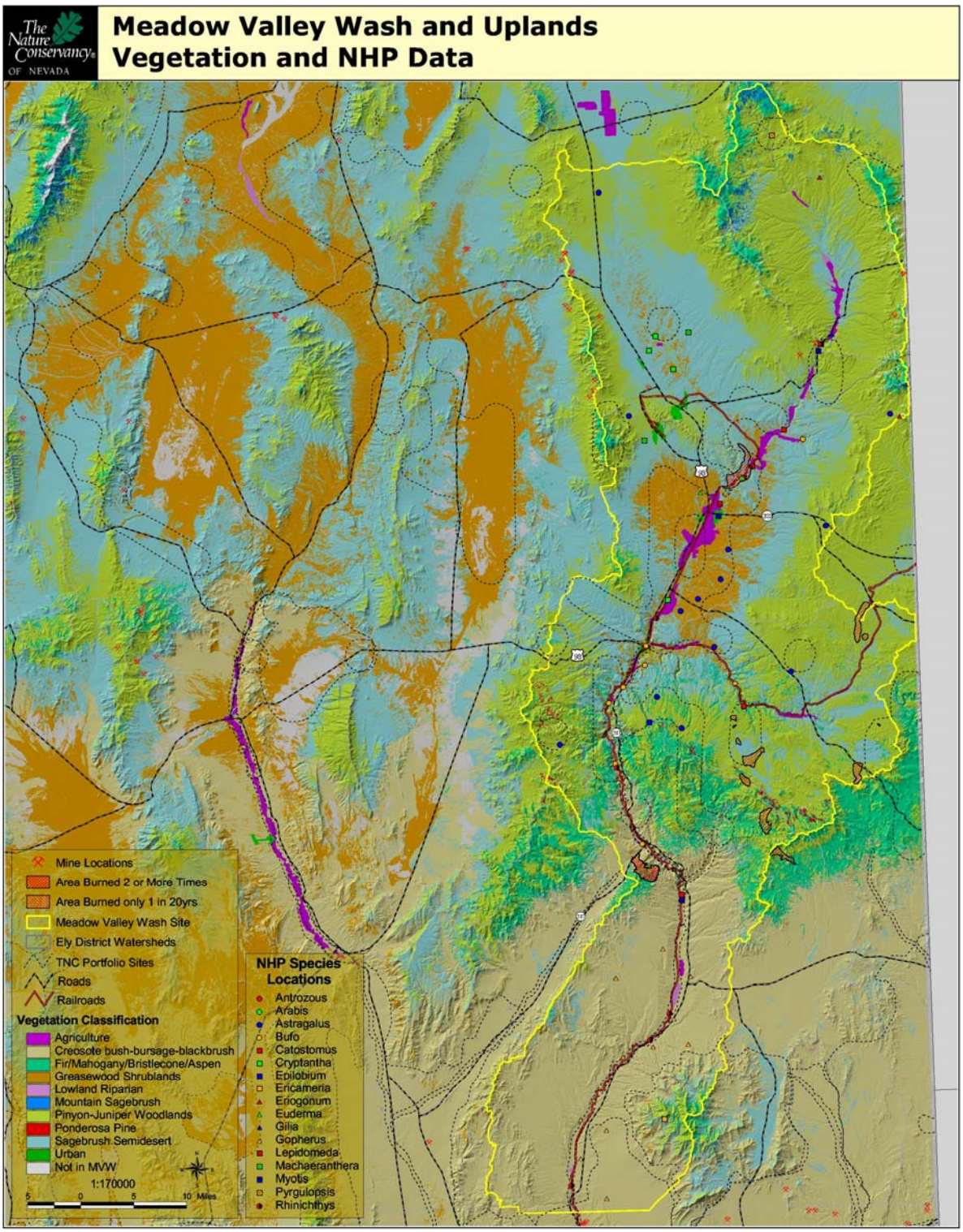

Fig.5. Meadow Valley Wash assessment area.

7,416 ft (2,260 m) at the top of the Clover Mountains, and 9,396 ft (2,864 m) in the Highland Range.

Ownership and Management
The **Meadow Valley** site is predominantly managed by the BLM (96.7%). The remaining land is privately owned (3.1%), mostly along the wash and Clover Creek. The area is the ancestral homeland of the Moapa Southern Paiutes. The closest tribal land is the Moapa Paiute Indian Reservation in Moapa. The current Caliente Management Framework Plan of the Ely district applies to the area. The Ely District fire management plan (USDI-BLM 2000) allows for prescribed natural fire in the **Meadow Valley** area. Thirteen Wild Horse HMAs are in the area.

Lincoln County is coordinating with the U.S. Fish and Wildlife Service (USFWS) to develop a habitat conservation plan, which is required for the issuance of a permit to Lincoln County for take of listed species (i.e., Southern Lincoln County Multi-Species Habitat Conservation Plan or SLCMSHCP; Resource Concepts, Inc. 2002). Listed species are the desert tortoise (*Gopherus agassizii*) and the Southwestern Willow Flycatcher). The habitat conservation plan must demonstrate that the take requested by Lincoln County will sufficiently minimized and mitigated to the extent that it will not preclude survival or recovery of the listed species. Currently, there is little private land in Southern Lincoln County. The county cannot develop public land, and future economic expansion will most likely occur in areas that will be converted from public to private ownership. The SLCMSHCP and completion of the new Ely BLM District's Resource Management Plan/Environmental Impact Statement (RMP/EIS) are moving on parallel tracks with the USFWS being the link between them.

Natural Communities and Species
The **Meadow Valley's** geology is complex. In approximate decreasing order of area, the Mojave Desert section consists of Quaternary alluvium, Lower Paleozoic carbonate rocks, Mesozoic sedimentary, volcanic, and intrusive rocks, Tertiary sedimentary rocks, Upper Paleozoic carbonate rocks, and Upper Tertiary volcanic rocks. The Great Basin section includes Upper Tertiary volcanic rocks, Lower Tertiary volcanic rocks, Lower Paleozoic carbonate rocks, Tertiary sedimentary rocks, Quaternary sediments in the valleys, and small patches of Quaternary-Tertiary volcanic rocks. A distinctive feature of the geology are outcrops of white tuff at Beaver Dam State Park and in a few canyons of the Clover Mountains (e.g., Tepees Rock in Barnes Canyon near Clover Creek).

This geology greatly affects the geomorphology of the area. Although the Mojave Desert section conforms to a classic desert wash, a traveler going north through the Great Basin section would experience a desert canyon with high and reddish walls of volcanic tuff (Rainbow Canyon) up to Indian Cave (north of Caliente), then a broad valley of ancient lakebed sediments, mudhills, badlands, and irrigated hay pastures surrounded by distant mountains in all directions. The volcanic tuff reappears in the distant mountains, which support large, sometimes grassy flats and moderately steep mountains. Meadow Valley Wash itself veers to the northeast of Panaca through Condor and Rose canyons, with its headwaters in the Wilson Creek Range.

Riparian, aquatic, upland, and montane communities in both the Mojave Desert and Great Basin are well represented. Meadow Valley Wash is perennial upstream of Elgin but intermittent

downstream. Clover Creek is an important, perennial tributary of Meadow Valley Wash. All the water in Meadow Valley Wash is from precipitation, which falls mostly in the mountains (orographic precipitation). The Mojave Desert part of Meadow Valley Wash receives annually 4-6 inches (1.57-2.36 cm) of rain on average, whereas the northern section gets 8-14 inches (3.15-5.51 cm) of precipitation per year. Meadow Valley Wash is ecologically significant because it is the only remaining corridor of bird migration between the Mojave Desert and Great Basin with a large fraction of native riparian vegetation.

The Mojave Desert vegetation types in the area include: desert riparian vegetation made of desert riparian forests (cottonwood [*Populus* spp.], willow [*Salix* spp.], velvet ash [*Fraxinus velutina*], and exotic tamarisk [*Tamarix ramosissima*]), desert riparian shrublands, interior riparian marsh and seeps, saltbush shrublands, and mesquite bosque where the bedrock forces water to emerge from the alluvium; uplands consisting of mixed desert shrubland dominated by creosote (matrix community), associations of blackbrush-hopsage (*Coleogyne ramosissima-Grayia spinosa*) vegetation (matrix community), and salt desert scrub (matrix community); and mountain communities harboring low montane shrublands, grasses, and pinyon-juniper on the slopes of Mormon Mountain and Meadow Valley Mountains.

The two animal species receiving the most public attention in the Mojave Desert section of **Meadow Valley** are the desert tortoise and the Southwestern Willow Flycatcher. **Meadow Valley** is the northern limit of the desert tortoise where it is found in low to moderate densities on flats and bajadas covered with blackbrush-hopsage and mixed desert shrubs. There are 13 Heritage occurrences of desert tortoise in the **Meadow Valley** site. The desert tortoise feeds on both annual and perennial grasses and forbs. The southern part of the assessment area 2 miles (3.22 Km) north of the Clark County line is critical desert tortoise area. Otherwise, there are no critical desert tortoise areas, although some are close by on Mormon Mesa, Kane Springs, and south of Beaver Dam Wash.

The Southwestern Willow Flycatcher inhabits cottonwood-willow forests, thickets and scrubby areas, open second growth, swamps, and open woodlands. It nests near moving water or saturated soil primarily in swampy thickets. Home range size of breeding territories for successful reproduction is 1.5 acres (0.6 ha)**.** Wasps and bees are their most common food items, with beetles, flies and butterflies/moths and caterpillars being other components.

Great Basin vegetation types in the northern part of **Meadow Valley Wash** include mosaics of sagebrush semi-desert (a matrix-forming ecological system that includes sagebrush steppe) and pinyon-juniper woodlands, blackbrush-hopsage, mountain mahogany woodlands, ponderosa pine (*Pinus ponderosa*) woodlands, and desert riparian shrubland and woodland along mostly Meadow Valley Wash, Clover Creek, and Beaver Dam Wash. The Wilson Creek Range, Clover Mountains and Cedar Range support the majority of the pinyon-juniper woodlands, however, many woodlands are the result of trees recently invading sagebrush semi-desert and steppe. Sagebrush shrublands are more prevalent in the northern third of the area around Caliente, in the Clover Valley, and into Pioche where Quaternary sediments are found. The last remaining large stands of ponderosa pine are found on the Clover Mountains, and to a lesser extent the Cedar and Delamar ranges, on mountain tops and slopes and as stringers down washes. Small communities of salt desert shrubland are found in the Great Basin section at lower elevations. The Clover

Mountains include transitional Mojave Desert and Great Basin communities such as pinyon-juniper woodlands with sagebrush, blackbrush, manzanita (*Arctostaphylos patula*), ceanothus (*Ceanothus* spp.), and scrub oak (*Quercus* spp.) understories. Ponderosa pines will often be found intermixed with these species. After fires, these understory shrubs resprout readily. A clear example of this vegetation is found at East Pass where one can look down into the Tule Desert from an old wildfire in the Clover Mountains.

Elk is found in the Deer Lodge Canyon Herd Management Area, northeast of Panaca. Elk was recently observed in the Clover Mountains. In most areas, the list of larger mammals includes desert mule deer, coyote, grey fox (*Urocyon cinereoargenteus*), kit fox in the Clover Mountains, bobcat, and mountain lion. Nested conservation targets in **Meadow Valley** are listed in the Appendix.

Historic and Current Land Uses

During the peak of gold and silver mining more than a century ago, the Pioche area was very active. As a consequence, spoil piles are common around the tributaries of Meadow Valley Wash, especially in Caselton. Mining activity was more limited south of Pioche (e.g., Pennsylvania Mine). Few mining operations are active today. Starting in the mid-1800's, historic ranching using year-long livestock grazing and high stocking rates was prevalent in **Meadow Valley** as it was everywhere else in the west.

Large areas of woodlands in the Clover Mountains and Cedar Range were chained decades ago and reseeded, in many cases with crested wheatgrass (*Agropyron cristatum*) that is still abundant today. These chaining areas are located on large flats, which are distinctive throughout the area. Chaining operations are sufficiently old that several have reverted to young woodlands with trees 10-15 ft (3-5 m) high in the absence of fire (e.g., Sheep Flat).

The Union Pacific railroads had an important impact on the development of towns (Elgin, Leith, Carp) and ranching. Today, the railroads remain very active and their maintenance affects the hydraulics and riparian habitats of Meadow Valley Wash and Clover Creek.

Current land uses include mostly cattle grazing, a small amount of mining, agriculture along the wash in the vicinity of Caliente and Panaca, and recreational activities, including off-highway vehicle use, hunting, fishing, horse riding, mountain biking, camping, and hiking (in State Parks). Wild horse management occurs throughout the area. Additionally, there are several Wilderness Study Areas throughout the area.

3. The 5-S Methodology

3.1. Conservation Targets

The 5-S methodology strives to limit the number of ecological systems and species that form focal conservation targets for an area to eight. This number is based on many years of experience and has worked in 99% of cases. Working with a maximum of eight conservation targets forces teams to adopt the coarse and fine filter approach, and to be efficient. The coarse filter approach assumes that most species can be managed effectively if the ecological system they live in functions within its normal range of variability or is managed to simulate key ecological processes (e.g., prescribed burning). Species that do not require special attention and can be managed as part of a larger ecological system are considered nested targets within the focal conservation target. The fine filter approach addresses the species whose ecological requirements do not match those of the broader ecological systems in which they are spatially nested. These species need to be specifically considered so that their special management needs are addressed. The only fine filter target identified for the four conservation areas was bats for **Newark**.

The four teams identified the following focal conservation targets that were sufficiently common to all sites:

1. **Sagebrush-grass-pinyon-juniper mosaic**, which encompasses sagebrush steppe and semi-desert, historic sagebrush sites (except mountain sagebrush for **Newark**), variable, but usually low cover of encroaching pinyon and juniper within the natural range of variability;
2. **"Historic" pinyon-juniper ecological site**, which is defined by unproductive soils and topography that do not support abundant fine fuel production; includes trees typically older than 150 years and some younger non-dominant trees;
3. **Montane woodland**, which includes open areas dominated by mahogany, white fir, aspen (except for **Antelope**), limber pine, or bristlecone pine;
4. **Springs and creeks**, which are springs and associated outflow creeks, the immediate vegetation, and aquatic fauna;
5. **Salt desert shrublands**, which are composed of greasewood, species of saltbush, and winterfat (except **Newark** where it is a separate focal target).

In addition to the multi-site conservation targets, each area had local targets:

<u>Antelope</u>
1. aspen stands
2. badlands
3. riparian systems and wetlands

<u>Steptoe</u>
1. alpine
2. badlands/Pygmy sage community (mostly Ruth site)
3. cave and mine habitats
4. valley springs/marshes/streams

<u>Newark</u>
1. bats (fine filter)
2. montane sagebrush mosaic
3. winterfat communities

<u>Meadow Valley</u>
1. badlands
2. chaparral-ponderosa pines-pinyon-juniper woodlands
3. creosote bush-bursage-blackbrush (Mojave desert)
4. higher elevation riparian corridor (upstream of Caliente)
5. lower elevation riparian corridor (downstream of Caliente)

The nested targets for each focal conservation target are listed in the Appendix.

3.2. Viability of Focal Conservation Targets

Prior to identifying the sources of stress that degrade conservation targets, TNC's 5-S methodology involves an initial assessment of the **viability** of each conservation target based on the qualitative ranks assigned by experts to its **size**, **condition**, and **landscape context**. **Viability** is an overall measure of the level of degradation caused by stresses. Definitions for qualitative ranks of viability using the "historic" pinyon-juniper ecological sites as an example is provided below (Table 3.1). These definitions were not available for the majority of systems, however. **Size** is the abundance for a species or extent for a community relative to its potential for the area. **Condition** is a combination of the target's composition, structure, and biotic interactions, which is a reflection of the integrity of reproductive processes and age/size structure, or the biological composition of the community. **Landscape context** combines two processes — ecological processes that maintain or establish the target occurrences and connectivity among occurrences. Overall, these three factors set a benchmark for stress analysis and development of conservation strategies, which allows measures of success over time.

Table 3.1 Definitions of viability ranks for "historic" pinyon-juniper ecological sites from the **Meadow Valley** team.

Rank	**Size** **Minimum dynamic area**	**Condition** **Characteristic native vegetation**	**Landscape Context** **Fire regime**
Very Good	**Woodland soils =** overlay of elevation, soil types, southern and southwestern slopes (dry), steep enough slopes, porous infertile soils, canyon walls.	1) Mosaic of woodland on woodland soils with patches of open (<10% canopy cover), sparse (11-20% canopy cover), medium (21-35% canopy cover), and dense (>35% canopy cover) woodlands in roughly equal amounts. 2) Multiple age classes. Clumped regeneration of trees. >More than 15% cover of mature potential trees - trees that are >150 years old. 3) Understory biomass (perennial grass, forbs, shrubs, and tree saplings & seedlings) near potential for normal year given soil type and canopy cover.	Open woodland surrounded by shrubland-grassland mix with a few dispersed trees. No cheatgrass in surrounding area.
Good	**Too much**: Sparse canopy cover over the area described under FAIR. **Too little**:	1) Mosaic of woodland on woodland soils with >40% of patches in either open or dense canopy cover. 2) Multiple age classes. Clumped regeneration of trees. 3) Understory biomass near potential for a normal year, but less diverse.	Open woodlands surrounded by shrubland with mostly young trees (<2 m in height). Reduced herbaceous understory, but present. Cheatgrass abundance minimal in surrounding area.
Fair	**Too much**: Woodland soils + deep soils, riparian areas, mid-elevation mountain benches with medium canopy cover. **Too little**: Loss to catastrophic fire	1) Mosaic of woodland on woodland soils with >55% of patches in either open or dense canopy cover 2) Multiple age classes but smaller trees increasing in abundance. More uniform distribution of trees..	Woodland surrounded by moderate PJ expansion into shrubland (young trees 50-75%). Cheatgrass present in expansion area.

	and human disturbance	3) Cover of native perennial grasses, forbs, and shrubs in trace amounts.	
Poor	**Too much**: Dense canopy cover over the area described under FAIR. **Too little**: Type conversion to annual grasses	1) Mosaic of woodland on woodland soils with >70% of patches in either open or dense canopy cover or with <10% in either sparse or medium canopy cover. 2) Midstory filled with small trees. 3) Complete loss of understory or understory of weedy annuals or perennials.	Woodland completely surrounded by heavy PJ expansion (multiple age classes) into shrubland with cheatgrass being significant in expansion understory

3.3. Stresses and Sources of Stress

A stress is the impairment that results in reduced viability of a target. Stress analysis is the equivalent of the Evaluation Phase in the BLM's Rangeland Health Standard handbook. Stresses are evaluated separately from the sources of stress so that we may develop effective conservation strategies to address the causes of degradation in a target's viability. Hence, the stress directly affects the conservation target. The sources of stress are extraneous factors, such as incompatible human uses, policies, or biological impacts from non-native species. When evaluating the seriousness of a stress, two factors are considered: the severity of damage and the scope of damage to the target over its occurrence. Both factors are based on what can be expected within a 10-year period under current management or circumstances. In this summary, we do not describe stresses (e.g., altered fire regimes) to the conservation targets. However, they are found in the attached 5-S spreadsheets for each area and they are integral to the sources of stress analysis described below.

Each stress affecting a conservation target has at least one or more sources of stress. It is important to identify and rank the sources of stress in order to develop the most effective conservation strategies. In BLM language, a source of stress is the same as a causal factor investigated during the Determination Phase established in the Rangeland Health Standard handbook. Most stresses are caused by incompatible human activities that either occurred in the past (historical stress), or that are occurring now (active stress). Historical sources are no longer active and are no longer adding stress to a target, although they may be responsible for the present state (structure, composition, and function) of the targets. Active sources of stress are those that can be expected to affect the target within a 10-year timeframe. Once sources of stress have been identified they are ranked as to the relative seriousness of the source based on the degree of contribution to the stress and the irreversibility of the stress. For example, a parking lot over a wetland is highly irreversible, whereas drainage ditches have low irreversibility because they can be more easily filled and the wetland restored. The monetary cost of restoration is an excellent consideration when evaluating irreversibility.

Once the stresses and sources of stress are identified and ranked for each of the conservation targets, the critical sources of stress are synthesized from the data. Critical sources of stress are those that rank highest and are active. Persistent sources of stress are those with historical sources. We describe critical sources of stress in this summary, while the intermediate steps that led to this analysis are found in the attached 5-S spreadsheets for each area.

Identifying the critical sources of stress across the system allows managers to focus conservation efforts on source of stress abatement strategies with the assumption that these will result in higher viability of the conservation targets. For highly ranked sources of stress with an historical source, managers must focus on restoration strategies that improve the ecological health of the conservation target. Conservation strategies for all targets will be presented after the review of all conservation targets in the following section.

4. Viability and Sources of Stress for Multi-Site Focal Conservation Targets

During the second Efroymson workshop, it became obvious that all four areas shared five conservation targets in common that had comparable viability and sources of stress. Despite minor differences among the multi-site conservation targets, we decided that each site need not repeat the same ecological information. Hence, we present a synthetic description of viability and sources of stress and point out the worse and best cases among the four sites. Later, the summary for each team will be limited to local conservation targets.

Table 4.1. Viability of Multi-Site Focal Conservation Targets.

Conservation Targets	Area	Size	Condition	Landscape Context	Overall Viability
Sagebrush-grass-pinyon-juniper mosaic					
	Antelope	Poor	Poor	Fair	Poor
	Steptoe	Good	Poor	Fair	Fair
	Newark	Good	Fair	Fair	Fair
	Meadow Valley Wash	Very Good	Poor	Poor	Fair
"Historic" pinyon-juniper ecological site					
	Antelope	Good	Fair	Fair	Fair
	Steptoe	Good	Fair	Fair	Fair
	Newark	Good	Good	Good	Good
	Meadow Valley Wash	Very Good	Good	Poor	Fair
Montane woodlands					
	Antelope	Good	Good	Fair	Good
	Steptoe	Good	Fair	Fair	Fair
	Newark	Good	Good	Good	Good
	Meadow Valley Wash	Very Good	Good	Fair	Good
Springs & creeks					
	Antelope	Good	Good	Good	Good
	Steptoe	Fair	Fair	Fair	Fair
	Newark	Good	Fair	Fair	Fair
	Meadow Valley Wash	Fair	Poor	Poor	Poor
Salt desert shrublands					
	Antelope	Fair	Poor	Fair	Fair
	Steptoe	Good	Good	Good	Good
	Newark	Good	Fair	Good	Good
	Meadow Valley Wash	Good	Good	Good	Good

4.1. Sagebrush-Grass-Pinyon-Juniper Mosaic

(Left) Depleted black sagebrush semi-desert with initial juniper and pinyon encroachment on eastern slope of Schell Creek Range. (Right) Diverse grassland in sagebrush steppe after Robinson Pass wildfire in Egan Range.
Photo: Louis Provencher, TNC, 2002

The vast majority of the area occupied by sagebrush-grass-pinyon-juniper mosaics has not been converted to land uses or vegetation types that would not support this plant community again. Houses, roads, and agricultural fields may have permanently damaged the soils supporting sagebrush communities, but the proportional extent is small. The exception is in **Steptoe** where home and resort development, the towns of Ely and McGill, and the proliferation of roads have irreversibly converted sagebrush communities to other land uses. Although the size of the target is, therefore, very good to good on average (Table 4.1), its condition is generally poor. The encroachment (encroachment is the process by which a native species will increase to dominate the vegetation) of pinyon and juniper beyond the unproductive soils where they were historically found is extensive, as it is in the Great Basin in general (Blackburn and Tueller 1970; Taush and Nowak 1999; Miller and Tausch 2001). For example, replacement of sagebrush semi-desert and steppe by these tree species on the mid- and upper-elevation mountain benches across the Wilson Creek Range and Clover Mountains represents several 100,000 acres (40,485 ha) of dense woody fuel accumulation in **Meadow Valley**. The Delamar Mountains, southern Schell Creek Range, the Antelope Range, and the Egan Range are in similar condition. The least affected of the four areas is **Newark**, and this may be due to historical land use. **Newark**, especially the southern part closest to Eureka (e.g., Pancake Range), was heavily logged to fuel the stamp mills and smelter of Eureka. Tree encroachment also has resulted in the disappearance of understory shrub and herbaceous species (Blackburn and Tueller 1970; Taush and Nowak 1999), and the continual loss of topsoil after precipitation events. Where trees have not invaded, the vast majority of shrublands either lack or have low perennial grass cover and the canopies of sagebrush are closed with cheatgrass and other undesirable species in the understory. Finally, habitat disturbance from agricultural use of the land is a stress and rabbitbrush (*Chrysothamnus* spp.), a disturbance increaser, has been observed to move upwards through the sagebrush semi-desert. The last element of viability is landscape context, which is poor because the periodic and patchy sagebrush fires with fire return intervals varying between 20-125 years have been excluded by the reduction of fine fuels by historic grazing and fire management practices (Caldwell et al. 1981; Chambers et al. 1999; Tausch 1999; Young and Sparks 2002).

The top sources of stress that threaten the viability of the sagebrush-grass-pinyon-juniper mosaic are: fire suppression, invasive/alien species, forestry practices, home and resort development (**Steptoe** and **Meadow Valley**), feral livestock, grazing practices, management of elk, and recreational vehicles (**Steptoe** only; Tables 4.2-4.5). The **Newark** team identified the expansion of woody species as an important source of stress in addition to fire suppression, whereas other teams considered it a subset. This team also combined livestock and wild horse management as grazing management, whereas other teams separated them. Forestry practices was identified by the **Antelope** team, whereas other teams included this source as part of the fire suppression story. By far, fire suppression and invasive/alien species are the most important problems.

Table 4.2. Summary of sources of stress for **Antelope**.

Active Threats Across Systems	Riparian and Wet-lands	Springs and Creeks	Sage-brush-grass-PJ mosaic	"Historic" P-J ecolo-gical site	Bad-lands	Montane Wood-lands	Salt Desert Shrub-lands	Aspen Stands	Overall Threat Rank	Total Score
Fire suppression	Low	Medium	High	High	-	Medium	-	Very High	High	4.22
Wild horse grazing practices	High	High	High	-	Medium	-	Medium	High	High	3.70
elk use	High	Medium	Medium	-	-	-	-	Very High	High	3.70
Invasive/alien species	Low	-	High	-	-	-	High	-	High	2.03
Construction of ditches, dikes, drainage or diversion systems	Medium	High	-	-	-	-	-	-	Medium	1.20
Climate Change	-	-	High	-	-	-	-	-	Medium	1.00
Livestock grazing practices	Medium	Medium	Low	-	-	-	Low	Medium	Medium	0.66
Recreational vehicles	Low	Low	Medium	-	Medium	-	-	-	Medium	0.46

Table 4.3. Summary of eight out of nine conservation targets and sources of stress for **Steptoe**.

Active Threats Across Systems	Upland springs/ creeks	Valley springs/ marshes /streams	historic PJ ecologic al site	Sage-brush-grass-PJ mosaic	Mon-tane wood-lands	Salt desert Shrub-land	Badland /Pygmy Sage commu nity	Alpine	Overall Threat Rank	Total Score
Fire suppression	-	-	High	Very High	Very High	-	-	-	Very High	6.00
Home/resort development	-	-	High	Very High	High	-	-	-	High	4.00
Invasive/alien species	-	-	Medium	Very High	-	Low	-	-	High	3.12
Excessive groundwater withdrawal	-	Very High	-	-	-	Low	-	-	High	3.02
Recreational vehicles	-	-	High	High	-	-	Low	Low	High	2.06
Grazing practices	Medium	-	Medium	High	Medium	-	-	Medium	Medium	1.80
elk use	Medium	-	-	High	Medium	-	-	-	Medium	1.40
Construction and operation of ditches, dikes, drainage or diversion	High	Medium	-	-	-	-	-	-	Medium	1.20

systems										
Recreational use	-	-	-	-	High	-	-	-	Medium	1.00
Conversion to agriculture or silviculture	-	-	-	Low	-	Medium	-	-	Low	0.23
Development of roads, railroads, or utilities	-	-	Medium	-	-	-	-	-	Low	0.20
Soil water withdrawal by expanding PJ	Medium	-	-	-	-	-	-	-	Low	0.20
Crop production practices	-	Medium	-	-	-	-	-	-	Low	0.20
Incompatible roads and trails	Medium	-	-	-	-	-	-	-	Low	0.20
Excessive pinyon-juniper evapotranspiration	-	Medium	-	-	-	-	-	-	Low	0.20
Development of roads or utilities	-	-	-	-	Low	Low	-	-	Low	0.06
Threat Status for Targets and Site	Medium	High	High	Very High	High	Low	Low	Low	Very High	

Table 4.4. Summary of conservation targets and sources of stress for **Newark**.

Active Threats Across Systems	**montane sage-brush mosaic**	**sage-brush-grass-PJ mosaic**	**winter-fat**	**montane wood-lands**	**springs-creeks**	**bats**	**salt desert shrub-lands**	**historic PJ ecolo-gical sites**	**Overall Threat Rank**	**Total Score**
Invasive/alien species	Low	Very High	Medium	-	High	-	Low	-	High	3.63
Grazing management (Wild Horses and Wildlife)	-	High	Low	Medium	High	-	Low	Medium	High	2.43
Fire suppression	Low	Medium	-	High	-	Low	-	High	High	2.23
Expansion of woody species	-	High	-	-	Medium	-	-	-	Medium	1.20
Forestry practices	-	-	-	High	-	Low	-	-	Medium	1.03
Grazing practices	-	-	-	-	High	-	-	-	Medium	1.00
Recreational vehicles	-	Medium	-	Low	Low	-	Low	-	Low	0.29
Development of roads or utilities	-	-	Medium	-	-	-	-	-	Low	0.20
Excessive groundwater withdrawal	-	-	-	-	Medium	-	-	-	Low	0.20
Recreational use	-	-	-	-	-	Medium	-	-	Low	0.20
Mining practices	-	-	-	Low	-	Low	-	-	Low	0.06
Parasites/pathogens	-	-	-	-	-	-	-	Low	Low	0.03
Threat Status for Targets and Site	Low	High	Medium	High	High	Low	Low	Medium	High	

Table 4.5. Summary of eight out of 10 conservation targets and sources of stress for **Meadow Valley**.

Active Sources of Stresses Across Systems	**low elevation riparian corridor**	**creosote bush-bursage-black-brush**	**sage-brush-grass-pinyon-juniper mosaic**	**"historic" P-J ecological sites**	**Chaparral-Pon-derosa-P/J Wood-lands**	**hi elevation riparian corridor**	**Montane Wood-lands**	**springs/ creeks**	**Overall Threat Rank**	**Total Score**
Fire suppression	High	-	High	High	High	Medium	Medium	High	High	4.20

Invasive/alien species	High	High	High	High	Medium	Low	-	Medium	High	3.72
Development/maintenance of roads, railroads, or utilities	High	Medium	-	-	-	Medium	-	-	Medium	1.40
Operation of drainage or diversion systems	High	-	-	-	-	Medium	-	Medium	Medium	1.40
feral livestock	Low	Low	Medium	-	-	-	-	High	Medium	1.23
elk use	-	-	Medium	-	-	-	-	High	Medium	1.20
Excessive groundwater withdrawal	High	-	-	-	-	Low	-	-	Medium	1.03
Grazing practices	Medium	Low	Medium	-	-	-	-	Medium	Medium	0.63
Recreational vehicles	-	Low	Low	-	-	-	Low	Medium	Low	0.29
Conversion to agriculture or silviculture	-	-	Medium	-	-	-	-	-	Low	0.20
military training	-	Medium	-	-	-	-	-	-	Low	0.20
Primary home development	-	-	Medium	-	-	-	-	-	Low	0.20
Mining practices	Low	-	-	-	-	-	-	-	Low	0.03
Channelization of rivers or streams	-	-	-	-	-	Low	-	-	Low	0.03
Operation of dams or reservoirs	-	-	-	-	-	Low	-	-	Low	0.03
Threat Status for Targets and Site	High	Medium	High	High	Medium	Medium	Low	High	High	

The legacy of fire suppression is an important source of reduced viability because it increases the potential for vast and catastrophic fires causing massive runoff, sedimentation, and cheatgrass dominance where this annual grass is present and native grasses are reduced. The kidney-shaped expanse of pinyon and juniper from Wilson Creek Range to the Clover Mountains, which is the headwaters of Meadow Valley Wash and home to >300 springs on the Wilson Creek Allotment alone, is especially prone to catastrophic wildfires. One such wildfire caused 10 mi. (6.7 Km) of sedimentation in the wash. Other areas prone to catastrophic wildfires are the Antelope, Schell Creek, Egan, and Duck Creek Ranges. It is dangerous to fight pinyon and juniper crown fires and also expensive to rehabilitate vegetation cover after fire.

The continuation of fire suppression is simply a holding pattern while more affordable restoration and fuels reduction practices are tried and deployed. One important drawback of maintaining fire suppression is the continuation of tree encroachment towards lower and higher elevation shrublands (Blackburn and Tueller 1970). Another drawback to fire suppression is continuing shrubland fragmentation as trees expand from creek slopes to uplands. Sagebrush obligates, such as the Greater Sage Grouse, will not use these areas and may ignore the fragments of sagebrush shrublands.

Cheatgrass is the primary invasive species that has degraded this ecological system. Cheatgrass changes plant community composition by successfully depleting soil moisture before native grasses begin growing (Melgoza et al. 1990) and by decreasing the fire return interval to a frequency that native shrubs and grasses cannot tolerate (Young et al. 1987; Miller and Tausch 2001). Additionally, many weed specialists fear that exotic forbs, such as knapweeds (*Centaurea* spp.), will be worse than cheatgrass because they are known to outcompete even cheatgrass and change soil characteristics. These exotic forbs are in low numbers throughout these areas, but they will eventually invade unless prevention, eradication, and control are aggressive.

Home and resort development is closely related to fire suppression and habitat fragmentation. An important reason for aggressive fire suppression in **Steptoe**, and to some extent in **Meadow**

Valley, is the protection of structures and air quality. Teams noted home buyers appear to prefer sagebrush shrublands intermixed or encroached with pinyon and juniper for their aesthetic value. Home and resort development is not a problem for **Antelope** and **Newark**. Air quality must be maintained for the hospital and schools in Ely. Fires occurring within a few miles of Ely could quickly reach the town. During June 2002, a wildfire burned into the town of Pioche in **Meadow Valley**. This perceived danger is the justification for the Ely Wildland-Urban Interface project and the Wilson Wildland-Urban Interface project. The other consequence of home and resort development is increased fragmentation resulting from housing, roads, utilities. Although we do not have enough data, it is known that Greater Sage Grouse, Sage Thrasher, and maybe other species avoid fragmented sagebrush shrublands.

Feral livestock (wild horses and cattle) contribute to excessive herbivory and alteration of plant species composition. The existing herd management areas and plans have allowed the BLM to periodically gather wild horses in **Meadow Valley**, **Newark**, and **Antelope**. Wild horses are not managed for in **Steptoe**. Because wild horses continually graze areas near water sources, they have a great impact on of native grasses and forbs, especially during the last three years of drought. Unlike domestic livestock, wild horses do not follow a rest-rotation system.

Grazing practices are important because of their cumulative impact on perennial grasses and forbs already utilized by wild horses and elk. Some effects of excessive grazing such as woody expansion (Young and Sparks 2002) date to practices as old as 1890 (Caldwell et al 1981, Brussard et al. 1994) and high year-round (traditional) grazing was standard ranch operating procedure until the 1960's. **Newark** has suffered most from a history of overgrazing, but today this area may support the least livestock grazing. The three other areas appear equally affected by livestock grazing, however, drought and forage depletion has been more severe closer to the Mojave Desert in **Meadow Valley**. Grazing practices are the easiest source of stress to manage because grazing permits can be modified in response to utilization measurements. Several grazing allotments have been closed during the current drought and many ranchers have chosen to not graze livestock. Moreover, many ranchers use best-management practices that may include rest-rotation, taking voluntary non-use, frequently moving cattle or sheep, and spreading salt blocks across the landscape. Although these practices have alleviated many problems (National Research Council 1994), stocking rates have been persistently high because a rancher's ability to secure loans in an unfavorable cattle market is based on number of livestock.

Elk numbers have been growing in three areas, except **Newark** where elk are absent. Although elk are managed and hunted in the Schell Creek, Duck Creek, Wilson Creek, and Cedar ranges, they are increasingly seen in **Steptoe**, the Antelope Range, and the Clover Mountains (**Meadow Valley**). Archeologists from the Nevada State Museum providing input to the Central Nevada Elk Plan and studies in the Ely area consider elk to have had an incidental prehistoric presence in eastern Nevada (only one bone was found in a cave) and were absent from central Nevada excavations, whereas elk were present in low, but consistent numbers in archeological findings for the northeastern part of the state (i.e., Elko BLM district). There were lengthily discussions during workshops about the accuracy of elk population censuses, especially given the cost of census flights. Overall, elk grazing adds to wild horses and livestock impacts in assessment areas.

The proximity to towns and surrounding home development is causing a proliferation of recreational vehicles and unauthorized roads on public lands. All-terrain vehicle, motorcycle, and 4WD vehicle use abound in the Schell Creek, Duck Creek Range, and Antelope Ranges, and in a few areas of the Wilson Creek Range and Clover and Kern mountains. Current topographic maps do not reflect the heavy use and creation of recreational vehicles because unauthorized roads and trails have proliferated, particularly within the past ten years. For example, the BLM estimates that the Duck Creek Range has seen unauthorized road creation rates increase from 2.1 mi/year (3.32 Km) in 1977 to 3.3 mi/yr (5.3 Km) in 2001, which corresponds to an additional 141 mi (227 Km) of new roads. Team members have reported several unauthorized off-highway vehicle competitions throughout the Schell Creek and Antelope Ranges. With the popularity of all-terrain vehicles for hunting, narrow two-track trails are common in elk hunting areas. Roads and increased recreational vehicle activity disturb and destroy vegetation, disturb wildlife, cause erosion and land fragmentation. Areas of erosion can be widespread. Contaminated vehicles are also significant vectors for non-native invasive plant species.

Another source of stress identified by the **Antelope** team, albeit more hypothetical than demonstrated, was global climate change. There is indirect evidence that the rate of pinyon and juniper encroachment in shrublands and cheatgrass invasion is accelerated by CO_2 enrichment (Tausch and Nowak 1999). More quantitative studies are needed to demonstrate this hypothesis.

4.2. "Historic" Pinyon-Juniper Ecological Sites

"Historic" pinyon-juniper ecological site in Callenger Wash, Ward Mountain
Photo: Louis Provencher, TNC, 2002

“Historic” pinyon-juniper ecological sites are distinguished by low productivity soils that do not support a sufficient cover of fine fuels (grasses) to carry fire (West et al. 1998; Tausch 1999; Miller et al. 1999). These sites may be found on steep slopes, rapidly permeable soils, shallow soils, slopes with southern exposures, and so on. This target, therefore, has a patchy distribution. Fires from the surrounding sagebrush communities would generally self-extinguish when they reached these soils. Sometimes these fires would snake through the grass and shrubs and kill younger, and rarely even larger trees. Crown fires were unlikely because woodlands were open (<30% canopy cover). As a consequence, pinyon and juniper could grow very old (120-600 years) unless they were hit by lighting strikes. Recruitment would be slow because of competition for soil moisture by established trees and understory shrubs and grasses.

The viability of the target is interesting because the degradation is due mostly to the landscape context. Size is very good (**Meadow Valley**) to good (other areas) because the soils that support this community type are generally unsuitable for roads and construction. A few historic woodland sites have been lost, however. For example, the McGill pipeline crosses through several patches of unproductive soils on steep slopes that would have supported stands of old pinyon and juniper trees. A few roads in the northern Schell Creek Range are situated on slopes with unproductive soils. Condition is fair to good due to varying degradation of vegetation structure attributed to an overabundance of younger trees that would normally have been removed by creeping fires. Composition has changed with the presence of cheatgrass, albeit not in large cover. Landscape context is poor because the surrounding vegetation has been converted from sagebrush shrubland (the sagebrush-grass-pinyon-juniper mosaic on deeper soils) to a continuous tree canopy that can only burn by catastrophic crown fires. These crown fires would kill all the old trees in several patches at once. Although we can imagine a small fraction of “historic” pinyon-juniper ecological sites experiencing stand replacement fires once per 100-300 years, teams did not believe that the replacement of all sites in a single fire (e.g., 10,000 acre or 4,048 ha) was within the normal range of variability. The landscape context is also degraded by the invasion of cheatgrass in the surrounding landscape that increases the chance of ignition and frequency of catastrophic fires.

Sources of stress affecting the viability of “historic” pinyon-juniper ecological sites are: fire suppression, invasive non-native species, recreational vehicles, home and resort development, grazing practices, and inappropriate (lack of) woodland management.

Again, the first two sources of stress are entirely due to the landscape context. With the understanding that patches of pinyon-juniper ecological sites are embedded in depleted sagebrush and sagebrush communities fully encroached by pinyon and juniper, explanations for fire suppression and cheatgrass follow the logic given above for the sagebrush-grass-pinyon-juniper mosaic conservation target.

Recreational vehicles are a source of stress because they sometimes use historic woodland sites, especially those on flatter ground. Roads and trails cause loss of vegetation and accelerate erosion. Currently, the effect of recreational vehicles is worse near Ely and in elk hunting areas. Therefore, **Steptoe** and **Antelope** areas are most affected.

Home and resort development was identified as a high-ranked source of stress by the **Steptoe** team not necessarily because structures are built on woodland soils, but because of the footprint of influence of homes affecting surrounding historic woodland sites. The team noted that the proximity of homes and resorts adversely affects wildlife with large woodland requirements. Fragmentation of habitat and presence of domestic cats and dogs may discourage nesting and foraging by pinyon and juniper obligate species.

"Historic" pinyon-juniper ecological sites are occasionally grazed. Livestock, wild horses, and elk generally will not be found in these unproductive and usually steep areas. It was pointed out that livestock will resort to grazing woodlands when forage has been exhausted elsewhere. Livestock may also use the old trees for shade during the summer, thus causing heavier localized grazing. Given that grass production is low, we do not expect a long residence time for grazers in woodlands.

4.3. Montane Woodlands

White fir and mountain mahogany on Antelope Range with Antelope Valley and Deep Creek Range in background
Photo: Jan Nachlinger

Montane woodlands are more common in the northern areas than in **Meadow Valley,** where they are found in a few areas on Mount Wilson, Table Mountain, and the Highland Range. These woodlands have not been converted to other land uses, thus their size is good to very good (Table 4.1). Condition averages fair in **Steptoe** because it ranges from poor in the Duck Creek Range and to somewhat better elsewhere. Condition is good in the three other areas because the extent of conifer invasion into aspen stands is low to moderate. However, for the **Antelope** area, the latter does not apply because aspen were singled out as a local conservation target. Regeneration in aspen stands has been observed in **Meadow Valley**. Aspen regeneration is generally not observed in northern areas. A few instances of knapweed invasion have been reported on ridges of Mount Wilson. Also, the northern aspen stands, including those encroached by conifers, are heavily used for camping by hunters and recreational users. Landscape context is fair because natural fires have been suppressed by management and altered by livestock grazing (removal of fine fuels). The natural fire return interval is believed to be around 50-75 years in the dry climate of Nevada, although it is between 7-10 years for aspen in Utah and Colorado (Howard 1996). The Ely BLM fire management plan (USDI-BLM 2000) assumed a 6-20 years fire return interval for white fir based on the little available data from the Missoula USFS fire laboratory. Many woodlands have not experienced fire for 200 years.

Six sources of stress were identified that reduce the viability of montane woodlands (Table 3.2): fire suppression, forestry practices, home and resort development (**Steptoe** only), grazing practices (**Steptoe** only), and current elk use. The **Newark** team gave practically identical explanations for both fire suppression and forestry practices with the latter emphasizing the lack of tree thinning operations. Most teams considered the lack of fuel management as a component of fire suppression to avoid confounding sources of stress.

Decades of fire suppression in montane woodlands has allowed conifers to increase cover in both aspen and conifer stands. Woodlands are becoming forests and understories are shaded as conifer densities increase. The problem is extreme in the Schell Creek Range, Duck Creek Basin, and Kern Mountains. Aspen stands in these areas are even-aged and approximately 100 years old. The disease *Cryoptosporan* spp. is observed to attack old trees and some entire clones have been killed after the disease progressed to the roots. Normally, fire would topkill aspen and cause regeneration. **Meadow Valley** aspen stands are still relatively open. Although it is difficult to implement fuel reduction programs in these high mountain ridges and slopes, the target is sufficiently localized that is appears achievable for most areas, with the exception of the Duck Creek Basin and the Schell Creek Range. However, fuel reduction programs have not been conducted.

Home and resort development is a serious issue for the Duck Creek Basin and Schell Creek Range because the proximity to Ely and Las Vegas and their popularity for hunting favors development in landscapes better suited for wildlife habitat. Houses have a determining influence on the BLM's and USFS's fire suppression policies. Each new house is an additional constraint on fire management and will force full fire suppression. Therefore, restoration of natural fire regimes may not be possible, and tree thinning will likely be the only option for developed areas.

Grazing of montane woodlands by livestock occurs mostly in the **Steptoe** area with livestock consuming understory plants and concentrating near water sources during the summer. Concern was also expressed for the recent expansion of the introduced elk populations in Schell Creek, Antelope, and Wilson Creek ranges. Elk concentrate in aspen stands, consume the bark of aspens and aspen sprouts. Teams identified a clear need for studies that address the confounded effects of different herbivores on aspen stands. There are relatively few and small aspen stands in these areas, therefore a growing elk population could overwhelm the current viability of stands already affected by livestock grazing.

4.4. Springs and Creeks

Buck Springs in Newark Valley
Photo: Louis Provencher, TNC, 2002

Springs and outflow creeks are generally the least viable of all conservation targets, except in **Antelope** where overall viability was estimated good. Their size is fair because many have been diverted, with flow absent or greatly reduced, and livestock and wild horses have changed their characteristics from excessive herbivory and trampling. In **Meadow Valley**, for example, springs depend almost entirely on precipitation, but not deep aquifers, for water recharge. Any land use, water diversion, or vegetation that prevents water from reaching the spring will degrade it and the water table. It is not surprising, therefore, that the condition is fair to poor. Springs do not flow or flow less, aquatic species have been trampled, and tamarisk and expansion of pinyon and juniper, which have greater evapotranspiration rates than shrubs, have all negatively impacted springs and creeks. Landscape context is poor to fair because hydrologic regimes have been altered by surrounding vegetation that has converted sagebrush shrublands to pinyon and juniper closed canopies that cause greater evapotranspiration. Moreover, invading and growing tamarisk saplings have the potential to further dry up springs in **Meadow Valley**.

In decreasing order of importance, seven sources of stress cause the degradation of springs and outflow creeks: fire suppression, feral livestock, elk use, non-native invasive species, operation of diversion systems, grazing practices, and recreational vehicles.

Many of the springs and outflows creeks are embedded in the larger sagebrush-grass-pinyon-juniper matrix vegetation. Encroachment of conifers in aspen stands, which often contain springs, follows a similar pattern. Closed canopies of trees transpire more water than the shrubs and grasses they replaced. Removal of western juniper in Oregon has caused decreased water stress on grasses compared to uncut controls (Bates et al. 2000). Trees eventually will encroach

springs if outflow is low. Moreover, lack of understory in closed canopies causes precipitation to sheet flow and form rills, whereas herbaceous vegetation facilitates infiltration and recharge of the water table. For these reasons, the various teams estimated that encroachment of trees into former sagebrush communities was the most serious cause of spring and groundwater depletion. Flow resumption at springs that were dry for several decades after either fires or pinyon-juniper removal has been repeatedly observed in eastern Nevada. The subject has received little scientific inquiry and the majority of result is from arid, monsoonal systems of Arizona (Bradford et al. 1994; Miller and Wigand 1994). Results from both cold and hot deserts are generally mixed because the very patchy nature of precipitation reduces the statistical power of analysis; however, marginal increases in subsurface water has been reported after tree removal (Miller and Wigand 1994).

The problem of feral livestock, primarily wild horses, but also cattle, is described above; however, it impacts springs and creeks more so than other systems. For wild horses, springs and outflow creeks are their main sources of drinking water. These animals visit these areas frequently, and visitation rates and duration have increased during the current drought. Travel for forage becomes impossible because animals must return to those water sources that have not dried up. As a result, many wild horses have been observed to stay at springs while becoming weakened by starvation. This problem is more acute closer to the Mojave Desert in **Meadow Valley**. Also, wild horses tend to set up territories and may dominate springs and creeks thus keeping wildlife from accessing these areas during the hottest times of the year. Frequent prolonged visits have caused excessive trampling of spring sediments and vegetation, and modification of basin and creek channel morphology.

The growth of the introduced elk population has increased over-utilization and trampling of springs and creeks. The phenomenon is more prevalent in the northern areas, such as in the Red Hills of Antelope Valley. The existing elk management plan allows for the growth of the elk population up to the specified limit.

Two important non-native invasive species inhabit springs and outflow creeks: tamarisk and tall whitetop (*Lepidium latifolium*). Other non-natives, such as Canada thistle (*Circium arvense*), musk thistle (*Carduus nutans*), and Russian knapweed (*Centaurea repens*), are occasional in northern areas. Tamarisk is found in many, if not most springs of **Meadow Valley** as revealed by a recent BLM survey. Tamarisk is also found in more northern springs (e.g., Tippett Spring). The small seeds of this species can spread by wind over long distances and germinate at new sites. They dry up springs because they access deep water and have high evapotranspiration rates. The severity of spring water withdrawal by tamarisk is expected to increase with time as the numerous tamarisk saplings occupying the spring areas grow. The detection of tall whitetop has been on the increase from **Meadow Valley** to the Elko County boundary. Tall whitetop colonizes upper banks of creek and riparian corridors. It can rapidly dominate, and is known to replace native vegetation with time. Other than water-labeled herbicides and goat grazing, we do not know of other forms of control for tall whitetop.

The four assessment areas have extensive water diversions with many springs having diversions at the spring's source. Alternative forms of spring management that allow for ecological integrity and water diversion lower downstream would diminish this source of stress (Sada et al. 2001).

Inappropriate grazing practices affect springs and their creeks similarly to wild horses and elk use. The main difference between wild horses, elk, and livestock use is that the latter are easier to regulate by allotment management, alternative water supply devices, and fencing spring sources.

Off-highway recreational vehicles are a source of decreased viability because people drive near or through spring systems. Recreational vehicles have disturbed or destroyed soil and vegetation in and around springs, such as at Blue Mass in the Kern Mountains, Lowry Springs on Ward Mountain, and Juniper Springs in the Clover Mountains.

4.5. Salt Desert Shrublands

Winterfat, basin big sagebrush, and greasewood in southern Newark Valley
Photo: Louis Provencher, TNC, 2002

Salt desert shrublands are composed of greasewood, winterfat, and saltbush communities. This ecological system occupies basins below sagebrush semi-desert. In **Meadow Valley**, salt desert scrub is primarily located on old lake sediments around Panaca. Cathedral Gorge State Park is located in the middle of this plant community. The viability of salt desert scrub varies greatly among areas (Table 4.1), and depends on winterfat viability primarily (a local conservation target in **Newark**). It is the least threatened conservation target in **Meadow Valley** along with badlands, whereas overall variability is low for **Antelope** further north. Part of the salt desert scrub has been converted to agriculture, but a large proportion remains in most areas. Therefore, the size of the target was judged good. In **Antelope**, however, winterfat has been greatly reduced by overgrazing and conversion to halogeton (*Halogeton glomeratus*). Therefore, size is fair in **Antelope**. The condition is fair to good depending on the extent of halogeton invasion into

winterfat or other salt desert shrubland types. **Antelope** and **Newark** are more heavily invaded by halogeton and cheatgrass. **Steptoe** and **Meadow Valley** have mostly greasewood, which is not heavily invaded by weeds. Although salt desert scrub is an upland system, tamarisk and Russian olive (*Elaeagnus angustifolia*) are occasionally found along drainages in **Meadow Valley**. Clearly, these species alter plant composition. Landscape context is difficult to evaluate because greasewood and winterfat are sensitive to fluctuations in the water table and, in addition, winterfat, a soil dependent community, appears to be shaped by low to moderate levels of herbivory. Pronghorn and mule deer are not known to graze winterfat, whereas rabbits and grasshoppers do. Winterfat communities are probably experiencing elevated herbivory levels from the combination of livestock, wild horse, and elk grazing. Winterfat does not tolerate fire and does not recover from it.

The dominant sources of stress to this community type are conversion to agriculture, non-native invasive species, grazing management, and wild horse grazing (Tables 4.2-4.6). Conversion to agriculture was more prevalent in the past and is unlikely to increase in the near future. In **Meadow Valley**, for example, there was more agriculture land in the past than today. Moreover, abandoned agriculture fields revert back to greasewood with time.

Table 4.6. Summary of sources of stress for salt desert scrub and badlands of the Meadow Valley Wash.

Active Threats Across Systems	**salt desert shrublands**	**badlands**	**Overall Threat Rank**	**Total Score**
Conversion to agriculture or silviculture	Medium	-	Low	0.20
Construction of ditches, dikes, drainage or diversion systems	Low	-	Low	0.03
Excessive groundwater withdrawal	Low	-	Low	0.03
Development of roads or utilities	Low	-	Low	0.03
Invasive/alien species	Low	-	Low	0.03
Recreational vehicles	-	Low	Low	0.03
Feral livestock	-	Low	Low	0.03
Threat Status for Targets and Site	**Low**	**Low**	**Low**	

Perhaps the most important source of stress to **Antelope** and **Newark** are invasive weeds, especially halogeton and cheatgrass. The teams are also aware that other weeds, such as knapweeds, could become the next threat to the salt desert shrubland.

Grazing management and wild horse management are obvious sources of stress to winterfat and, to a smaller extent, the rest of the salt desert shrubland. Although livestock grazing of winterfat can be managed through grazing permits and grazing practices, such as rest-rotation, little can be done about wild horses short of gatherings.

5. Viability and Sources of Stress for Local Conservation Targets in Antelope

5.1. Aspen Stands

Aspen and conifer stand in the Snake range
Photo: Keith Anderson, Ely BLM

This conservation target occurs as small patch high elevation communities or occasionally as riparian linear patches at middle elevations scattered through the North Schell Creek Range, Antelope Range, and Kern Mountains. Overall viability of aspen stands was assessed as poor for the Antelope area (Table 5.1). The size of aspen patches is poor because of their overall reduction from encroaching conifers from surrounding montane woodlands. Aspen stands in Blue Mass of the Kern Mountains have been especially reduced in size. There is no evidence of complete conversion of patches to other vegetative cover types, which would reduce the overall number of patches, but only partial conversion of most if not all patches. Aspen stands are in poor condition for a variety of reasons. Shoot regeneration and reproduction is not occurring within most aspen stands and older stems are dying. Individual aspen shoots have reduced vigor as a result of trampling and grazing. The understory is depauperate with fewer species present, and those present have decreased vigor and cover, also a result of trampling and grazing. Encroachment by white fir has altered both structure and composition of aspen stands. The landscape context was rated poor because historic and continued fire suppression has altered the natural fire regime and possibly the hydrologic regime. The fire return interval within aspen and surrounding montane woodlands has increased beyond the acceptable range of variability to maintain aspen stands as either successional or climax vegetation types in the montane zone. As conifers continue to increase density and close the canopy within aspen stands, the risk of catastrophic crown fire and complete stand replacement increases. It is unclear whether

conversion from broad-leaved deciduous trees to needle-leaved evergreens changes soil moisture and impacts ecological succession of aspen stands. However, increased conifer densities prohibits regeneration of aspen, and reduces health of aspen stands.

Table 5.1. System viability for local conservation targets in **Antelope**.

Systems (Target) Viability	Size	Condition	Landscape Context	Viability Rank
Riparian and Wetlands	Good	Fair	Fair	Fair
Aspen Stands	Poor	Poor	Poor	Poor
Site Biodiversity Health Rank				**Fair**

Four sources of stress were noted as high or very high for aspen stands in the **Antelope** area. They are elk use, fire suppression, wild horse management and grazing practices, and historic livestock grazing practices. Current livestock grazing practices were ranked as a medium source of stress to aspen stands.

Current elk use has led to herbivory within the relatively few and decadent aspen stands, which is a preferred habitat for summer use. Elk use in aspen is confounded by wild horse and livestock grazing practices, but the team concluded that evidence suggests the greatest contribution of excessive herbivory is from elk. As mentioned above, studies are needed.

Fire suppression over the last one and a half centuries has permitted conifers, primarily white fir, to predominate in **Antelope's** aspen stands and their surrounding montane woodlands. Under natural fire regimes, aspen vigorously reproduce by root suckers following fire and have a distinct advantage over conifers, which reproduce from seed (Mueggler 1988). However, in the absence of fire, conifers establish, increase cover over time, eventually close the canopy, and thin understories as light becomes limiting. In extreme situations (not yet noted in the **Antelope** area) aspen clones may die causing complete loss of these patch communities.

Wild horse management and grazing practices are a source of stress to aspen stands primarily because of their contribution to excessive herbivory of aspen shoots and understory grasses. Their contribution to altering composition of aspen stands, again, is confounded by other ungulates (elk and cattle) and the historic impacts from the era of high cattle and sheep grazing in the **Antelope** area.

5.2. Riparian and Wetlands

Cattle in Stonehouse wetland south of Schellbourne Pass in North Spring Valley
Photo: Louis Provencher, TNC, 2002

Antelope's riparian and wetland systems have fair overall viability with initial assessments of good size and fair condition and landscape context (Table 5.1). Most riparian and wetland areas are at their full extent, although some degree of conversion has occurred as a result of ranching operations in North Spring Valley and along Chin Creek in the Antelope Range. Some riparian areas and spring wetlands (e.g., Chin Creek and Sharp Creek) are degraded with introduced species and altered structure. Also, some riparian drainages are downcut (parts of the east side of Schellbourne Pass), and the riparian has being converted to drier sagebrush or rabbitbrush vegetation because of deeper water tables. Also, some riparian areas (e.g., Sharp Creek) are drying because surrounding uplands are not allowing recharge to occur as it as in the past. Denser pinyon and juniper growth uses more soil moisture and reduces recharge of streams and springs. Some streams and springbrooks are partially diverted for livestock watering (e.g., Springs in Stage Canyon and Chin Creek).

Eight sources of stress have been identified for riparian and wetlands, but only four of them have been ranked high and medium. The most important are current elk use, wild horse management, and grazing practices. Livestock grazing ranked as a medium source of stress. Elk, wild horses, and cattle frequent riparian areas for water and lush grasses. Their use of riparian areas appears to have increased as a result of the current 3-year drought. More frequent and prolonged use of riparian and wetlands has resulted in excessive herbivory and habitat degradation.

Wild horse and elk grazing practices contribute to a greater degree than livestock because there is no control of when these animals graze in the riparian areas (other than fencing them out). Timing for livestock is more controlled, although, some livestock grazing still occurs during summer in the Antelope area.

Ditches, drains, and other components of diversion systems have resulted in changes to the hydrologic regime of riparian areas and wetlands. The diversions are typically for livestock operations. These changes have diminished riparian vegetation, led to changes in species composition and structure, allowed weedy plants to establish, and may have increased water temperatures in creeks adjacent to riparian corridors.

Invasive plant species are present in some riparian areas, but overall their source of stress is considered at a low level. These plant species include Canada thistle, musk thistle, tall whitetop, and Russian knapweed. A strategy to prevent the spread of these weeds while at the current low levels is warranted to decrease future levels of threat to riparian systems.

5.3 Badlands

The Badlands in Antelope Valley
Photo: Jan Nachlinger

Overall viability of the badlands conservation target that occupies the northeast corner of the Antelope area is very good (Table 5.1). The badlands are extensive and have not diminished in size as a result of multiple use management currently in place. Much of the badlands are remote and little visited, although there are several roads traversing the landscape and occasionally an off-highway vehicle will infringe on unroaded areas because of the openness of the terrain and vegetation. There is minor use by wild horses. Consequently, condition of the badlands conservation target is slightly downgraded to good. The badlands are essentially a fire-free area because of the lack of understory vegetation and sparseness of the overstory that precludes fire disturbance. The main ecological processes driving the badlands system are climatic and edaphic regimes, which appear intact and functional. Thus, the landscape context is initially assessed as very good.

Only two sources of stress were identified for the badlands and they were both considered only medium ranked. Both recreational vehicle use and wild horse grazing practices lead to habitat degradation in badlands, however, vehicle use is the larger contributor throughout the area. Wild horses are fairly common, yet there is little grass vegetation and water in the area to sustain them so they are probably using it as they travel through to other ecological systems, such as the winterfat flats and black sagebrush, scattered among the badlands.

6. Viability and Sources of Stress for Local Conservation Targets in Steptoe

6.1. Alpine

Ward Mountain alpine and mountain woodlands
Photo: Jan Nachlinger

The alpine is a spatially limited conservation target above treeline. It consists of Ward Mountain in the Egan Range and a few other high peaks in the Schell Creek Range. This conservation targets was found to have the best viability (Table 6.1). The size is very good because it has not been converted to other land uses. The condition is good because, despite its remoteness, species composition has been affected by sheep and wild horse grazing. Road and trail access has created some habitat disturbance. Landscape context is good because, although wind and snow still shape the community, the historic loss of bighorn sheep and replacement by more abundant livestock and wild horses was perceived as an alteration of natural processes.

Grazing practices and recreational vehicles were the only sources of stress identified by the team. Only grazing had a medium rank. Bighorn sheep historically used the alpine, but are not present today. Instead, domestic sheep, cattle, and wild horses have used the alpine for summer forage for decades, if not more than a century. Alpine communities are susceptible to mechanical damage and soil erosion, and are slow to recover because of their low productivity. The team noted that livestock (sheep) have caused erosion, such as on the west slopes below South Schell Creek Range. Similarly, recreational vehicles, which reach some of these areas, would also cause erosion.

Table 6.1. System viability for local conservation targets in **Steptoe**.

Systems (Target) Viability	**Size**	**Condition**	**Landscape Context**	**Viability Rank**
Upland springs/creeks	Fair	Fair	Fair	Fair
Valley springs/marshes/streams	Fair	Fair	Fair	Fair
Badland/Pygmy Sage community	Good	Good	Fair	Good
Alpine	Very Good	Good	Good	Good
Site Biodiversity Health Rank				Fair

6.2. Badlands and Pygmy Sagebrush Community

Ruth badlands with mine tailings in background
Photo: Jan Nachlinger

The only occurrence of badlands with a pygmy sagebrush (*Artemisia pygmaea*) community of concern is the Ruth site near the junction of the Ghost Train railroad and the road leading into Ruth Mine. The target is very limited in size but it has the unique characteristic of containing seven uncommon to rare plants species found only on badland soils. The size is slightly diminished and ranked good because the roads and railroad around the site have been built on the badland soil that would support these species. However, it is not known whether mine tailings have covered some of the badlands and decreased their size more significantly. Condition is good because the site is only slightly disturbed from recreational use and vehicles. Landscape context is more worrisome. The proximity of the badlands to communities of Ely and Ruth may allow future increases in recreational vehicle use, which could alter the edaphic processes controlling the badlands. Recreational vehicle use is the only source of stress identified here.

6.3. Valley Springs, Marshes, and Streams

(Left) Warm Springs and outflow creeks of Steptoe Ranch. (Right) Steptoe Valley slough with Schell Creek Range in back.
Photo: Louis Provencher, TNC, 2002

All measures of viability for valley springs, marshes, and streams are fair and reflect the water demand by humans. The conservation target is appreciably smaller than its potential size because 1) the McGill mine tailings and containment areas are built on the marshes; 2) water is impounded at several locations, most notably Bassett Lake and Commins Lake; 3) several houses, roads, railroads, and utilities are built on valley bottom marshes; 4) many springs have dried or have been partially diverted; and 5) the flow of surface and subsurface water from the mountains has been tapped for other uses, shrinking lowland marshes. The condition is fair because without sufficient water and with grazing by livestock, the riparian, wetlands, and wet meadows plants are being selectively affected. The landscape context is very dependent on fluctuations in the water table and seasonal flooding. These processes are regulated today and there may not be enough water for flooding within the historic range of variability.

The team identified four sources of stress. Excessive groundwater withdrawal had a very high rank, whereas the construction and operation of ditches, dikes, drainage, and diversion systems, crop production practices, and excessive pinyon-juniper evapotranspiration were each ranked medium.

The assessment of excessive groundwater withdrawal was based on current sources of stress and the likely construction of a power plant in the valley, possibly a water-cooled power plant. The cause of current groundwater withdrawal is pumping for agriculture and domestic uses. The obvious consequence of a lowered water table, especially during the current drought, is the desiccation of the marshes, wetlands, streams, springs, and creeks. Springs are tightly linked to the water table. In theory, **Steptoe's** water levels are regulated and monitored by the State Engineer. There are not many monitoring wells in the valley, however, and it was not believed that monitoring was sufficiently frequent. The Ely area is expected to expand because of hunting, retirement opportunities, and other recreational opportunities are attracting an increasing number of second home residents. Therefore, we expect water use to increase also. For example, Ely experienced a serious water shortage in summer 2002. Given these current problems, there is considerable debate about the availability of water for a power plant and the plausible scenario of

the Southern Nevada Water Authority buying water rights in **Steptoe**. Not only would sensitive species be affected, but agricultural irrigation could be compromised.

Ditches, dikes, drainage, and diversion systems provide water for agriculture, and the greatest demand happens at the same time that the flow in springs and creeks is at its lowest. The negative effect of diversion is greatest when water is taken at the spring source instead of further down the outflow creek (>10 m downstream; Sada et al. 2001). Sensitive spring species, such as springsnails and desert fishes (relict dace), are found at the spring source and upper most portions of outflow creeks. The Efroymson team's field visit to an ecologically important spring system on Steptoe Ranch showed that springsnail viability and water diversion are compatible when water is partially diverted further down the creek. Redesigning ecologically damaging diversion systems is sometimes expensive, but not technically difficult.

Crop production is partially a problem for marshes because marsh soil is not the best for crops. The more suitable soil is in greasewood shrublands, which is close to **Steptoe** marshes and sloughs. When crops are placed in these habitats, they are destructive.

The least obvious and potentially most widespread source of stress to valley springs and marshes is the evapotranspiration in adjacent uplands from an expanding front of pinyon and junipers into shrublands. We described this phenomenon under multi-site sources of stress for springs and creeks.

6.4. Caves and Mine Habitats

Cave in the Schell Creek Range
Photo: Jan Nachlinger

Caves and mine habitats were singled out for Townsend's big-eared bat, pallid (*Antrizous pallidus*) and spotted bats (*Euderma maculatum*), and other cave species that may not be known. Many caves exist throughout limestone formations of the Egan and Schell Creek ranges. Mines represent 75% of the known bat occurrences, but there is a question about the long-term durability of mines and their continued use by bats. The team considered size of the target very good because mines have increased available bat habitat compared to pre-mining times. Condition is fair because disturbances to caves are documented and can easily cause bats to abandon them. Landscape context was judged fair because the process of cave and mine colonization is greatly dependent on humans using these habitats for recreation. As Ely grows and becomes a more active recreational center, bats increasingly will be disturbed and limited to more difficulty accessed caves and mines.

Hence recreational use is the dominant source of stress to animal assemblages inhabiting caves and mines (Table 6.2). It is a common practice to organize caves exploration trips in the Ely district. Cave and mine exploration directly disturbs bats. When cave holes are enlarged to facilitate entry, the thermal budget of the cave is changed and bats are very sensitive to this disturbance.

Maintenance or neglect of mines can harm bats in several ways. Neglect will eventually cause the ceiling of caves to fall and kill animals. On the other hand, maintaining mines to prevent

normal decay, also disturbs bats. The team felt that although mines provide alternative habitat for bats, basing this assessment on artificial habitats that did not exist historically was problematic.

Table 6.2. Summary of sources of stress for caves and mines of Steptoe Valley.

Active Threats Across Systems	Caves and mines habitat	Overall Threat Rank
Recreational use	Medium	Low
Mining practices	Low	Low

7. Viability and Sources of Stress for Local Conservation targets in Newark

7.1. Montane Sagebrush Mosaics

Mountain sagebrush mosaic above pinyon-juniper belt on Diamond Mountains. Wyoming sagebrush semi-desert in foreground.
Photo: Louis Provencher, TNC, 2002

The overall viability of the montane sagebrush mosaic conservation target is good. It is located on higher elevations of the Diamonds and the Pogonip Ridge area in the southeast. The target in the Diamond Mountains in the northwest Newark Valley is good. It has good size, condition and landscape context. This area has maintained itself through a normal disturbance and fire regime. The lack of dominance by contiguous woodland species (although dense woodland species are concentrated in drainages and on north-facing slopes) lead the team to conclude that the area has

periodically burned in a normal length fire cycle. It supports significant, consistent populations of wildlife (Mike Perkins, *pers. comm.*). The montane sagebrush mosaic in the northwestern Newark Valley owes part of its intact condition to the difficulty in placing and maintaining livestock. There is no use by wild horses.

Table 7.1 System viability for unique conservation targets of Newark.

Systems(Target) Viability	Size	Condition	Landscape Context	Viability Rank
montane sagebrush mosaic	Very Good	Good	Good	Good
winterfat	Good	Fair	Fair	Fair
bats	Good	Fair	Fair	Fair
Site Biodiversity Health Rank				Good

The viability of the montane sagebrush mosaic in the mid-western portion of **Newark** is less than good due to the presence of cheatgrass at the lower and mid elevations. The shortened fire cycle is clearly demonstrated by the expanse and pattern of cheatgrass. With an invasive plant seed source present and the potential for fires, the team assessed condition as fair in that area.

Additionally, Pogonip Ridge was considered to be in fair condition, due to the presence of dense woodland species (juniper) creating a potential for catastrophic fire. Juniper dominates the bench leading up to Pogonip Ridge.

Only two sources of stress were identified for the montane sagebrush mosaic (Table 4.4). Both fire suppression and invasive alien species have led to degradation of the target areas, however, invasive species were considered the more serious of the two sources of stress, especially in the Diamonds. Fire suppression was considered to be a continuing contributing factor of stress in the Pogonip Ridge area.

7.2. Winterfat Communities

Forage utilization cage in winterfat community west of Pogonip Range, southern Newark Valley
Photo: Louis Provencher, TNC, 2002

The overall viability of winterfat communities found on both sides of the Pancake Range in southern **Newark** is good. Winterfat communities are sensitive to fire, while distribution is determined by soils, and this target is still found at traditional locations in **Newark**. Its size and landscape context are both good. Its condition, however, is only fair. Development of roads and utilities have had a minimal detrimental effect upon winterfat communities causing both a disconnection within the community and introduction of invasive plants. Additionally, off-road vehicle use associated with livestock, utilities, or recreation is considered a source of stress for viability of winterfat communities.

The introduction of fire-adapted invasives is a low level threat to winterfat communities (Table 4.4). However, this was not considered as important a threat as the invasion by opportunistic plants such as halogeton, which once established, exclude winterfat without some control treatment. Historical overuse (livestock overgrazing) on the western side of the Pancake Range has resulted in a condition which is only fair with reduced cover by the dominant winterfat. Current livestock management allows the winterfat range to improve; however, recovery to its earlier condition may require decades. Another concern is the year round presence of wild horses and the herd's tendency to stay at one particular location. Winterfat is susceptible to continual grazing. All winterfat communities are showing affects of drought degrading condition and impeding recovery; however, east of the Pancake Range, it is the wild horses that are the more contributory source of stress.

7.3. Bats

Townsend's big-eared bat
Photo: © Merlin D. Tuttle, Bat Conservation International

The overall viability of bats is good in **Newark**. The team considered bat populations have good size, fair condition and good landscape context. Bat populations are considered to have increased because of the roosting and brooding habitat created by mine shafts, especially in the Pogonip Ridge area. Forestry practices have done little to disturb or fragment bat habitat; however, lack of forest management has not created a diverse mosaic of habitats for bats (Table 4.4). The activity of greatest concern is disturbance of mines by recreational explorers who directly disturb bats or lead to mine closures to protect recreationists.

Juniper stands provide both roosting and food sources for bats. Any wholesale removal of juniper should be avoided.

Habitat disturbance is high in both severity and scope for Townsend's Big Eared bat (a candidate species in the Bat Conservation Plan for Nevada [Attenback et al. 2002]). The team considered removal of feeding or brooding habitat as a threat; however, protecting existing dominant stands of pinyon-juniper should be evaluated because of the potential of catastrophic wildfire. A catastrophic fire would remove foraging habitat. Because bats feed on insects, any degradation of riparian areas would be detrimental.

Our ranking of the system was fair to good due to our lack of knowledge of the existing situation of bats in **Newark**.

8. Viability and Sources of Stress for Local Conservation Targets in Meadow Valley

8.1. Higher Elevation Riparian Corridors

(Left) Riparian meadow with tamarisk and willows north of Caliente. (Right) Entrenched and tamarisk invaded Meadow Valley Wash in Condor Canyon before the recent wildfire, TNC preserve
Photo: (left) Louis Provencher, TNC, 2002. (Right) Jan Nachlinger

The principal distinction between higher and lower elevation riparian corridors is the dominant vegetation communities and geomorphology. Riparian meadows and open valleys with alluvium are prevalent in high elevation riparian corridors, whereas low elevations systems have more energy and contain mostly riparian woodlands and shrublands growing in rocky canyons. The Mojave Desert section of the wash is low energy but prone to strong flash flooding. The high elevation riparian areas include the upper Meadow Valley Wash north of Caliente and Clover Creek. Caliente, the confluence of Clover Creek and Meadow Valley Wash, appears to be the transition zone between systems.

The size of high elevation riparian corridors (Clover Creek and Meadow Valley Wash) is good (Table 8.1) because the majority of the channel is still present, however the width of the riparian corridor has diminished over time and parts of the Meadow Valley Wash flowing between Rose Canyon and Caliente have been completely diverted. (Historically, the wash would have intermittent perennial water around Panaca). Also, the wash, more than Clover Creek, has entrenched in several areas due to historic grazing and channel and water manipulations. A little less than half of the riparian corridor in the wash (not in Clover Creek) has been converted to agriculture. The condition of the riparian corridors is fair because there is less water due to water withdrawals and groundwater depletion and timing of discharge is altered with pulses of flash flooding diminished by Eagle Valley reservoir. As a result, the hydrology cannot support riparian meadows and trees as it did in the past. Predictably, tamarisk has been able to invade the upper wash, albeit in small numbers. It is likely that Meadow Valley Wash and Clover Creek do not meander freely anymore. This altered hydrology will reduce diversity and abundance of riparian animal species as structure of the riparian system is simplified. The riparian meadows that dominate the upper wash are still abundant, some probably because of irrigation, which makes the condition fair rather than poor. Landscape context is fair because reservoir management, as

well as water diversions and depletion attenuate natural flash flooding processes and prevent water from meandering. Clover Creek appears to be in comparatively better shape.

Table 8.1. System viability for local conservation targets in **Meadow Valley**.

Systems(Target) Viability	Size	Condition	Landscape Context	Viability Rank
low elevation riparian corridor	Good	Fair	Good	Good
creosote bush-bursage-blackbrush	Very Good	Fair	Fair	Good
chaparral-Ponderosa-P/J Woodlands	Good	Fair	Fair	Fair
hi elevation riparian corridor	Good	Fair	Fair	Fair
Site Biodiversity Health Rank				**Fair**

Although seven sources of stress reduce the viability of high elevation riparian corridors, only three are sufficiently high (medium rank) to discuss (Table 4.5): fire suppression, maintenance of railroads, roads, or utilities, and operation of drainage and diversion systems.

We discussed the role of fire suppression and pinyon and juniper expansion on groundwater depletion for springs and outflow creeks. Because Meadow Valley Wash and Clover Creek depend entirely on precipitation and groundwater in this watershed, it follows that the replacement of sagebrush communities by pinyon and juniper throughout all mountain ranges, but especially the Wilson Creek Range and Clover Mountains, is a serious cause of excessive evapotranspiration and degraded viability for hydrologically driven systems. The depletion of groundwater, however, needs to be quantified. Sedimentation is also part of the problem of fire suppression. One cause of excessive sedimentation is the lack of understory vegetation under the dense canopy of pinyon and juniper. Without understory shrubs and grasses to slow runoff and facilitate infiltration, rills form and topsoil erodes during storm events. In watersheds with already highly erodable soils, this accentuates the problem of sedimentation in riparian corridors. The extent of damage to desert riparian fishes such as the Big Spring spine-dace and the Meadow Valley Wash desert sucker, is not known. A second form of sedimentation results from the high erodability of soil devoid of any vegetation after catastrophic wildfires. Excessive sedimentation due to one storm event following the catastrophic wildfires on the Wilson Creek Range noted along 10 miles (6.6 Km) in Meadow Valley Wash.

The presence and maintenance of railroads (more so than roads and utilities) has at least three effects on Clover Creek. First, maintenance of tracks (grinding) produces sparks that ignite numerous small fires, and sometimes large fires. Riparian trees and shrubs are sensitive to fire, which favors tamarisk. We do not know the effect of railroad fires on riparian meadows, but assuming they are sufficiently dry to ignite, we think that grasses and sedges will likely recover. Second, the railroad is a predictable source of toxic spills. Toxic contaminants come in all forms from chemicals to fermenting grain. These spills will kill aquatic wildlife in localized areas. Third, the railroad prevents Clover Creek from meandering in areas where the railroad is close to the creek. Channelization will cause entrenchment and loss of riparian vegetation over time.

The third most important source of stress to higher elevation riparian corridors is the operation of drainage and diversion systems, which are prevalent on both corridors. These diversions are designed to bring water to agricultural lands and meadows. They use less water than the larger diversions structures, but they modify water levels nevertheless. It may be difficult to address

this source of stress because local livelihoods are directly affected. Disturbance caused by the maintenance of ditches impacts the main stem of the creek through bank disturbance and sedimentation. It may be possible to design local strategies to minimize these effects. Irrigation water is most needed during the driest months, which corresponds to lowest stages in Meadow Valley Wash and Clover Creek. Peak water use can have a lethal effect on several endemic fishes in both creeks. Lessons learned from other areas may be worth considering where water rights were purchased and converted to instream flows for beneficial use of wildlife. Also, state management of Eagle Valley Reservoir and release of water could be considered for beneficial flows to wildlife.

8.2. Lower Elevation Riparian Corridors

Meadow Valley Wash: (Left) Willow trees in Rainbow Canyon with floodplain converted to agriculture and (right) creek after the town of Caliente removed willow trees north of southern Highway 93 bridge
Photo: Louis Provencher, TNC, 2002

The only river in the lower elevation section is Meadow Valley Wash itself. The lower elevation portion of **Meadow Valley** is long, extending from Caliente to the confluence with the Muddy River (although the assessment area was extended only to the Clark County line). The size of the riparian corridor is good because water is perennial from Caliente to Elgin and intermittent lower down depending on where bedrock surfaces from Quaternary alluvium (Table 8.1). The width of the riparian vegetation has narrowed over time. This rank is debatable, however, and was determined prior to reading historical accounts. We have since learned that, based on 1904 observations, Meadow Valley Wash had surface flow from Caliente to Leith, then again near Lyman crossing, and was perennial again (Averett 1995). There was sufficient water flow to supply the Delamar mining town with 100,000 gallons daily from Stine (or Bamberger; Averett 1995). This is a sobering revelation for a river that has not seen such flow for 50+ years. Therefore, we are unsure about the size assessment of Meadow Valley Wash in the Mojave Desert portion. The condition of the wash is fair because 1) water is diverted; 2) the wash is disturbed by agriculture and livestock; 3) it has been channelized somewhat by the road and railroad; and 4) tamarisk has invaded, especially sections where water emerges in the Mojave Desert. The section between Caliente and Elgin (Rainbow Canyon) has the highest biological integrity. The landscape context is considered good because despite all the problems described above, flash flooding is still very much part of the wash's dynamics. Also, migrant bird species

that make Meadow Valley Wash such an important ecological corridor are frequently detected and could easily reestablish following restoration of degraded riparian areas (Lund 2002).

Six sources of stress, presented in decreasing order of importance, are especially injurious to the lower elevation riparian corridor (Table 4.5): fire suppression, non-native invasive species, railroad maintenance, the operation of drainage and diversion systems, excessive groundwater withdrawal, and grazing practices. The latter is the only medium-level source of stress, while the others are high. The fire suppression issue is identical to that presented for high elevation riparian corridors and is not repeated here. Because the lower wash integrates the whole watershed, the effect of pinyon and juniper expansion on water depletion may be worse than for the high elevation riparian corridors.

The invasion of tamarisk is especially acute in lower **Meadow Valley**. Tamarisk is capable of completely replacing native vegetation and depleting water through excessive evapotranspiration. Again, there is marked difference between Rainbow Canyon and the lower Mojave Desert portion. Tamarisk is less abundant in Rainbow Canyon, even before the tamarisk eradication program was started. Every perennial reach of the wash in the Mojave Desert portion is invaded by tamarisk, which is mostly on private lands. Control of tamarisk is costly (for both time and money) and requires cutting trees and immediately applying herbicide (Garlon®) to stumps by certified users. Tamarisk is not the only riparian weed species. Tall whitetop, a very aggressive mustard, has been found in **Meadow Valley**. This species can completely replace native understory vegetation. It spreads by small root fragments, vegetative growth, and seed. The only effective control for tall whitetop are the application of water-labeled herbicides and domestic goat grazing, which is used at the Tracy Power Plant on the Truckee River (Dr. Jim Young, *pers. comm*.). In addition to these species, hoary cress (*Cardaria draba*), Russian knapweed, and spotted knapweed (*Centaurea maculata*) have been detected and assumed to be increasing in numbers.

The presence and maintenance of the railroad has a large affect on geomorphology, plant composition, and water quality of the wash. The Union Pacific railroad runs along the whole wash and is often on one of its banks. The railroad, therefore, prevents the wash from fully meandering. Sections of the wash have repeatedly been moved to accommodate the path of the railroad. Also, the repetitive use of heavy equipment to clear bridges (e.g., confluence of Cottonwood and Rainbow canyons) and prevent the movement of the wash towards the railroad, has directly altered geomorphology of the wash. In essence, the railroad has disconnected the river from its floodplain. These alterations lead to loss of point bar formation and natural erosion (meandering), entrenchment and desertification of the floodplain after the water table drops, recruitment failure by riparian trees and shrubs, and invasion by tamarisk. All of these symptoms are observed along the wash to some degree. These symptoms are moderated because by flash flooding, which is still a powerful process in the wash. As in higher elevation riparian corridors, railroad maintenance causes fires from rail grinding and is a source of toxic spills.

The operation of ditches and drainage systems in a water-limited environment is a key source of stress, especially in the Mojave Desert portion during the current drought. The operation of ditches and drainages is more important upstream of Caliente, but some minor agriculture and water diversion occurs where water surfaces in the lower section of the wash. The effects of

ditch and drainage operations are amplified when so little water is available to native species and tamarisk is transpiring large quantities of water.

Perhaps a more threatening and looming source of stress is excessive withdrawal of water along the whole length of the wash and Clover Creek. Currently, withdrawal of water is regulated and monitored by the State Engineer. In theory, water is not over-utilized, although it may be over-appropriated. Nonetheless, water used upstream that does not return to the water table results in reduced flow in the lower portion of Meadow Valley Wash because this system is not fed by a deep aquifer. The greatest risk to the riparian system, especially to two endemic fishes and riparian bird species of concern (e.g., Southwestern Willow Flycatcher and Western Yellow-Billed Cuckoo), is the proposed withdrawal of water from private lands at the Rox Siding area to the town of Moapa. Recent hydrologic studies in this area of the wash predict loss of surface water flow and a drop of the water table sufficient to severely impair or destroy riparian vegetation if the proposed groundwater withdrawal proceeds. Moreover, the proposed withdrawal is expected to prevent subsurface water to flow downstream over the bedrock barrier restricting current flow. This section of the river is recognized as critical to desert riparian bird species on the priority list of the Clark County multi-species habitat conservation plan (Lund 2002) and to the viability of the largest remaining mesquite bosque in the area.

Grazing practices have a moderate effect on the plant composition and geomorphology of the lower elevation riparian corridor. Stocking rates are currently low because the drought has forced the cancellation of grazing permits or reduction of stocking rates. Therefore, it is probable that allotments will be restocked after the drought. Poor grazing practices lead to over-utilization of riparian vegetation in those few areas where water surfaces. Usually, cottonwoods and willows are heavily browsed and eventually killed. Without the midstory shrub layer, at least 70% of riparian bird species, including those of concern, cannot breed. Riparian shrubs and trees also play a role in sediment trapping and bank stabilization. Trampling by livestock causes bank slumping and a decrease in water quality. Clearly, alternative water delivery systems and shading need to be provided for livestock to mitigate their impacts to riparian systems. The team believed that changing grazing practices was much easier than closing allotments entirely.

8.3. Chaparral-Ponderosa Pine-Pinyon-Juniper Woodland

(Left) Ponderosa pines with sagebrush-grass understory in the Clover Mountains. (Right) East Pass wildfire overlooking Tule Desert with chaparral species reprouting and standing ponderosa pines.
Photo: Louis Provencher, TNC, 2002

The ponderosa pine woodlands with chaparral understories are primarily found in the Clover Mountains at the transition between the Great Basin and the Mojave Desert. The team agreed that we do not understand the natural fire regime of this system because it fits both the Colorado Plateau model with grassy understories and fire recurring every 15-30 years (Fulé et al. 1997) as well the California model with woody understories. The Colorado Plateau model may be more accurate because ponderosa pine cannot survive chaparral fires unless rugged topography is present to shelter pines from flames and intense heat (Hugh Safford, USFS , *pers. comm*.). The Clover Mountains have gentle to moderate topography and ponderosa pine is widespread. Also, the dominant manzanita and ceanothus species resprout readily after fire, which indicates short fire return intervals (20-60 years). Manzanita and ceanothus species that reproduce by seed have longer fire return interval (>60 years). Basic fire regime studies are clearly needed for this conservation target.

The size of the conservation target is good because the remote area where it is found has not been converted to other land uses, although we believe that ponderosa pines were probably logged heavily for fuel and mining structures more than a century ago (Table 8.1). Also, catastrophic wildfires appear to have killed large stands of ponderosa pines, although dense chaparral vegetation has returned. Ponderosa pine is a prolific seeder and can easily recolonize when mineral soil is exposed. The condition of the target is fair because decades of fire exclusion has led to abundant growth of midstory oaks and chaparral and encroachment by pinyon and juniper. These woody species create fuel ladders that generally kill the ponderosa pine canopy during fires. Hot fires are likely to harm herbaceous species and sterilize the seed bank. Therefore, we would expect the natural condition to harbor more bunchgrasses (Colorado Plateau model) and less midstory. Finally, the classic gap regeneration that characterizes ponderosa pine woodlands is not readily observed in the Clover Mountains. Patchy regeneration usually develops on mineral soil of former wildfire hot spots, but these patches have been filled in by midstory species here. Landscape context is fair because the lower intensity and chronic fires have not been part of this system for several decades and cannot be expected to occur again without first thinning the midstory vegetation.

Only two identified sources of stress degrade the viability of chaparral-ponderosa pine-pinyon-juniper woodlands (Table 4.5): fire suppression (high) and non-native invasives species (medium). Fire exclusion here is very similar to the situation described for the sagebrush-grass-pinyon-juniper mosaic. Past fire suppression policy and the need to prevent fire under the current and dangerous fuel loading is a classic national scenario. The continuation of fire suppression does not help the situation and it is assumed, and recognized in the Ely BLM fire management plan (USDI-BLM 2000), that mechanical thinning will need to occur in conjunction with local prescribed burns. Meanwhile, there is a clear need to define the natural fire regime of this transitional community.

Cheatgrass is the non-native species endangering this system type. Cheatgrass is common in the understory. It is also common in the understory of the surrounding sagebrush communities. Expanding cheatgrass cover shortens fire return interval because of its fine fuel. The greatest threat from cheatgrass is the increased probability of ignition leading to catastrophic crown fires that kill ponderosa pines and favor cheatgrass, but probably not at the expense of aggressive chaparral species.

8.4. Badlands

Cathedral Gorge State Park badlands
Photo: Louis Provencher, TNC, 2002

Badlands in **Meadow Valley** have very good viability. Badlands have not been converted to other uses because they are highly erodable landscapes. The size of badlands here is, therefore, very good (Table 8.2). Condition is good, but somewhat reduced, because badlands attract off-highway vehicle use and they have some wild horse use. Badlands in **Meadow Valley** are isolated edaphically controlled systems shaped by erosion processes. This landscape context therefore appears to be functioning quite well.

Table 8.2. Viability of salt desert shrubland and badlands for Meadow Valley Wash.

Systems(Target) Viability	Size	Condition	Landscape Context	Viability Rank
badlands	Very Good	Good	Very Good	Very Good
Site Biodiversity Health Rank				Very Good

The only sources of stress to badlands are recreational vehicles and feral livestock. Both have low ranks (Table 4.6). The proximity of badlands to Panaca and Pioche exacerbates excessive soil disturbance caused by recreational vehicle use. The impact of wild horses here at the edge of the Wild Horse HMA is a minor problem.

8.5. Creosote Bush-Bursage-Blackbrush

Creosote bush-bursage-blackbrush community in the Mojave Desert
Photo: The Nature Conservancy

The creosote bush-bursage-blackbrush conservation target is vast and represents matrix communities of Mojave Desert scrub. The size is very good in **Meadow Valley** because very little of it has been converted to other land uses (Table 8.1). Few roads exist in the assessment

area. Condition is fair because two non-native species, red brome (*Bromus madritentis* spp. *rubens*) and Mediterranean split-grass (*Schismus arabicus* and *S. barbatus*), have invaded large areas of the hot desert. Red brome, a close relative of cheatgrass, will outcompete native grasses and forbs (Brooks 2000). Landscape context is fair because of the ubiquitous red brome. The more worrisome consequence of this annual grass is that it introduces an abundant fine fuel to ecosystems that have not evolved with fire. Fires fueled by red brome will cause the elimination of Mojave Desert scrub vegetation, habitat of the threatened desert tortoise. The reason a poor rank was not assigned to landscape context is because red brome is not yet that abundant yet here compared to other areas of the Mojave Desert and there is still sufficient connectivity for desert tortoises. A potentially important barrier to desert tortoise dispersal, however, is the Union Pacific Railroad.

Only three sources of stress ranked as high or medium (Table 4.5): non-native invasive species, the development and maintenance of roads, railroads, and utilities, and military training activities. Invasive species was the only high threat.

As explained for landscape context, red brome is changing composition and ecological processes in the Mojave Desert rapidly. Mojave Desert scrub and associated species will likely become increasingly threatened with the evolutionarily novel development of fire regimes. This species builds fuel continuity between desert shrubs. Red brome is capable of invading healthy desert scrub without being introduced or facilitated by livestock and feral animals. Furthermore, there is no known method of control. Red brome is not the only invasive weeds to cause concern. Russian knapweed is well adapted to the desert based on observations from Ash Meadows Wildlife Refuge and could be a future threat to the hot desert of **Meadow Valley**. Maintenance of the railroad, in conjunction with roads and utilities maintenance, is a major concern because grinding of rails ignites fires in Mojave Desert scrub. When red brome is present, the consequence is large wildfires that eliminate native vegetation. The railroad and utility poles that parallel it are also a potential threat to the desert tortoise, but more information is needed. The railroad is a sufficiently high barrier capable of blocking the movement of desert tortoise. The utility poles serve as perches for ravens, which have been identified as an excessive source of predation on desert tortoise eggs and juveniles.

The impact of military training activities on the decreased viability of Mojave Desert scrub is because of increased fires. Both ordinances and crashes of Air Force fighter planes (from Nellis Air Force Base) ignite fires. Training is frequent over **Meadow Valley**. When red brome or other fine fuels are present, fires will spread and eliminate native desert vegetation.

Although recreational off-highway vehicle use was identified as a low source of stress, we address it here because it is possibly an increasing problem for **Meadow Valley** area. Currently, soil and vegetation disturbance by recreational vehicles is limited because the area is remote, but Las Vegans do visit during the weekends. Evidence indicates that use is increasing, especially since a motorcycle compound was built in Elgin.

9. Conservation strategies

In Efroymson 5-S conservation planning, conservation strategies are proposed for higher ranking sources of stress, those sources that are likely to seriously impair one or several conservation targets. Because land owners' resources are limited, we focus on sources of stress whose abatement will make a large difference.

The four teams recognized a need to develop multi-site strategies for conservation targets common to all areas separate from local conservation targets and sources of stress. This is an exciting approach that could lead to increased efficiency at the agencies' implementation phase and simplifies the presentation of strategies in this section. Therefore, we first present overarching multi-site strategies and follow with local systems and their strategies. For a stated problem or conservation target need, each strategy has an outcome, which is the goal that the teams envision, and a number of action steps necessary to carry out the strategy. A future team discussion to determine most appropriate lead parties for accomplishing action steps for each strategy is recommended.

9.1. Multi-site Conservation Targets and Strategies

1. Danger of catastrophic fire in pinyon-juniper expansion within the sagebrush-grass-pinyon-juniper mosaic

Outcome: Decrease continuity of woody fuels by 50% while minimizing invasive weed expansion.

Strategy: Create islands of shrubs and grasses in continuous woody pinyon-juniper matrix using alternative fuel reduction methods (prescribed burns under non-catastrophic prescriptions, helitorch, and mechanical methods). Choice of sites for treatment should not be constrained by "historic" pinyon-juniper ecological site soil distribution.

Action Steps:

a) Prioritize areas by expected benefits and costs using state-transition models and watershed assessments.
b) Ensure that RMP/EIS allows for large scale treatments (>50,000 cumulative acres/year).
c) Conduct Environmental Assessments (EA) for large areas.
d) Work with all interested parties to ensure adequate resources by forming a broad coalition.
e) Define actions with and outside of Congress to find resources for taking action.
f) Use adaptive management as the guiding process in the implementation of restoration treatments.

2. Springs and Creeks restoration

Outcome: Create water flow at historic spring sites that are currently dry by restoring natural fire regimes and vegetation structure to surrounding uplands.

Strategy: If spring and creek flow increases with the area of pinyon-juniper clearing at pilot project, then implement region-wide restoration program at best scale.

Action Steps:

a) Design replicated pilot project in zero flow springs and some flowing springs (springs are replicates). Maximize data collection from these treatments.

b) Determine woody removal pattern and choice of tree selected.
c) Research retrospective case studies with wildfires while considering geology as a factor that affects water flow to increase understanding of driving variables.

3. Degradation of aspen stands
Outcome: Restore viability of all aspen stands where feasible.
Strategy: Thin encroaching conifers with mechanical methods and prescribed burns in aspen and montane conifer woodlands simultaneously over entire range of aspen distribution.
Action Steps:

a) Prioritize areas by expected benefits and costs using state-transition models and watershed analysis.
b) Ensure that RMP/EIS and revised USFS forest plan allow for large scale treatments, and develop USFS fire plan accordingly.
c) Conduct EAs for multiple aspen stands.
d) Work with all interested parties to ensure adequate resources by forming a broad coalition.
e) Define actions with and outside of Congress to find resources.
f) Use adaptive management as the guiding process in the implementation of restoration treatments.

4. Risk of ongoing fire suppression in sagebrush-grass-pinyon-juniper mosaic, "historic" pinyon-juniper ecological sites, and montane woodlands
Outcome: Allow prescribed fire and natural fires to meet targeted annual burn acreage.
Strategy: Address fire level planning issue such that prescribed burns can be applied during windows of opportunity and natural wildfire can be allowed to burn where and when appropriate.
Action Steps:

a) Address fire level planning issue within each land managing agency.
b) Train federal agency personnel in prescribed burning.
c) Work with all interested parties to ensure adequate resources and public education by forming a broad coalition.
d) Increase targeted burn acreage to be proportional to scope of restoration needs (Calculate acres/year with an assumed fire return interval and known GIS acreage of targeted vegetation type).
e) Address liability issue with prescribed burning and quantifying incentive to burn.
f) Create legal and political framework under which a line officer can use a reasonable amount of accountability.

5. Lack of consistently available native seed for sagebrush-grass-pinyon-juniper mosaic, "historic" pinyon-juniper ecological sites, and montane woodlands
Outcome: Restore native cover in all revegetation areas.
Strategy: BLM and Forest Service guarantee to buy an agreed upon amount of native seed/year for 20 years.
Strategy Create a thriving native seed industry that can support post-fire and restoration revegetation efforts.
Action Steps:

a) Tap into existing Farm Bill (and other appropriate opportunities) with timely proposal to create and support local seed industry. Work with NRCS and find willing land owners.
b) NGO and coalition lobby Congress to create sustained demand.

6. Inordinate number of appeals and lawsuits on restoration projects in all conservation targets
Outcome: Implement effective restoration projects in a timely manner.
Strategy: Improve the public lands planning process and document quality such that all plans and policy are legally defensible. Explore scientifically-based peer-review process for projects that can substitute for judicial review.
Actions Steps:
a) Complete watershed assessments, EIS, and EAs for Ely BLM district.
b) Conservation partners address scientifically-based peer-review process given completion of planning.
c) Investigate timelines for BLM appeal process and consider the of USFS 45-day timeline as a model.

6. Invasives: risk from first tier priority perennial species (rush-skeleton weed, yellow starthistle [Centaurea solstitialis], etc) in sagebrush-grass-pinyon-juniper mosaic and salt desert shrublands
Outcome: Eradicate priority perennial weeds in entire watershed.
Strategy: Support and bolster tri-county weed district and Lincoln County Cooperative Weed Management Area
Action Steps:
a) Provide weed inventory support.
b) Secure funding for aggressive control of weeds.
c) Take measures to prevent introductions (e.g., wash machinery and other best management practices).

7. Invasives: risk from second tier priority perennial species (Russian knapweed, tall whitetop, hoary cress, toad flax (Linaria spp.*), tamarisk, spotted knapweed) in sagebrush-grass-pinyon-juniper mosaic, salt desert shrublands, and springs and creeks*
Outcome: Manage priority perennial weeds and tamarisk in entire watershed.
Strategy: Support and bolster tri-county weed district and Lincoln County Cooperative Weed Management Area
Action Steps:
a) Provide weed inventory support.
b) Secure funding for aggressive control of weeds.
c) Take measures to prevent reintroductions, including restoration of native species.
d) Prioritize areas for control efforts, such as tamarisk in isolated springs.

8. Invasives: risk from third tier priority species (invasive annual grasses) primarily in sagebrush-grass-pinyon-juniper mosaic
Outcome: Restore native herbaceous cover in sagebrush-grass-pinyon-juniper mosaic**s**.
Strategy: Implement restoration projects to test and evaluate methods of control and reestablishment of natives.
Action Steps:

a) Seek Joint Fire Science Program and other sources of funding to test management methods.
b) Seek internal BLM funding to accomplish restoration projects.
c) Work towards the creation of National Science Foundation Long-Term Ecological Research Site with a Great Basin administrative site in Ely district.

9. Livestock management in sagebrush-grass-pinyon-juniper mosaic, springs and creeks, salt desert shrublands, and montane woodlands
Outcome: Restore the viability of ecosystems by appropriate livestock management within capacity of grazing allotments and actively restore historic damage.
Strategy: Faithfully implement agency standards and guidelines. Identify and restore sites degraded by historic use.
Action Steps:
a) Ensure appropriate timing and distribution of use.
b) Initiate restoration projects in areas of greatest restoration potential.
c) Protect native vegetation in restoration areas.
d) Pursue alternative sources of forage during rest (e.g., grassbank).
e) Continue to use and improve best management practices.

10. Wild horse management in all conservation targets
Outcome: Restore and maintain healthy ecosystems by keeping herd size within carrying capacity of the land.
Strategy: Faithfully implement statewide wild horse management plan.
Action Steps:
a) Review each HMA to determine long term suitability as horse habitat.
b) Set AML based on historic precipitation pattern.
c) Maintain horse numbers within AML and maintain band social structure.
d) Use all appropriate methods to control herd size.
e) Develop media and education campaign on the relationship between wild horse management and sustainable grazing practices.
f) Exclude wild horses from sensitive areas.

11. Elk management in springs and creeks and montane woodlands
Outcome: Restore and maintain healthy ecosystems by keeping herd size within carrying capacity of elk management areas.
Strategy: Faithfully implement elk management plans.
Action Steps:
a) Identify sites suffering from elk damage using early indicators.
b) Work with NDOW to manage numbers of elk in areas showing initial signs of damage.
c) Coordinated resources management plan and coalitions need to support appropriate elk management actions.
d) Need to establish and secure funding for accurate elk counts in management areas.

9.2. Local Conservation Targets and Strategies for Antelope

1. Potential for increased grazing pressure in untreated aspen stands

Outcome: Avoid increasing risk of heightened grazing pressure when aspen stands are treated for encroaching conifers.

Strategy: Treat all aspen stands simultaneously and equally. Increase understanding of relative contribution by different grazing pressure sources.

Action Steps:

a) Rather than prioritizing areas by expected costs and benefits, take action at all stands simultaneously to mechanically thin conifers and where appropriate use prescribed fire.
b) Set up exclosures to monitor herbivory levels by livestock, elk, and wild horses.
c) Involve White Pine County technical review team in study design and research.

2. Grazing pressure in riparian corridors and wetlands

Outcome: Protect riparian areas from further degradation by livestock, wild horses and elk.

Strategies: Identify and protect known key riparian areas.

Action Steps:

a) Fence key riparian areas at Middle Creek, Chin Creek, Flat Spring (all three in the Antelope Range), and Blue Mass (in the Kern Mountains).
b) Control flow from the BLM Chin Creek water pipelines more closely to achieve better distribution of wild horses in **Antelope** area.

9.3. Local Conservation Targets and Strategies for Steptoe

1. Badlands and Pygmy sagebrush community disturbance at Ruth

Outcome: Protect the +15-acre badland site adjacent to Ruth mine from human disturbance.

Strategies: Determine if private conservation easement is feasible.

Action Steps:

a) Determine the interests of land owners.
b) Inform owner of importance of site, unique species, and potential as interpretive asset for tourists.
c) Make site known to Great Basin National Heritage Area board.
d) Find mine-land reclamation mitigation requirement that could be directed to benefit this site.
e) Determine if owners are agreeable to have the site on list for purchase under Southern Nevada Public Lands Management Act, thus transferring ownership to BLM as ACEC only if appropriate conservation and funding can be guaranteed in advance.
f) With permission of land owner, take local teachers and students on tour to increase appreciation of unique plant community.
g) Investigate whether knapweed is a threat to the Pygmy sagebrush community.

2. Home and resort development in sagebrush-grass-pinyon-juniper mosaic, "historic" pinyon-juniper ecological sites, and montane woodlands

Outcome: Help home development support ecological and fuels management of surrounding landscapes – or – establish no-development buffer areas sufficient to allow ecologically sustainable fuels management. Develop set-back and fire-safe community plans for all developed lands impacted by fire.

Strategy: Regulate private development by local government to provide for fire management

Action Steps:

a) By 6/03, complete assessment of private land development projects and sensitive sites in Steptoe, and develop workable alternative/approach to county-wide development that supports land management goals.
b) Secure funding with White Pine County Economic Development Council and seek academic support to conduct assessment.
c) Identify key development sites that require threat mitigation to protect key conservation targets.
d) Dovetail assessment with current BLM land planning for EIS and ensure that appropriate disposal areas are identified.
e) Identify private lands that should be purchased for conservation (Question 1 and SNPLMA model within Eastern Nevada).
f) Make BLM land disposal plan support fuels management.
g) Review paving plans for the Camp Success loop road and alert local entities of impacts from development of year-round homes.
h) Develop off-highway vehicle plan for the county.
i) Revise NRCS document to include woodlands in statute requiring subdivision review as is now required for timbered lands (NV Division of Forestry) as vehicle for fire-safe planning in pinyon and juniper expansion areas.
j) Develop fuels management plans for key developable sites that are enforceable by the Nevada Division of Forestry.
k) Develop neighborhood fire-safe councils in key neighborhoods with Nevada Division of Forestry.
l) Establish a development and open space plan for the county. Help secure funding grant to county via federal agencies.

*3. Fire suppression in **Steptoe**'s Wildland-Urban Interface (WUI) for sagebrush-grass-pinyon-juniper mosaic*

Outcome: Reduce the fire risk of wildfire to developed areas. By 2005, 80% of WUI will have plan in place. Fuels reduced in 100% of WUI by 2008.

Strategy: Use a phased approach to demonstrate incremental fuel reduction successes.

Action Steps:

a) Implement demonstration projects on private and public lands.
b) Expand project to scale in increments.
c) Consider new WUI projects as development increases and work with NDF to create fire breaks.
d) Develop local land use plan.

4. Excessive groundwater withdrawal in valley springs, marshes, and streams

Outcome: Maintain groundwater tables and spring flows to sustain existing aquatic systems.

Strategy: Address issue of over-appropriation and ensure adequate monitoring of water levels with State Engineer.

Action Steps:

a) Meet with State Engineer to discuss over-appropriation, future power plant consequences, and monitoring.
b) Approach power company to discuss water- versus air-cooled power plant and other options to minimize impacts to groundwater.

c) Secure funding for additional monitoring wells and continued monitoring by USGS.

5. Recreational vehicles in sagebrush-grass-pinyon-juniper mosaic, "historic" pinyon-juniper ecological sites, and badlands
Outcome: Reduce habitat fragmentation and erosion, as well as number of roads.
Strategy: Reemploy coordinated resources management plan process for specific high priority areas.
Action Steps:

a) Conduct trail inventory (through ENLC contract, USFS and BLM funding).
b) Develop trail plan (through ENLC contract, USFS and BLM funding) with input from stakeholders.
c) Establish trail designation with assignment of limited status to trails.
d) Implement trail closure where appropriate and restoration programs with signage, maps, and public outreach with key user groups.
e) Ensure law enforcement after designation.

6. Flow diversions in springs and creeks
Outcome: Partially restore flow and riparian vegetation to Timber, Bird, North Fork and Main Fork of Berry Creek in Duck Creek watershed.
Strategy: Negotiate with Kennecott to donate or sell water rights to restore partial in-stream flow.
Action Step:

a) Negotiate with Kennecott for restoration and maintenance of flows via ownership of water rights.

9.4. Local Conservation Targets and Strategies for Newark
1. Degradation of winterfat communities
Outcome: Preserve and restore winterfat communities.
Strategy: Implement restoration and protection from excessive wild horse grazing.
Action steps:

a) Develop and implement a comprehensive restoration plan.
b) Manage wild horse numbers to appropriate AML.

2. Loss of bat habitat from risk of catastrophic fire
Outcome: Maintain bat populations.
Strategy: Implement fuel load reduction projects and strengthen public awareness of bats.
Action Steps:

a) Develop and implement a fire restoration plan in the Pogonip Ridge area to create viable sagebrush-grass-pinyon-juniper mosaic, "historic" pinyon-juniper ecological sites, and montane woodlands.
b) Implement public education and information program on bat habitat and population needs.
c) Implement current surface management regulation to manage for bat habitat.

9.5. Local Conservation Targets and Strategies for Meadow Valley Wash

1. Development and maintenance of roads and railroads in lower and higher elevation riparian corridors

Outcome: Restore the hydrology of the lower and upper Meadow Valley Wash to viable condition including native vegetation.

Strategy: Work with Union Pacific railroad to develop a plan to improve channel design and maintenance procedures to minimize impacts to riparian system.

Action Steps:

a) Identify goals, priorities as determined by survey.
b) Meet with Union Pacific to share common vision for restoration of hydrology and native biota.
c) Identify sources of funding, such as Lincoln County and Clark County money for biological assessment of Meadow Valley Wash.
d) Develop a proposal for restoration for emergency and non-emergency situations.
e) Work with Union Pacific, Lincoln County, and NDOT to develop a reclamation plan for derailments or other significant land disturbances.

2. Development and maintenance of roads and railroad trestles in lower and higher elevation riparian corridors and creosote bush-bursage-blackbrush

Outcome: Minimize unnatural fire ignition.

Strategy: Investigate use a shield by Union Pacific to minimize spark dispersal from grinding operations.

Action Steps:

a) Assess costs to Union Pacific and BLM for fire management.
b) Engage engineering expert and meet with Union Pacific to propose shield strategy.
c) Create fire plan for Union Pacific; evaluate their first response plan.

Outcome: Reduce mortality of desert tortoise and other wildlife from railroad and road impacts.

Strategy: Monitor desert tortoise populations and impacts along railroad tracks, perhaps using manipulative experiments.

Action Steps:

a) Implement litter control program with predator-proof refuse containers.
b) Consider raven control with poison eggs.

3. Operation of drainage or diversion systems in lower and higher elevation riparian corridors

Outcome: Restore natural hydrology of Meadow Valley Wash. Partially restore dry portions of the river for wildlife protection.

Strategy: Work with State Engineer and private landowners to address maintenance of surface water flows.

Action Steps:

a) Determine desired level of water flows for wildlife and vegetation.
b) Evaluate alternative irrigation strategies.
c) Evaluate and address maintenance of irrigation systems.
d) Evaluate and address alternative dam operation strategies with NDOW and State Parks.
e) Encourage the coordinated resources management plan to resolve flood control issue in Caliente.

4. Excessive groundwater withdrawal in lower and higher elevation riparian corridors
Outcome: Groundwater withdrawals do not negatively influence surface water flows.
Strategy: Involve State Engineer in actions to protect groundwater recharge process.
Action Steps:

a) Investigate BLM/State Engineer water monitoring plan and its ability to abrogate water rights.
b) Develop high level strategy to address interaction between groundwater and surface water rights with State Engineer.
c) Work with State Engineer and other interested parties to gather all available information on the hydrology of surface and groundwater for Meadow Valley Wash to document water recharge processes.

5. Recreational vehicles in lower elevation riparian corridors
Outcome: Reduce habitat fragmentation and erosion, and reduce trail expansion.
Strategy: Reemploy coordinated resources management plan process for specific high priority areas in low elevation riparian areas.
Action Steps:

a) Conduct trail inventory (through ENLC contract, USFS and BLM funding).
b) Develop trail plan (through ENLC contract, USFS and BLM funding) with input from stakeholders.
c) Establish trail designation with assignment of limited status to trails.
d) Implement trail closure where appropriate and restoration programs with signage, maps, and public outreach with key user groups.
e) Ensure law enforcement after designation.

6. Fire management in chaparral-ponderosa pine woodlands
Outcome: Maintain multi-age ponderosa pine woodland and appropriate understory.
Strategy: Restore natural fire regime by reducing long-term transition to pinyon-juniper dominated woodland and reducing fuel ladders.
Action Steps:

a) Reduce fuel ladders by mechanical removal.
b) Selectively thin pinyon and juniper followed by prescribed fire.
c) Develop burning prescription for this fuel type in Clover Creek, Delamar Mountains, Mt. Wilson Creek Range, and Highland Range.

7. Erosion and channelization in higher elevation riparian corridors
Outcome: Raise water table and restore wet meadows.
Strategy: Work at reducing stream head-cutting in upper watersheds.
Action Steps:

a) Approach private landowners to put in low-tech erosion control devices via cost-share programs (e.g., EQIP).
b) Work with BLM to implement similar programs on public land, particularly in conjunction with fire rehabilitation plans and projects.
c) Explore use of volunteers in community-based program to implement.

10. Measures of Success

Although the larger Efroymson group decided to not have a third workshop on measures of success, we recommend that the BLM work closely with partners during the development of watershed assessments to define methodologies for sampling, and selection of variables for each conservation target (or more ecological sites if based on finer soil-vegetation associations) before and after management actions are implemented. Variables retained for measures of success should track the functionality of each target (e.g., percent perennial grass cover for sagebrush semi-desert and pinyon-juniper-sagebrush mosaics, cheatgrass cover, and the cover of riparian midstory shrubs) and not require large sample sizes to achieve a statistical power of at least 80% to detect a 10-20% change in the mean of a variable. Moreover, sampling should conform to simple sampling designs with random selection of stations. Ultimately, one should design sampling under two scenarios. When experimentation is not necessary because the effect of management action is well known, monitor change in selected variables over time (Elzinga et al. 1998). When alternative actions are possible and it is not certain how a given conservation target will respond to each, deploy an adaptive management experiment using a formal experimental design to compare the efficacy of methods while abating sources of stress (Wilhere 2002, Steel and Torrie 1980).

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Appendix: Nested Conservation Targets (Plant Communities, Habitats, Species, and Assemblages) by Conservation Area

1. Antelope

	Nested Conservation Target	**Global Rank, Sensitive Species Listing Agency**	Focal Conservation Target
Communities	Antelope Valley sand dunes		Salt Desert Shrublands
	Aquatic insect assemblage		Springs and Creeks
	Aspen communities		Aspen Stands
	Black sagebrush communities		Sagebrush-Grass-PJ Mosaic
	Dwarf pygmy sagebrush communities		Badlands
	Emergent marshes (cattails and bulrushes)		Riparian and Wetlands
	Greasewood shrublands		Salt Desert Shrublands
	Limber pine communities		Montane Woodlands
	Montane brush shrublands		Montane Woodlands
	Mountain mahogany woodlands		Montane Woodlands
	Old-growth Juniper Woodlands		"Historic" P-JP-J Ecological Site, Badlands
	Old-growth Pinyon Woodlands		"Historic" P-J Ecological Site
	Old-growth Pinyon-Juniper Woodlands		"Historic" P-J Ecological Site
	Rabbitbrush shrublands		Riparian and Wetlands
	Sedge meadows		Riparian and Wetlands
	Sickle (Gardner) saltbush communities		Salt Desert Shrublands
	Tippett Lake playa		Salt Desert Shrublands
	Vasey mountain sagebrush communities		Sagebrush-Grass-PJ Mosaic
	White fir communities		Montane Woodlands
	Willow riparian shrublands		Riparian and Wetlands
	Winterfat (white sage) communities		Salt Desert Shrublands
	Wyoming sagebrush communities		Sagebrush-Grass-PJ Mosaic
Plants	broad-pod freckled milkvetch (*Astragalus lentiginosus* var. *latus*)	G5T1, NNHP	"Historic" P-J Ecological Site, Sagebrush-Grass-PJ Mosaic
	dad's beardtongue (*Penstemon patricus*)	G2Q, NNHP	Sagebrush-Grass-PJ Mosaic, Aspen Stands
	dwarf peppergrass (*Lepidium nanum*)	G3, NNHP	Badlands
	intermountain wavewing (*Cymopterus basalticus*)	G2, NNHP	Sagebrush-Grass-PJ Mosaic, Salt Desert Shrublands
	mound catseye (*Cryptantha compacta*)	G1 rank, NNHP	Badlands
	Mount Moriah beardtongue (*Penstemon moriahensis*)	G1G2, NNHP	"Historic" P-J Ecological Site, Sagebrush-Grass-PJ Mosaic, Montane Woodlands
	rayless tansy aster (*Machaeranthera grindelioides* var. *depressa*)	G5T3T4, NNHP	Badlands
Invertebrates	White River wood nymph (*Cercyonis pegala pluvialis*)	G5T2, NNHP	Riparian and Wetlands
Mollusks	Toquerville springsnail (*Pyrgulopsis kolobensis*)	G3, NNHP	Springs and Creeks
	Transverse gland springsnail (*Pyrgulopsis cruciglans*)	G1, NNHP	Springs and Creeks
Fish	Relict dace (*Relictus solitarius*)	G2G3, NNHP	Springs and Creeks
Amphibians	Columbia spotted frog (*Rana lutiventris*)	G4T?Q, NNHP	Riparian and Wetlands
Birds	Bald Eagle	G4, federally endangered, USFWS	Sagebrush-Grass-PJ Mosaic

	Cooper's Hawk	G4, declining, priority species, NPF	Montane Woodlands
	Ferruginous Hawk	G4 declining, priority species, NPF	"Historic" P-J Ecological Site, Sagebrush-Grass-PJ Mosaic
	Gray Flycatcher	G5 declining, NNHP	"Historic" P-J Ecological Site
	Greater Sage Grouse	G5 declining,	Sagebrush-Grass-PJ Mosaic
	Mountain Quail	G5, NRS 501	Montane Woodlands
	Northern Harrier	G5 declining, priority species, NPF	Riparian and Wetlands, Sagebrush-Grass-PJ Mosaic
	Peregrine Falcon	G4G3, federally threatened, USFWS	Badlands
	Pinyon Jay	G5 declining, NNHP	"Historic" P-J Ecological Site
	Prairie Falcon	G5, priority species, NPF	Badlands
	Red-naped Sapsucker	G5 declining, NNHP	Montane Woodlands
	Sage Sparrow	G5 declining, NNHP	Sagebrush-Grass-PJ Mosaic
	Sage Thrasher	G5, NNHP	Sagebrush-Grass-PJ Mosaic
	Short-eared Owl	priority species, NPF	Montane Woodlands
	Vesper Sparrow	G5, NNHP	Sagebrush-Grass-PJ Mosaic
Mammals	Pygmy rabbit (*Brachylagus idahoensis*)	G4, NNHP	Sagebrush-Grass-PJ Mosaic

2. Steptoe Valley

	Nested Conservation Target	**Global Rank, Sensitive Species Listing Agency**	Focal Conservation Target
Communities	Artemisia pygmaea dwarf shrubland	G3G4	Badlands/ Pygmy Sage Community
	Cottonwood-willow forest		Springs and Creeks
Plants	Barneby beardtongue (*Penstemon barnebyi*)	G3, NNHP	Badlands/ Pygmy Sage Community
	broad-pod freckled milkvetch (*Astragalus lentiginosus* var. *latus*)	G5T1, NNHP	Alpine
	dwarf peppergrass (*Lepidium nanum*)	G3, NNHP	Badlands/Pygmy Sage Community
	hanging bladderpod (*Lesquerella pendula*)	G2?, NNHP	Badlands/Pygmy Sage Community
	Hitchcock bladderpod (*Lesquerella hitchcockii*)	G3, NNHP	Montane Woodlands, Alpine
	Howard evening primrose (*Oenothera howardii*)	G3, NNHP	Badlands/Pygmy Sage Community
	ivesia (*Ivesia baileyi* var. *setosa*)	G5T3?, NNHP	Badlands/Pygmy Sage Community
	Maguire bitterroot (*Lewisia maguirei*)	G1, NNHP	Alpine
	marsh blue grass (*Poa abbreviata* ssp. *marshii*)	G5T2, NNHP	Alpine
	Monte Neva Paintbrush (*Castilleja salsuginosa*)	G1, NNHP	Valley Springs, Marshes, and Streams
	Nachlinger catchfly (*Silene nachlingerae*)	G2 , NNHP	Montane Woodlands, Alpine
	Pennell beardtongue (*Penstemon leiophyllus* var. *francisci-pennellii*)	G3T2, NNHP	Alpine
	rayless tansy aster (*Machaeranthera grindelioides* var. *depressa*)	G5T3T4, NNHP	Badlands/ Pygmy Sage Community
	rhizome beardtongue (*Penstemon rhizomatosus*)	G1, NNHP	Alpine
	stalked cusick whitlowgrass (*Draba*	G4T3?, NNHP	Alpine

	cusickii var. *pedicellata*)		
Invertebrates	Bee (Osmia tanneri)	G1	Alpine
	Dark sandhill skipper (*Polites sabuleti nigrescens*)	G5T2 , NNHP	Sagebrush-Grass-P-J Mosaic
	Koret's checkerspot (*Euphydryas editha koreti*)	G5T1Q, NNHP	Alpine
	Solitary bee (*Andrena raveni*)	G2, NNHP	Sagebrush-Grass-P-J Mosaic
	Steptoe Valley crescentspot (*Phyciodes batesii arenacolor*)	G5T1, NNHP	Sagebrush-Grass-P-J Mosaic
Mollusks	Undescribed Tryonia (*Tryonia* sp.)	G1	Valley Springs, Marshes, and Streams
	White Pine mountainsnail (*Oreohelix hemphilii*)	G?, NNHP	Alpine
	White River wood nymph (*Cercyonis pegala pluvialis*)	G5T2, NNHP	Sagebrush-Grass-P-J Mosaic
	Flat-topped Steptoe springsnail (*Pyrgulopsis planulata*)	G1, NNHP	Valley Springs, Marshes, and Streams
	Landyes springsnail (*Pyrgulopsis landyei*)	G1, NNHP	Valley Springs, Marshes, and Streams
	Lyes springsnail (*Pyrgulopsis lyei*)	G1, NNHP	Valley Springs, Marshes, and Streams
	Neritiform Steptoe Ranch springsnail (*Pyrgulopsis neritella*)	G1, NNHP	Valley Springs, Marshes, and Streams
	Schell Creek mountainsnail (*Oreohelix nevadensis*)	G1, NNHP	Alpine
	Southern Steptoe springsnail (*Pyrgulopsis sulcata*)	G1, NNHP	Valley Springs, Marshes, and Streams
	sub-globose Steptoe Ranch springsnail (*Pyrgulopsis orbiculata*)	G1, NNHP	Valley Springs, Marshes, and Streams
	Toquerville springsnail (*Pyrgulopsis kolobensis*)	G3, NNHP	Valley Springs, Marshes, and Streams
Fish	Relict dace (*Relictus solitarius*)	G2G3, NNHP	Valley Springs, Marshes, and Streams
Reptiles	Mountain short-horned lizard (*Phrynosoma hernandesi*)	G3, NNHP	Alpine
Birds	Bald Eagle	federally endangered, USFWS	Valley Springs, Marshes, and Streams, Sagebrush-Grass-P-J Mosaic, Springs and Creeks
	Black Rosy-Finch	G4, NNHP	Alpine
	Black-throated Gray Warbler	priority species, NPF	"Historic" P-J Ecological Site, Sagebrush-Grass-P-J Mosaic
	Cooper's Hawk	priority species, NPF	Sagebrush-Grass-P-J Mosaic, Alpine
	Ferruginous Hawk	priority species, NPF	"Historic" P-J Ecological Site, Sagebrush-Grass-P-J Mosaic
	Flammulated Owl	G4, NNHP	Alpine
	Gray Flycatcher	priority species, NPF	"Historic" P-J Ecological Site, Sagebrush-Grass-P-J Mosaic
	Greater Sage Grouse	priority species, NPF	Springs and Creeks, Sagebrush-Grass-P-J Mosaic
	Greater Sandhill Crane	G5, NNHP	Valley Springs, Marshes, and Streams
	Juniper Titmouse	priority species, NPF	"Historic" P-J Ecological Site, Sagebrush-Grass-P-J Mosaic

	Lewis's Woodpecker	G5, NNHP	Springs and Creeks, Alpine
	Long-billed Curlew	priority species, NPF	Valley Springs, Marshes, and Streams
	MacGillivary's Warbler	priority species, NPF	Springs and Creeks
	Northern Goshawk	G4 , NNHP	Alpine
	Orange-crowned Warbler	G5, NNHP	Montane Woodland
	Peregrine Falcon	federally threatened, USFWS	Alpine
	Pinyon Jay	priority species, NPF	"Historic" P-J Ecological Site, Sagebrush-Grass-P-J Mosaic
	Prairie Falcon	priority species, NPF	Sagebrush-Grass-P-J Mosaic, Badlands/Pygmy Sage Community
	Red-naped Sapsucker	priority species, NPF	Alpine
	Sage Sparrow	priority species, NPF	Sagebrush-Grass-P-J Mosaic
	Sage Thrasher	priority species, NPF	Sagebrush-Grass-P-J Mosaic
	Sandhill Crane	priority species, NPF	Valley Springs, Marshes, and Streams
	Vesper Sparrow	priority species, NPF	Sagebrush-Grass-P-J Mosaic
	Virginia Warbler	priority species, NPF	"Historic" P-J Ecological Site, Sagebrush-Grass-P-J Mosaic
	Yellow-breasted Chat	priority species, NPF	Springs and Creeks, Valley Springs, Marshes, and Streams
Mammals	Townsend's big-eared bat (*Corynorhinus townsendii*)	G4, NNHP	Caves and Mine Habitats

3. Newark Valley

	Nested Conservation Target	**Global Rank, Sensitive Species Listing Agency**	Focal Conservation Target
Communities	Playa salt lake beds		Salt Desert Shrublands
	Sand dunes		Salt Desert Shrublands
Plants	dwarf peppergrass (*Lepidium nanum*)	G3, NNHP	Sagebrush-Grass-P-J Mosaic
Invertebrates	Dark sandhill skipper (*Polites sabuleti nigrescens*)	G5T2, NNHP	Sagebrush-Grass-P-J Mosaic
Mollusks	White Pine mountainsnail (*Oreohelix hemphilii*)	G?, NNHP	Montane Sagebrush Mosaic
Fish	Newark Valley tui chub (*Gila bicolor newarkensis*)	G4T1, NNHP	Springs/Creeks
Birds	Ferruginous Hawk	G4, NNHP	Montane Woodlands, "Historic" P-J Ecological Site
	Flammulated Owl	G4, NNHP	Montane Sagebrush Mosaic
	Loggerhead Shrike	G5, NNHP	Springs/Creeks, Salt Desert Shrublands
	Long-billed Curlew	G5, NNHP	Springs/Creeks
	MacGillivary's Warbler	priority species, NPF	Montane Woodlands
	Northern Goshawk	G4, NNHP	Montane Woodlands
	Peregrine Falcon	G4G3, federally threatened, USFWS	Montane Woodlands
	Sage Sparrow	G5, NNHP	Sagebrush-Grass-P-J Mosaic
	Sage Thrasher	G5, NNHP	Sagebrush-Grass-P-J Mosaic
	Greater Sandhill Crane	G5, NNHP	Springs/Creeks
	Trumpeter Swan	G4, NNHP	Springs/Creeks
	Vesper Sparrow	G5, NNHP	Montane Woodlands

	Western Snowy Plover	G4T2&3, NNHP	Springs/Creeks
Mammals	Pygmy rabbit (*Brachylagus idahoensis*)	G5, NNHP	Sagebrush-Grass-P-J Mosaic
	Townsend's big-eared bat (*Corynorhinus townsendii*)	G4, NNHP	Caves

4. Meadow Valley Wash

	Nested Conservation Target	**Global Rank, Sensitive Species Listing Agency**	Focal Conservation Target
Communities	Cottonwood gallery forest		High Elevation Riparian Corridors
	Ponderosa pine forests		Chaparral-Ponderosa Pine-P-J Woodlands
	Riparian gallery forest		Low Elevation Riparian Corridor
	Riparian meadows		Low Elevation Riparian Corridor
	Riparian meadows		High Elevation Riparian Corridors
	Riparian wetlands		Low Elevation Riparian Corridor
	Winterfat communities		Salt Desert Shrublands
Plants	basin Jamesia waxflower (*Jamesia tetrapetala*)	G2	Montane Woodlands
	Beaver Dam breadroot (*Pediomelum castoreum*)	G3, NNHP	Low Elevation Riparian Corridor, Creosote Bush-Bursage-Blackbrush
	Clark Mountain agave (*Agave utahensis* var. *nevadensis*)	G4T3Q, NNHP	Creosote Bush-Bursage-Blackbrush
	lesser rushy milkvetch (*Astragalus convallarius* var. *finitimus*)	G5T3, NNHP	"Historic" P-J Ecological Site, Sagebrush-Grass-P-J Mosaic
	Needle Mountain milkvetch (*Astragalus eurylobus*)	G2, NNHP	Sagebrush-Grass-P-J Mosaic, Chaparral-Ponderosa Pine-P-J Woodlands, Salt Desert Shrublands, Creosote Bush-Bursage-Blackbrush
	Nevada willowherb (*Epilobium nevadense*)	G2, NNHP	Sagebrush-Grass-P-J Mosaic, Chaparral-Ponderosa Pine-P-J Woodlands, Montane Woodlands, "Historic" P-J Ecological Site
	Nye milkvetch (*Astragalus nyensis*)	G3, NNHP	Creosote Bush-Bursage-Blackbrush
	one-leaflet Torrey milkvetch (*Astragalus calycosus* var. *monophyllidius*)	G5T2, NNHP	Sagebrush-Grass-P-J Mosaic, Badlands
	pink egg milkvetch (*Astragalus oophorus* var. *lonchocalyx*)	G4T1, NNHP	Sagebrush-Grass-P-J Mosaic, Chaparral-Ponderosa Pine-P-J Woodlands, Montane Woodlands, "Historic" P-J Ecological Site
	rock purpusia (*Ivesia arizonica* var. *saxosa*)	G4T1, NNHP	"Historic" P-J Ecological Site, Sagebrush-Grass-P-J Mosaic, Chaparral-Ponderosa Pine-P-J Woodlands

	Schlesser's pincushion (*Sclerocactus schlesseri*)	G1Q, NNHP	Salt Desert Shrublands
	sticky buckwheat (*Eriogonum viscidulum*)	G2, NNHP	Creosote Bush-Bursage-Blackbrush
	threecorner milkvetch (*Astragalus geyeri* var. *triquetrus*)	G4?T2T3, NNHP	Creosote Bush-Bursage-Blackbrush
	Ute ladies' tresses (*Spiranthes diluvialis*)	G2, NNHP	High Elevation Riparian Corridors, Low Elevation Riparian Corridor
	Welsch's cat's eye (*Cryptantha welshii*)	G3, NNHP	High Elevation Riparian Corridors, Low Elevation Riparian Corridor, Badlands
Invertebrates	Broadlined hedgerow hairstreak (*Satyrium saepium*)	G5T1	Montane Woodlands
	Intermediate Colorado hairstreak (butterfly; *Hypaurotis crysalus intermedia*)	G5T1	Montane Woodlands
Mollusks	Camp Valley springsnail (*Pyrgulopsis montana*)	G1	Springs and Creeks
Fish	Big Spring speckled dace (*Lepidomeda mollispinis pratensis*)	G1T1	Springs and Creeks
	Desert sucker (*Catostomus clarki*)	G3G4	Springs and Creeks
	Meadow Valley speckled dace (*Rhinichthys osculus* ssp. 2 mv)	G5T2	Springs and Creeks
	Meadow Valley Wash desert sucker (*Catostomus clarki* ssp. 2)	G3G4T2	Springs and Creeks
	Virgin spinedace (*Lepidomeda mollispinis*)	G1	Springs and Creeks
Amphibians	Arizona southwestern toad (*Bufo microscaphus microscaphus*)	G3G4	Creosote Bush-Bursage-Blackbrush
Reptiles	Banded Gila monster (*Heloderma suspectum cinctum*)	G4T3	Creosote Bush-Bursage-Blackbrush
	Desert iguana (*Dipsosaurus dorsalis*)	G5	Creosote Bush-Bursage-Blackbrush
	Desert tortoise (*Gopherus agassizii*)	federally threatened, USFWS	Creosote Bush-Bursage-Blackbrush
Birds	American Avocet	G5	High Elevation Riparian Corridors
	Arizona Bell's Vireo	G5	Low Elevation Riparian Corridor
	Ash-throated Flycatcher	species of concern NPF	High Elevation Riparian Corridors
	Black-throated Gray Warbler		Sagebrush-Grass-P-J Mosaic, Chaparral-Ponderosa Pine-P-J Woodlands, Montane Woodlands
	Blue Grosbeak	G5	High Elevation Riparian Corridors, Low Elevation Riparian Corridor
	Cooper's Hawk	G4	High Elevation Riparian Corridors, Low Elevation Riparian
	Eared Grebe	G5	High Elevation Riparian Corridors
	Ferruginous Hawk		Creosote Bush-Bursage-

			Blackbrush
	Gray Flycatcher	species of concern NPF	"Historic" P-J Ecological Site, Sagebrush-Grass-P-J Mosaic, Chaparral-Ponderosa Pine-P-J Woodlands
	Gray Vireo	species of concern NPF	"Historic" P-J Ecological Site, Sagebrush-Grass-P-J Mosaic, Chaparral-Ponderosa Pine-P-J Woodlands, Creosote Bush-Bursage-Blackbrush
	Greater Sage Grouse		Sagebrush-Grass-P-J Mosaic, Chaparral-Ponderosa Pine-P-J Woodlands
	Greater Sandhill Crane	G5	High Elevation Riparian Corridors
	Juniper Titmouse	species of concern, NPF	"Historic" P-J Ecological Site, Sagebrush-Grass-P-J Mosaic, Chaparral-Ponderosa Pine-P-J Woodlands, Montane Woodlands
	Lewis Woodpecker	species of concern, NPF	Chaparral-Ponderosa Pine-P-J Woodlands, Montane Woodlands
	Loggerhead Shrike	G5, NNHP	Low Elevation Riparian Corridor
	Long-billed Curlew	G5S3?BNV, NNHP	High Elevation Riparian Corridors
	Lucy's Warbler	G5, NNHP	Low Elevation Riparian Corridor
	MacGillivray's Warbler		Montane Woodlands
	Peregrine Falcon	G4G3, NNHP	Badlands
	Phainopepla	G5, NNHP	Low Elevation Riparian Corridor, Creosote Bush-Bursage-Blackbrush
	Pinyon Jay	G5, NNHP	"Historic" P-J Ecological Site, Sagebrush-Grass-P-J Mosaic, Chaparral-Ponderosa Pine-P-J Woodlands
	Prairie Falcon	G5, NNHP	Badlands
	Redhead	G5, NNHP	High Elevation Riparian Corridors
	Sage Thrasher	species of concern, NPF	Sagebrush-Grass-P-J Mosaic
	Scott's Oriole		Creosote Bush-Bursage-Blackbrush
	Southwestern Willow Flycatcher	US ESA LE; G5T1T2	Low Elevation Riparian Corridor
	Summer Tanager	G5, NNHP	Low Elevation Riparian Corridor
	Vesper Sparrow	species of concern, NPF	Montane Woodlands, Sagebrush-Grass-P-J Mosaic
	Virginia's Warbler	G5, NNHP	Low Elevation Riparian Corridor, "Historic" P-J Ecological Site
	Western Bluebird	species of concern, NPF	High Elevation Riparian

			Corridors, Sagebrush-Grass-P-J Mosaic, Chaparral-Ponderosa Pine-P-J Woodlands
	Western Burrowing Owl		Creosote Bush-Bursage-Blackbrush
	Western Yellow-billed Cuckoo's	G5T2T3, NNHP	High Elevation Riparian Corridors, Low Elevation Riparian Corridor
	White-faced Ibis	G5, NNHP	High Elevation Riparian Corridors
	Wilson's Warbler		High Elevation Riparian Corridors, montane Woodlands
	Yellow-breasted Chat	G5, NNHP	High Elevation Riparian Corridors, Low Elevation Riparian Corridor
Mammals	Desert pocket mouse (*Chaetodipus penicillatus*)	G5	Low Elevation Riparian Corridor
	Nelson's bighorn sheep (*Ovis canadensis nelsoni*)	G4T4	Creosote Bush-Bursage-Blackbrush
	bat assemblage, Farrier Siding		Creosote Bush-Bursage-Blackbrush

Abbreviations: USFWS – United States Fish and Wildlife Service; NPF – Nevada Partners in Flight; NRS 501 – Nevada Revised Statute 501 which provides for protection of fauna; NNHP – Nevada Natural Heritage Program; G1 – Globally critically imperiled because of extreme rarity, imminent threats, and/or biological factors, generally with 5 or fewer occurrences and/or less than 1,000 individuals, and/or less than 2,000 acres in extent; G2 – Imperiled because of rarity and/or other demonstrable factors, generally with 6-20 occurrences and/or 1,000-3,000 individuals and/or 2,000-10,000 acres in extent; G3 – Rare and local throughout its range, or with very restricted range, or otherwise vulnerable to extinction, generally with 21-100 occurrences and/or 3,000-10,000 individuals, and/or 10,000-50,000 acres in extent; G4 – Apparently secure, though frequently quite rare in parts of its range, especially at its periphery, generally with greater than 100 occurrences, and/or greater than 10,000 individuals, and/or greater than 50,000 acres in extent; G5 – Demonstrably secure, though frequently quite rare in parts of its range, especially at its periphery, with greater than 100 occurrences, and/or greater than 10,000 individuals, and/or greater than 50,000 acres in extent. T1-T5 – Status identical to G status, but applies to trinomial (subspecific) rank.