Southern Nevada Agency Partnership

# Science and Research Needs Assessment, 2010

## Southern Nevada Agency Partnership

Science and Research Team

November, 2010

## SNAP Science and Research Needs Assessment 2010

Signature Page

12/10/10

**Stephanie Phillips** Date
Deputy Forest Supervisor
USDA Forest Service, Humboldt-Toiyabe National Forest
4701 N. Torrey Pines Drive
Las Vegas, NV 89130

11/19/10

**Kevin J. DesRoberts** Date
Deputy Project Leader
US Fish and Wildlife Service, Desert National Wildlife Refuge Complex
4701 N. Torrey Pines Drive
Las Vegas, NV 89130

11/19/10

**Mary Jo Rugwell** Date
District Manager
Bureau of Land Management, Southern Nevada District Office
4701 N. Torrey Pines Drive
Las Vegas, NV 89130

11/19/10

**William K. Dickinson** Date
Superintendent
National Park Service, Lake Mead National Recreation Area
601 Nevada Way
Boulder City, NV 89005

# Executive Summary

The Southern Nevada Agency Partnership (SNAP) was established as a forum for the four federal land managing agencies in Clark County, Nevada (BLM, NPS, USFWS, USFS) to address common issues pertaining to management of public lands in Southern Nevada. Through SNAP, these agencies work with each other, the local community, and partners to conserve and enhance the federal lands of Southern Nevada for current and future generations. The SNAP Board of Director's established an interagency science and research team for the purpose of developing and implementing an interagency science program that creates a consistent scientific approach across agency boundaries to enhance federal lands. That team was charged with the development of a SNAP Science and Research Strategy ((*http://snap.gov/upload/SNAP-S-R-Strategy-2009r.pdf*) to guide the development of an interagency science program.

The purposes of the SNAP Science and Research Strategy include to identify priority science needs related to agency goals; to integrate science activities, projects and results; and to outreach to potential science partners to enhance science capabilities. One of the primary outreach tools outlined within the Strategy is the development each year of an SNAP Science and Research Needs Assessment. The annual Needs Assessment will document priority needs for the immediate future, within the context of current significant ecosystem influences and current management influences and opportunities. Additional ecological context for the Strategy will be provided in the future by state of the science synthesis reports, currently under development.

The SNAP 2010 Science and Research Needs Assessment is organized around the nine sub-goals of the SNAP Science Strategy. Priority science questions for the Needs Assessment were obtained from agency staff through a process of soliciting input for science priorities through submission of concept papers which identified research needs in relationship to the sub-goals. The submission of concept papers for 2010 was limited to agency staff for the first development of an annual Needs Assessment. For future Needs Assessments the intention is to solicit input of concept papers broadly from interested scientists.

Priorities for 2010 reflect input from resource staff and science partners as well as current programs. One of the purposes of producing the SNAP Science and Research Needs Assessment on an annual basis is to have the opportunity to document needs within the context of current management and ecosystem influences. For example, while issues related to water availability are a high priority to resource and science teams, there are a number of funded projects underway related to groundwater inventory and analysis. Currently funded activities like these are not addressed in this report.

## Management Focus Areas

The SNAP Board of Directors, in light of current management priorities within Southern Nevada public lands, identified four focus areas for the 2010 Needs Assessment from a management perspective.

- What are the predicted effects resulting from climate change on Southern Nevada resources (natural and cultural) and resource uses?

- Are tortoise critical habitat areas (including ACECs) sufficient in size and quality to offset impact to the species and meet recovery needs? How is quality measured?
- Where are the most appropriate locations for solar energy development in Southern Nevada that balance social/economic demands and conservation of natural resources (i.e., Amargosa Desert, spring-dependent species, desert tortoise, rare plants, Amargosa toad, and dune scarabs)?
- Are there adequate recreational opportunities to meet the interests and demands of an increasingly diverse population (demographically, economically, and ethically) in Southern Nevada? What are those interests and demands?

The intention is to distribute the Needs Assessment broadly and outreach to potential science partners for collaboration in meeting these needs. Such collaboration may be in the form of solicitation of proposals for particular funding opportunities managed by the agencies, or partnering in proposals to outside funding sources. Beyond funding sources, it is hoped that such collaboration also includes potential for information sharing, education of students, and analysis of existing data.

The science questions within the SNAP Science Strategy and their presentation here, as stated are organized around the goals of the strategy. Such seeming compartmentalization of topics is not intended to preclude the integration of several questions from several sub-goal areas into more comprehensive research programs. An example of such potential integration exists within the interest in climate change research, or within the understanding of fire and invasive plants; each of which would be served by integration of questions from several sub-goals.


# General Overview

Federal lands managed by SNAP agencies in Southern Nevada include two national recreation areas, two national conservation areas, four national wildlife refuges, 18 congressionally designated wilderness areas, five wilderness study areas, 22 areas of critical environmental concern, and critical habitat for 17 listed species. The more than seven million acres of public lands, though seemingly dry and harsh, encompass eleven distinct and fragile ecosystems that support many species and their habitats. See Figure 1.

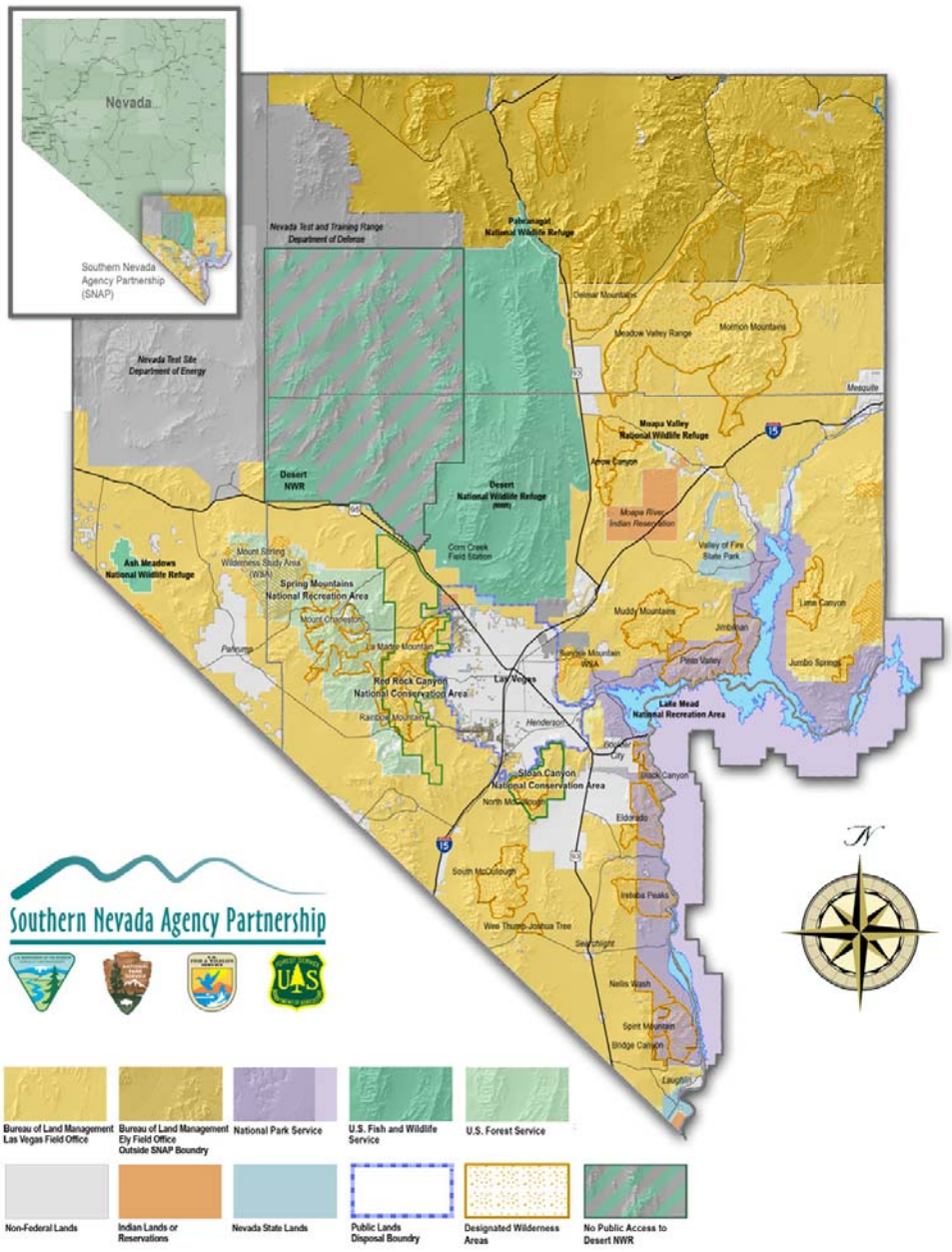


Figure 1. Map of SNAP partnership which includes all of Clark County and portions of Lincoln and Nye counties.

The purpose of the SNAP Annual Needs Assessment is to document high priority resource actions and science needs based upon available knowledge and existing conditions. It guides interagency activities within existing budgets, and provides information to potential science partners to apply to joint efforts. The Needs Assessment can provide information on the development of science and research projects and associated funding requests for the Southern Nevada Public Land Management Act (SNPLMA), Clark County Multiple Species Habitat Conservation Plan initiatives, the Healthy Lands Initiative, or other funding programs available to the partner agencies.

The annual needs assessment is organized around the sub-goals of the SNAP Science and Research Strategy which are (1) Fire, (2) Invasive species, (3) Landscapes and Watersheds, (4) Biodiversity, (5) Cultural Resources, (6), Historic Context, (7) Land Use, (8) Recreation, and (9) Conservation Education and Interpretation. This document was prepared by the interagency science and research team based upon professional knowledge of the area and local programs. Input was requested from agency staff through concept papers that identified specific priority science needs, ongoing research to address this need, why this need is important to management, and why this need should be included in this year's needs assessment. A total of 45 concept papers were submitted and reviewed. In addition, input was solicited from the SNAP Board and an independent SNAP Science Panel. In the future, the Science Strategy calls for a broader solicitation of concept papers from resource managers and the scientific community.

# SNAP Science and Research Needs and Priorities- Goal 1

**Within the context of agency missions:**

## GOAL 1. Restore, sustain, and enhance Southern Nevada's ecosystems.

### Sub-goal 1.1.
### Manage wildland fire to sustain Southern Nevada's ecosystems

## Background

The effects of wildland fires are a growing concern in Southern Nevada. In recent years, there have been increasing trends in the size of fires. In the summer of 2005, over 1 million acres of the Mojave Desert burned, mostly in Southern Nevada. Land managers are concerned that these trends may be increasing particularly due to the invasion of non-native annual grasses that is creating a grass fire regime that will fundamentally alter the Mojave Desert ecosystem at lower elevations. Historic fire suppression strategies have removed fire from fire adapted communities at higher elevations. An understanding of how fire management activities are impacting ecosystems and biodiversity is needed for all federal lands in Southern Nevada including the Spring Mountains.

The Strategy identified several overarching science and research topics: identification of effective pre-fire strategies and post-fire practices to maintain ecosystems; understanding of the effects of current fire management strategies and the changing role of fire; and the historic and current role of fire on the long-term health of Southern Nevada ecosystems.

The federal agencies have identified the following focused priority needs for the 2010 and 2011 calendar years:

## Priority Needs

1. What are the effective pre-fire strategies for maintaining ecosystem health in the Desert of Southern Nevada with an emphasis on invasive grasses, reducing fuels, and within the Spring Mountains ways to effectively manage detrimental effects and enhance viability of species?
2. What effect does the changing role of fire have on the health of Southern Nevada's ecosystems and on species biodiversity with an emphasis on special status aquatic species and the biotic communities in the Spring Mountains?
3. What are the effects of current fire management strategies on the long-term health of ecosystems in Southern Nevada with an emphasis on Wilderness and Wilderness Study Areas, and a focus

on the Spring Mountains and Sheep Range biotic communities?

## Rationale

Research is needed to identify pre-fire strategies that can disrupt the invasive grass fire cycle in the Mojave Desert in non-fire adapted vegetative communities including blackbrush, creosote-bursage scrub, and saltbush scrub. These pre-fire strategies would include seed bank reduction, treatment of strategic locations. A similar focus on pre-fire strategies is needed for fuels treatments and vegetation management in the Spring Mountains. An understanding of the effects of fire (natural & prescribed burns) on biotic communities is needed.

To inform ongoing restoration efforts, studies of fire effects on special status aquatic species such as endangered fishes and spring snails at the Ash Meadows National Wildlife Refuge and biotic communities of the Spring Mountains are needed. Research on the effects of current fire management strategies on the long-term health of ecosystems is needed to achieve the desired outcome of preserving natural conditions and maintain wilderness characteristics. Land management agencies are seeking fire management strategies and methods that can return fire to its natural role so the effects of fire as a natural agent are observed and not the effects of fire management activities. Similar research is needed to understand the effects of current fire management strategies in the long-term health of biotic communities in the Spring Mountains.

Wildland fire management efforts within the SNAP partnership

## Sub-goal 1.2.
## Protect Southern Nevada's ecosystems from the adverse impacts of invasive species.

## Background

Biotic invaders are species that establish a new range in which they proliferate, spread, and persist to the detriment of the environment. Invasive species are a critical threat to Southern Nevada ecosystems. Invasive plants can spread rapidly across the landscape transcending administrative boundaries. Invasive plants can out-compete native plants and alter trophic structure and wildlife communities through aggressive negative growth, extensive root structures and allopathy. Increasing densities of non-native annual plants are increasing fine fuel loads and altering the fire ecology of the entire Mojave Desert. In addition, aquatic invasive species can negatively impact native aquatic habitats and species. Delays in preventing the spread of invasive species escalates negative ecosystem effects, boosts the costs of control measures and undermines efforts to restore habitats.

The Strategy identified three overarching science and research topics: known or potential invasive species of concern and their basic biological attributes related to invasiveness; the effects of invasive species on natural biotic communities; and effective management methods to prevent, control, and eradicate invasive species.

The federal agencies have identified the following focused priority needs for the 2010 and 2011 calendar years:

## Priority Needs

1. What are the known or potential species of concern and what are their basic biological attributes related to invasiveness with a focus on crayfish, Quagga mussels and Sahara mustard?
2. What are the effective management methods for riparian restoration in light of the tamarisk beetle bio-control project?
3. What are effective management methods for investigation, prevention, control, and eradication of invasive species to meet management objectives of riparian and aquatic habitat restoration and appropriate techniques for use in Wilderness?
4. What is the effective inventory method for aquatic invasive species that are not effectively trapped using conventional methods or are too costly to trap?

## Rationale

Many aquatic and terrestrial invasive species are of concern in Southern Nevada. Crayfish are often abundant and destructive to native species and impact conservation efforts for rare and endemic aquatic species. An understanding of their dispersal ability is needed to prevent movement into currently

unoccupied areas and to achieve eradication from spring systems in Southern Nevada. Invasive quagga mussels have spread rapidly throughout the lower Colorado River system impacting water delivery infrastructure and changing food web dynamics. Sahara mustard is an invasive plant that has spread quickly across the Mojave Desert. It has increased fire potential and may out-compete rare endemic plants. Research is needed to understand the basic biological attributes related to the invasiveness of these species.

The tamarisk beetles, released for bio-control of salt cedar in riparian ecosystems, have been documented on the Virgin River near Mesquite, Nevada. Federal agencies want to reduce the dominance of tamarisk and increase native plants in riparian systems along rivers and lakes in southern Nevada. In light of the arrival of tamarisk beetles, the agencies are interested in understanding the most effective restoration techniques to enhance the natural regeneration of native plants in these riparian systems.

Research is needed to assist management with the control of other invasive plant species such as Russian Knapweed and exotic brome grasses in order to return impacted areas to native- dominated vegetation and prevent wildfire spread. Specific control measures are also needed for wilderness areas in order to address invasives while preserving wilderness character and natural conditions.

Effective inventory methods are needed to detect the presence, absence or abundance of invasive aquatic species such as using hydrophones to detect vocalizations. Priority areas needing inventory methods are Ash Meadows National Wildlife Refuge and other Southern Nevada waterways where rare or endemic species are found.

Examples of Sahara mustard infestation on land and quagga mussel infestation in the lake.

## Sub-goal 1.3.
## Restore and sustain proper function of Southern Nevada's watershed and landscapes.

## Background

All agencies share a mutual goal to sustain and enhance Southern Nevada ecosystems. Together they manage more than seven million acres of public lands encompassing eleven distinct and fragile ecological communities. These communities support many species and their habitats including those of interest or of management concern to those agencies. The conditions of these landscapes are shaped by physical processes and anthropogenic factors. Climate change may have a large impact. Other significant challenges are urbanization, land use changes, fragmentation, and habitat modification through off-highway vehicle (OHV) use.

The Strategy identified four overarching science and research topics: the effects of anthropogenic factors on the health of landscapes; ecosystem processes that modify or sustain the health of landscapes; the role of both surface water and ground water in sustaining the health of landscapes; and effective techniques for the restoration of affected landscapes.

The federal agencies have identified the following focused priority needs for the 2010 and 2011 calendar years:

## Priority Needs

1. What are the predicted effects resulting from climate change on Southern Nevada resources (natural and cultural) and resource uses?
2. What are the effects of 'external' (anthropogenic) activities to the health of the landscape with a focus on fragmentation of Mojave desert scrub and the salt desert scrub?
3. What are the ecosystem processes that sustain the Big Dune/Lava Dune system and how would they be affected by solar energy development in the Amargosa Valley?
4. What are effective techniques for restoration in areas with biological crusts?
5. What are the effective methods for large-scale restoration in the Mojave Desert of Southern Nevada?

## Rationale

Changes in climate can affect the integrity of different ecological life zones. Change in temperatures, precipitation, and climate variability can put stress on plant communities and potentially cause movement to favorable habitat conditions. Research is needed to understand the potential effects of climate change on Southern Nevada ecosystems such as effects on plants communities (phenology,

flowering lives, recruitment of native plants), aquatic systems (water temperature, chemistry, discharge, biota). This information is needed to help plan appropriate landscape-level management actions in response to climate change.

Research is needed to identify how dune systems function. The federal land management agencies need to develop an understanding of the geomorphology and ecology of the Big Dune and Lava Dune systems, and determine whether proposed solar energy development will have a significant impact on these systems. Are these relic or active systems where sand deposition and formations are still occurring? Are there other endemic or sensitive species, beyond those currently known, that rely on the systems for their viability. Will proposed adjacent or nearby solar development facilities affect the system and the dependent species?

Natural recovery of desert landscapes is slow. There are number of uses of public lands that result in habitat loss and fragmentation, particularly in the Mojave Desert Scrub and Salt Desert Scrub plant communities. Research is needed to understand the effects of the disturbances and fragmentation on the health of the landscape. Many plant communities in Southern Nevada support fragile biological crusts which are important to ecosystem function. The agencies need to find methods to expedite formation and reduce erosion of these biological crust systems.

In addition, the use of native plants for restoration projects is preferable to non-native resources. Techniques such as the identification of seed transfer zones are needed to increase restoration efficiency and effectiveness.

Big Dunes is both a recreation area set aside for OHV use and a separate, protected refuge for species of rare beetles.

## Sub-goal 1.4.
## Sustain and enhance Southern Nevada's biotic communities to preserve biodiversity and maintain viable populations.

## Background

The more than seven million acres of public lands in Southern Nevada encompass eleven distinct and fragile ecological communities that support many species and their habitats. Species of management concern to the agencies represent all major taxa. Many of the species are found only in this region. Several locations in the management area exhibit a high level of biodiversity (e.g., Spring Mountains and Ash Meadows).

The Strategy identified three overarching science and research topics: identification of key threats and stressors to the sensitive species and their habitats and how management actions affect them; understanding of the life history and ecology of these species; and the ecology of their habitats to assist land management agencies in protecting the viability of these species and the biodiversity of the ecosystem.

The federal agencies have identified the following focused priority needs for the 2010 and 2011 calendar years:

## Priority Needs

1. Are desert tortoise (*Gopherus agassizii*) designated critical habitat areas and conservation areas sufficient in size and quality to offset impact to the species and meet recovery needs? How is quality measured?
2. What are the most scientifically rigorous monitoring protocols for *Angelica scabrida*, *Astragalus aequalis*, *Astragalus oophorus* var. *clokeyanus*, *Arenaria kingii* ssp. *rosea*, Spring Mountains endemic alpine species, and endemic bristlecone pine species.
3. How do fish barriers and water monitoring flumes (permanent and temporary) impact the endangered fishes of Ash Meadows National Wildlife Refuge?
4. What are effective methods for improving relict leopard frog (*Lithobates onca*) and springsnail habitat including reproductive success and control of non-native species?
5. Can we create larger and more resilient populations of rare and endemic plants through propagation and which methods are best?
6. What are the germination and establishment requirements of *Anulocaulis leisolenus*, *Astragalas geyeri* var. *triquetrus*, and *Eriogonum viscdidulum*.
7. What is the ability of the threatened Ash Meadows naucorid (*Ambrysus amargosus*) to recolonize and disperse in restored habitats?
8. Are desert tortoises (*Gopherus agassizii*) maintaining viable populations in important local areas of Southern Nevada such as the Newberry Mountains and the Desert National Wildlife Refuge?

## Rationale

The conservation of the desert tortoise is an important management objective for the agencies. Research is needed to determine if high quality desert tortoise habitat conservation areas are of sufficient size and quality to meet recovery needs. This is particularly important in light of recent catastrophic fires and applications for renewable energy development on over 300,000 acres of tortoise habitat on multiple use lands. An important research question is how to measure the quality of desert tortoise habitat. Range-wide monitoring is being conducted for the desert tortoise. However, the viability of local populations of desert tortoises is also a research question of interest to the agencies. Areas of interest include the Newberry Mountains and the Desert National Wildlife Refuge.

Monitoring protocols are needed to address species distribution, environmental relationships, population dynamics, and population viability for sensitive endemic plant species in the Spring Mountains. Research is needed to evaluate the impacts of flumes and fish barriers to endangered fishes at the Ash Meadows National Wildlife Refuge. These flumes and barriers were installed to prevent upstream movement of aquatic invasive species, but there is limited understanding as to how they impact endangered fish gene flow and other native aquatic species.

Research is needed to identify the best methods for the propagation of rare and endemic plants found at Ash Meadows, Lake Mead, and the Spring Mountains. These methods could include sexual and asexual propagation, seeding on-site, or propagating in a greenhouse. Of special interest are the germination and establishment requirements of several rare or state-listed plants: *Anulocaulis leisolenus, Astragalas geyeri var. triquetrus, and Eriogonum viscdidulum*.

The relict leopard frog is one of the rarest frog species in North America and was believed to be extinct until its rediscovery in 1991. Research is needed to improve habitat, reproductive success, and control non-native species such as bull frogs, crayfish, and non-native fish. Similar efforts are needed for endemic springsnails in numerous Mojave Desert and mountain spring systems throughout southern Nevada. Research is also needed to determine the ability of the threatened Ash Meadows naucorid to re-colonize and disperse into restored habitats.

At left an aerial view of the Spring Mountains. At right native plant germination at the Lake Mead restoration nursery.

# SNAP Science and Research Needs and Priorities- Goal 2

**Within the context of agency missions:**

**GOAL 2** **Provide for responsible use of Southern Nevada's lands in a manner that preserves heritage resources and promotes an understanding of human interaction with the landscape.**

## Sub-goal 2.1.
## Develop an understanding of human interactions with the environment through time.

### Background

An understanding of past human interactions with the landscape and the methods of preserving the evidence of those interactions, are crucial to effective management of heritage resources on Federal lands. The documents that guide our current research on human occupation of these landscapes are the Prehistoric and Historic Contexts which were completed in the early 1980s and 1990s respectively. Since that time, extensive research, including cultural resource surveys, data recovery, and the reanalysis of extant collections has been completed. This data needs to be compiled and synthesized to update these guiding documents.

The federal agencies have identified the following focused priority needs for the 2010 and 2011 calendar years:

### Priority Needs

1. What is currently known about historic human occupation of Southern Nevada including how they used and interacted with the environment?

### Inventory and Monitoring Needs

1. What kind of heritage resources are found in different environmental zones?
2. How have humans interacted with the changing environment through time?
3. How has changing environmental conditions influenced human adaptation?

## Rationale

The prehistory and history of southern Nevada is currently presented in numerous separate reports. The federal land management agencies in southern Nevada need to identify heritage resources on public lands and understand the importance of these resources within a historic context. Recent thematic research has identified new directions of investigations through survey and data recovery. New approaches and techniques should be utilized to obtain and analyze data to broaden interpretation and understanding of past human interactions with the environment.

Ruins of the once underwater township of St. Thomas

## Sub-goal 2.2.
## Preserve heritage resources through responsible use of Southern Nevada's lands.

## Background

Federally managed lands in southern Nevada overlap the traditional use lands of several tribal groups within the greater Southwest. Knowledge of traditional use of the landscape is gained through archival and archaeological research combined with interviews and consultations with Native Americans currently living on and telling stories of these lands. As public use of these lands increase, areas of importance to traditional lifeways are threatened. Agencies are mandated by law to work with Native American groups in all planning processes that affect these federal lands to identify these ethnographic resources, document threats and mitigate accordingly.

The following are more specific priority research needs for the 2010 and 2011 fiscal years:

## Priority Needs

1. What land management strategies are effective to preserve traditional lifeways?

## Inventory and Monitoring Needs

1. Where are the areas within public lands in southern Nevada that are traditionally used or can be traditionally used by Native Americans?
2. What is known of traditional ecological knowledge for southern Nevada?
3. How has traditional ecological knowledge been preserved and passed to younger generations?

## Rationale

A multi-agency Ethnographic Overview and Assessment is being prepared to synthesize ethnographic research on identified tribes affiliated with federal lands in southern Nevada. These federally managed lands overlap the traditional use lands of several tribal groups within the greater Southwest. As public needs for federal lands increase, areas of importance to traditional lifeways are threatened. Federal agencies are mandated by law to work with Native American groups in all planning processes that affect federal lands to identify ethnographic resources, document threats and mitigate accordingly. The land management agencies need to work with affiliated tribal groups to identify traditional ecological knowledge obtained through oral interviews and histories, and other ethnographic information. This would allow federal agencies and tribes to collaborate on the preservation and perpetuation of traditional knowledge for the management and conservation of traditional use areas on public lands.

Petroglyphs on SNAP managed lands.

## Sub-goal 2.3.
## Manage current and future authorized Southern Nevada land uses in a manner that balances public need and ecosystem sustainability.

## Background

In addition to recreation, there are many other authorized uses for public lands in Southern Nevada. Examples of these are energy development, transportation and mineral extraction.

Research is needed to identify and minimize the impacts of authorized uses and to predict future demands for resources on public lands.

The following are more specific priority research needs for the 2010 and 2011 fiscal years. Research needs in 2010 focus on renewable energy as this is an emerging land use in southern Nevada.

## Priority Needs

1. Where are the most appropriate locations for renewable energy development (solar and wind) in Southern Nevada that balance social/economic demands and conservation of natural resources?
2. Where are the most appropriate locations for solar energy development in Southern Nevada that maintains recreational opportunities?

## Rationale

Land managers must balance social and economic development with the need to provide for recreation and conservation and protection of cultural and natural resources (i.e., maintain air and water quality, recovery of listed species, , preserve cultural properties, etc.). Renewable energy projects and associated infrastructure (e.g., transmission corridors) have the potential to impact broad areas of Southern Nevada public lands. In 2006, BLM completed a Wind Energy Development Programmatic Environmental Impact Statement (PEIS) and Associated Land Use Plan Amendments. A solar energy development programmatic environmental impact statement (PEIS) is currently underway as a broad stroke effort in the western U.S. to address these concerns. More localized investigations are needed to address potential impacts such as habitat fragmentation of desert tortoises and other sensitive species including rare endemic plants.

Due to the size of proposed solar energy development rights-of-way, there is a public concern that recreational opportunities will be lost if solar power plants are approved in southern Nevada. Where are high solar development potential areas that impact the fewest recreational opportunities and the fewest acres of lands used for recreation?

A specific example of research that is needed relates to proposed solar energy development in the vicinity of Big Dune and Lava Dune in Armargosa Valley.

Graphic representation of proposed Ivanpah wind farm in Southern Nevada

## Sub-goal 2.4.
## Provide for appropriate (type and location), quality, and diverse recreational experiences, resulting in responsible visitor use on federal lands in Southern Nevada.

## Background

The rapid urbanization of Southern Nevada has increased the use of nearby public lands for recreation. Research is needed to identify market demands and trends for recreation on public lands, how to meet these recreation needs without compromising resources, and how to gain an understanding of current visitor-use patterns and characteristics.

The following are more specific priority research needs for the 2010 and 2011 fiscal years:

## Priority Needs

1. Are there adequate recreational opportunities to meet the interests and demands of an increasingly diverse population (demographically, economically, and ethically) in Southern Nevada? What are those interests and demands?
2. What are the recreational interests and demands of the youth in Southern Nevada?
3. What are the impacts of rock-climbing and what are effective actions to minimize impact?
4. What are the current visitor use patterns and demands in Southern Nevada Wilderness and what are their impacts on wilderness values?
5. What are the thresholds of road and trail density and use that meet recreational needs without compromising habitat and species viability?
6. What types of public recreation uses will increase over time?
7. Where are the likely locations of future visitor use and opportunities for shared facilities and resources?

## Rationale

Land managers are interested in learning if the federal lands are providing adequate recreation opportunities for the increasingly diverse population in Southern Nevada. This topic should address quantity and quality of recreational opportunities. Information is needed on the specific interests of special components of the population such as youth or minorities and their specific interests where opportunities may not yet be available, or where the there are current deficiencies in opportunities.

Recreational climbing continues to increase in popularity, and demand for use at existing and new locations continues to grow, particularly in wilderness areas. Research is needed to identify the potential impacts to sensitive, cliff-dwelling species from recreational climbing. In addition, information is needed on visitor-use demands and trends for wilderness areas on public lands in southern Nevada to determine

characteristics of use, impacts and future needs. The overall goal is to develop strategies for wilderness preservation and maintain solitude and primitive recreation.

There is fair amount of literature on the impacts of fragmentation as a result of road and trail proliferation in various landscapes, ecosystems and species habitats throughout the United States. The federal land managing agencies need to understand how this information applies to the Mojave Desert and sky islands in southern Nevada in relation to recreational demands (number and opportunity types), fragmentation of habitat and species populations. How many and which types of roads and trails are needed to meet recreational demands? Are roads and trails and use of them compromising resources such as desert tortoise (as keystone desert species); low, elevation rare plants and sky island rare plants; and other sensitive species? Understanding the thresholds for density of roads and trails can assist the federal land management agencies in southern Nevada to employ appropriate management strategies to maintain viability of species habitats and populations in light of meeting recreation needs.

Research is needed to assist the agencies with the development of recreation management plans that would serve as a blueprint for recreation on the over 7 million acres of federal lands surround the Las Vegas Valley. This research should address the types of recreation that are likely to increase over time and the opportunities the agencies might have for sharing facilities and resources.

At left, climber in the Red Rock NCA. At right, kayaking on Lake Mead.

## Sub-goal 2.5.
## Promote an effective conservation education and interpretation program to improve the quality of resources and enhance public use and enjoyment of Southern Nevada public lands.

## Background

Conservation education and interpretation are key tools of land managers to encourage responsible visitor use and enjoyment of public lands.

Research is needed to determine the effectiveness of conservation education and interpretation actions, how to best communicate messages to the public, and what the key messages should be to enhance resource stewardship in Southern Nevada.

The following are more specific priority research needs for the 2010 and 2011 fiscal years:

## Priority Needs

1. What are the best and most cost effective ways to communicate stewardship to the public? How can we improve current methods?

## Rationale

There are many ways to communicate stewardship ethics and messages to the public. Research is needed to identify effective communication strategies that preserve resources and enhance visitor enjoyment of the public lands,


Student education is enhanced by use of the floating laboratory, Forever Earth, on Lake Mead.