



**Chapter Four:
THE AFFECTED ENVIRONMENT**

INTRODUCTION

This chapter describes the natural and cultural resources, visitor use and experiences, and wilderness character of the eight wilderness areas that might be affected either directly or indirectly by implementing any of the alternatives. This chapter is not a complete

description of the eight wilderness areas' environment. For additional information on the areas' environment, see http://www.nps.gov/lame/naturescience/area_wilderness.htm.

NATURAL RESOURCES

SOILS

Soils within the wilderness areas are generally shallow, friable, wind-deposited or alluvial materials that are very susceptible to wind and water erosion. Erosive forces cause significant, sometimes dramatic, and long-lasting changes in physiography. Evaporation rates are much greater than precipitation and this creates extremely low soil moisture conditions throughout the year, which severely restricts plant growth. Burros also establish trails; this increases soil compaction and soil erodibility, and decreases cryptogamic soil density. Modification by use or development causes loss of soils. This soil damage is slow to heal because of the lack of precipitation and slow plant growth.

Lithosols are thin, stony surface soils derived from rocky parent materials, which characterize the slopes and crests of parallel desert ranges. These soils support scant growths of desert shrubs. Areas include desert ranges, such as Eldorado, Newberry, and Black mountains; the crests, rocky slopes, and upper part of some associated alluvial slopes; and steep-walled canyons.

Red desert soils are pinkish, reddish, and brownish-gray soils, which are commonly only slightly leached, rich in lime and mineral plant nutrients. They are derived from alluvial outwash from a great variety of rocks in the mountain ranges (metamorphic, granitic, volcanic, and sedimentary). Red desert soils include stony to gritty alluvium of fan deposits and finer basin interior deposits. These soils support creosotebush, leguminous trees, cacti, etc. Areas include desert basins, Eldorado Valley, and others.

Six primary soil types are found in Lake Mead National Recreation Area (NPS 2002). All of these soil series would be expected to occur in the wilderness areas as identified in table 9.

The creosotebush community soils typically develop on gray alluvium and generally have high salt-alkali contents that often form caliche hardpans.

The desert riparian community soils are usually silty to sandy but become quite rocky at the higher elevations.

Soils and People

In the past livestock grazing affected portions of the wilderness areas, and one mine was located in the Spirit Mountain Wilderness. Burros also establish trails; this activity increased soil compaction and soil erodibility, and decreased cryptogamic crust density.

Another major source of soil disturbance has been tracks from off-highway vehicles, both before and after the wilderness areas were established. A small percentage of the users of Lake Mead National Recreation Area's approved roads system and nearby BLM roads leave the approved roads and illegally create new tracks and trails. Surveys by NPS rehabilitation crews have shown a serious documented increase in illegal off-highway vehicle damage over the last several years. Illegal off-highway vehicle use has been identified to be a problem in Black Canyon, Eldorado, Iretaba Peaks, Nellis Wash, Spirit Mountain, and Bridge Canyon. Vehicles enter the wilderness areas from nearby roads or from roads that were bounded by wilderness areas. While the numbers of vehicles illegally going into most of the wilderness areas is believed to be relatively small, they can cause substantial damage.

The presence of illegal vehicle tracks also is a visual invitation for others to do the same (NPS 2002).

Table 11: Soil Type and Vegetation

Type	Description	Vegetation
Carrizo	Deep, excessively drained soils formed in stratified alluvium, on floodplains and alluvial fans.	Sparse growth of cactus, creosotebush, white bursage, mesquite
Drygyp	Very shallow to a petrogypsic horizon, somewhat excessively drained soils that formed in alluvium derived from gypsum rock	Mainly creosotebush, white bursage, range ratany, catclaw, Mormon tea, and big galleta
Heleweiser	Very deep, somewhat excessively drained soils formed in alluvium derived from basalt, sandstone, and limestone	Mainly creosotebush, white bursage, range ratany, and big galleta
Chem	Very shallow and shallow over a duripan, well-drained soils on fan remnants, formed in alluvium from mixed rocks over semi-consolidated gravelly sediments	Mainly creosotebush, white bursage, ratany, white brittlebush, and red brome
Gypwash	Very deep, somewhat excessively drained soils that formed in alluvium derived dominantly from limestone	Mainly white bursage and creosotebush
Huevi	Very deep, well-drained soils that formed in semi-consolidated alluvium from mixed rock sources	Mainly creosotebush, range ratany, and various annuals.

Source: NPS 2002

Off-highway vehicle driving is extremely damaging to fragile and irreplaceable desert soils, threatening the long-term ecosystem sustainability of the wilderness areas. Mojave Desert soils are stabilized not so much by vascular plants as by cryptogamic soil crusts and a mosaic of rock mulch called desert pavement. Motorcycles, all-terrain vehicles and other off-highway vehicles create ruts, pulverize and disperse surface soil, compact the subsurface soil, demolish chemically bonded surface crusts and protective layers of desert pavement, and crush and destroy the cryptogamic crust that bind the soil together (NPS 1989). If these protective layers are removed, these areas are then vulnerable to wind, water, and mechanical erosion. Exposed soils are subsequently lost to wind and water erosion, removing all nutrients, microbiota, and seed in the process. Natural recovery after disturbance may take several decades to

thousands of years without active restoration or other intervention (NPS 2002).

VEGETATION

Overview of Vegetative Communities

The vegetation of the eight wilderness areas contains species representative primarily of the Mojave Desert. However, differences in elevation, presence of water (i.e., springs), soils, and other environmental factors affect the location and extent of vegetative communities found in the wilderness areas. The Spirit Mountain Wilderness contains more diverse vegetative communities than the other wilderness areas to the north due to its higher elevation, geographical features, and its Sonoran Desert plants, which are at the edge of their range and intermix with the Mojave Desert vegetation here.

Desert vegetation is mainly found on the flats and slopes throughout the wilderness areas up to 6,000 feet. The dominant vegetative communities in this area are creosotebush-bursage and Mojave mixed shrub. Together, these two communities comprise some 98% of the wilderness areas. The creosotebush-bursage community is widespread in all of the wilderness areas, and occurs below 4,000 feet in valley bottoms and lowlands of mild slope aspect. It is locally well-developed on lower bajadas, alluvial fans, and playas. It may be found occasionally at higher elevations on arid, south-facing slopes. Near the Colorado River, the topography occupied by this community is especially rocky and rugged. Vegetation cover is sparse in this community and dominated by creosotebush (*Larrea tridentata*) and white bursage (*Ambrosia dumosa*). Primary associated shrub species can include blackbrush (*Coleogyne ramosissima*, usually at higher elevations), Mormon tea (*Ephedra spp.*), indigo bush (*Psoralea fremontii*), shadscale (*Atriplex confertifolia*), hopsage (*Grayia spinosa*), desert thorn (*Lycium spp.*), ratany (*Krameria erecta*), burro bush (*Hymenoclea salsola*), honey mesquite (*Prosopis glandulosa*), and brittlebush (*Encelia farinosa*). Other associated species can include yucca (*Yucca spp.*), and prickly pear cactus (*Opuntia erinacea*). Profusions of annual wildflowers can be observed in this community in the spring.

The creosotebush-bursage community can transition into a blackbrush dominated community which occurs on upper bajadas (alluvial fans on the lower slopes of mountains), slopes, and valleys below 5,900 feet. The blackbrush community is similar but of greater density than the creosotebush community. This community is dominated by blackbrush, with the primary associated shrubs including spiny hopsage, Mormon tea, shadscale, desert thorn, snakeweed (*Gutierrezia sarothrae*), and creosotebush. Matchweed (*Gutierrezia microcephala*) is also frequently associated with this community.

Mojave mixed shrub is the other major vegetative community in the wilderness areas.

This community occurs on upper bajadas and hills at elevations from about 3,250 feet to 4,000 feet. Vegetation in this community is quite variable. Codominants and diagnostic species include blackbrush, California buckwheat, Nevada ephedra (*Ephedra nevadensis*), Hopsage (*grayia spinosa*), spiny menodora (*Menodora spinescens*), beargrass, opuntia acanthocarpa, goldeneye shrub (*Viguiera parishii*), Joshua tree (*Yucca brevifolia*), Mohave yucca (*Yucca schidigera*), and banana yucca (*Y. baccata*). Desert grasses, including ricegrass (*Achnatherum hymenoides*), desert needlegrass (*Achnatherum speciosum*), bush muhly (*Muhlenbergia porteri*), big galleta grass (*Pleuraphis rigida*), and black grama (*Bouteloua eriopoda*) may form an herbaceous layer. Scattered little Utah juniper (*Juniperus osteosperma* or desert scrub species may also be present.

The desert lowland riparian community comprises vegetation in local desert washes, which is not dramatically different in growth-form from that of the surrounding desert shrub communities. Plants are comparable but usually occur in greater density in the desert riparian community because of greater occurrence of water. It is scattered like fingers through the landscape. Washes support the only tree species present in the wilderness areas: catalpa or desert willow (*Chilopsis linearis*), mesquite (*Prosopis glandulosa*), and cat's claw acacia (*Acacia greggii*). In addition, common shrubs include brittlebush (*Encelia farinosa*), sweetbush (*Bebbia juncea*), cheesebush (*Hymenoclea salsola*), and desert rabbitbrush (*Chrysothamnus paniculatus*).

In areas with springs various aquatic plant species can be expected, and the peripheries of springs may have a number of sedges (*Cyperaceae sp.*), rushes (*Juncaceae sp.*), cattails (*Typha sp.*), saltgrass (*Distichlis spicata*), and salt-tolerant shrubs. Cottonwoods (*Populus fremontii*), mesquite, desert willow, and tamarisk may also be found in these mesic soils.

An important component of many of the vegetative communities in the wilderness

areas is the cryptogamic (or microphytic) crust. Composed of fungus, algae, lichen, and mosses, which grow on or just below the soil surface, the crusts play an important role in soil's stabilization in deserts. They have the potential of slowing soil erosion by wind and water, enhancing infiltration of precipitation, and stimulating vascular plant growth through improved soil, water, and available nitrogen relations.

Jimbilnan Wilderness¹

The vegetation in the Jimbilnan Wilderness is primarily composed of Mojave mixed scrub and creosotebush-bursage communities (Boone 2007). The flats and bajadas are dominated by species such as creosotebush, white bursage, indigo bush, Mojave yucca, a few beavertail cactus (*Opuntia basilaris*) and many other low-growing desert shrubs.

The mountain slopes include species such as creosotebush, white bursage, Nevada jointfir (*Ephedra nevadensis*), Schott's pygmycedar (*Peucephyllum schottii*), desert stingbush (*Eucnide urens*), sweetbush, brittlebush, and barrel cactus (*Ferocactus cylindraceus*). Washes support a diverse array of shrub (e.g., catclaw acacia, cheesebush, and rabbitbrush (*Chrysothamnus spp.*)) and forb species (e.g., desert tobacco (*Nicotiana obtusifolia*) and groundcherry (*Physalis lobata*)).

A community of largely gypsophile plants (plants that thrive on gypsum soils) occurs in the mud hills in the Jimbilnan Wilderness, and to a lesser extent in the Pinto Valley Wilderness. Common plants of this community are pygmy cedar (*Peucephyllum schottii*), indigo bush, Mormon tea, shadscale, desert holly (*Atriplex hymenelytra*), and globe mallow (*Sphaeralcea ambigua*). The Las Vegas bearpoppy (*Arctomecon californica*), listed as threatened by the state of Nevada, occurs here. Two other rare, state-listed plant taxa likely occur on these soils: threecorner

milkvetch (*Astragalus geyeri* var. *triquetrus*) and sticky buckwheat (*Eriogonum viscidulum*) (D. Bangle, botanist, University of Nevada, Las Vegas, pers. com., 8-21-08). Other plants found here include sunray (*Enceliopsis argophylla* var. *grandiflora*), Palmer's phacelia (*Phacelia palmeri*), Parry's sandpaper bush (*Petalonyx parryi*), desert trumpet (*Eriogonum inflatum*), prickly poppy (*Argemone sp.*), and desert stingbush (*Eucnide urens*). Two nonnative species, Russian thistle (*Salsola spp.*) and tamarisk (*Tamarix ramosissima*), occur in the area.

Pinto Valley Wilderness

The vegetation here is similar to that found in Jimbilnan. The vegetation generally is sparse Mojave desert scrub, dominated by creosotebush and white bursage, but with a diverse flora of annual and perennial plants. Boone (2007) observed several cactus species in the area, including beavertail pricklypear cactus, silver cholla (*Opuntia echinocarpa*), cottontop cactus (*Echinocactus polycephalus*), common fishhook cactus (*Mammillaria tetrancistra*), and California barrel cactus (*Ferocactus cylindraceus*). Washes support a variety of shrubs, including catclaw acacia, and honey mesquite. Sandstone Spring supports honey mesquite, catclaw acacia, desert almond (*Prunus fasciculata*), four-wing saltbush (*Atriplex canescens*), desert saltgrass, and other shrubs, while Cottonwood Spring supports two cottonwood trees and a thicket of honey mesquite, and catclaw acacia.

Nonnative invasive species such as tamarisk and Russian thistle occur in some washes.

Three state-listed plant species occur in the wilderness area: the Las Vegas bearpoppy, threecorner milkvetch, and sticky buckwheat. Las Vegas buckwheat (*Eriogonum corymbosum* var. *nilesii*), a sensitive species and a U.S. Fish and Wildlife Service candidate species, also has the potential to occur within this wilderness area.

¹ Much of the information on specific wilderness areas is taken from http://www.birdandhike.com/Wilderness/Wild_index.htm, accessed on August 22, 2008.

Black Canyon and Eldorado Wilderness Areas

The vegetation in these two areas is similar (Boone 2007). Mojave desert scrub is the primary vegetative community in the two wilderness areas. Vegetation is dominated by creosote bush, bursage, a few other low-desert shrubs, and a variety of cacti.

Boone (2007) notes that west of the crest in both areas the vegetation on the flats and hillsides is sparse, stunted creosotebush and bursage, with little else except exotic red brome. There are a few other shrub species mixed in, such as buckwheat and brittlebush, plus a few cacti (prickly pear and cholla) scattered about, but the diversity is low and there is none of the buckhorn cholla (*Opuntia acanthocarpa*) or teddybear cholla (*Opuntia bigelovii*) found south of here. Vegetation in the shallow drainages is more robust and diverse.

East of the crest, the vegetation on the steep, rocky hillsides is sparse, stunted creosotebush with little else in most places except red brome. Along the washes, the species diversity is higher, and species such as catclaw acacia and brittlebush are common.

The vegetation in Burro Wash is dense and diverse compared to the hillsides. Vegetation is dominated by creosotebush and snakeweed, with an occasional catclaw acacia and a limited variety of other low-growing shrubs. On the rocky hillsides just above the wash, the cover is mostly stunted creosote and red brome, plus a few barrel cactus among the rocks.

In the lower part of Burro Wash taller shrubs are present, including mesquite, catclaw acacia with mistletoe (*Phoradendron sp.*), desert willow, and tamarisk. Creosotebush, snakeweed, brittlebush, ephedra, and some prickly pear are also present. The rocky hillsides and cliffs support pygmy cedar (*Peucephyllum schottii*), creosotebush, Mormon tea, and barrel cactus.

Ireteba Peaks Wilderness

Creosote-bursage is the primary vegetative community in this area, with areas of Mojave desert scrub. Vegetation is dominated by creosotebush, bursage, brittlebush, yucca, and a few other low-growing shrubs and grasses. Boone (2007) observed that in the mountains, barrel cactus and Mormon tea are common on the steep, rocky hillsides. In the washes, the vegetation is more diverse. Catclaw acacia and mistletoe are common, plus there are numerous other shrubs, buckhorn cholla, and prickly-pear cactus. Big barrel cactus occur in some washes, and patches of teddybear cholla blanket some hillsides.

Nellis Wash Wilderness

Like Ireteba Peaks, creosote-bursage is the primary vegetative community in Nellis Wash, dominated by creosote bush, bursage, brittlebush, yucca, and a few other low-growing, sparse, desert shrubs and grasses. In the Newberry Mountains, Boone (2008) found barrel cactus and Mormon tea are common on the steep, rocky hillsides. In the washes, the vegetation is more diverse. In Empire Wash, catclaw acacia is common along with mistletoe, plus numerous other shrubs and buckhorn cholla. On the southeastern ridges, the vegetation is sparse, stunted creosotebush with little else mixed in. In some areas, however, patches of teddybear cholla blanket the hillside. On the northeastern bajada, creosote and bursage dominate, but they are more dense, less stunted, and other shrubs also are common. Yucca and buckhorn cholla occur here too.

Spirit Mountain Wilderness

Spirit Mountain supports the most diverse vegetative communities of the eight wilderness areas. The two primary vegetative communities are creosote-bursage and Mojave desert scrub. At lower elevations, the vegetation is less diverse with creosotebush and other shrubs dominating. In the washes, there are desert willow, cottonwood, grapevines, common reed, and rabbitbrush. In the rocky canyons and washes at the base of Spirit Mountain, the vegetation is a juniper

(*Juniperus californica*) forest with a diverse flora. Boone (2008) reported paperbag bush (*Salazaria mexicana*), catclaw acacia, buckhorn cholla, a variety of composite shrubs, bitterbrush, yucca, beargrass (*Nolina bigelovii*), buckwheat, scrub oak (*Quercus turbinella*), desert willow, pinyon pine (*Pinus monophylla*), skunkbush (*Rhus aromatic*), rabbitbrush, mound cactus (*Echinocereus triglochidiatus*), Mormon tea, green ephedra (*Ephedra viridis*), and barrel cactus. The lower slopes also support smoketree (*Psoralea argemone*), one of the northern-most populations in Nevada. At Christmas Tree Pass the dominant vegetation is California juniper and blackbrush, with some yucca, pinyon, cholla, scrub oak, and other species mixed in.

Bridge Canyon Wilderness

Bridge Canyon also supports a diversity of vegetation. Mojave desert scrub is the primary vegetative community in the area. At lower elevations, species like creosotebush, yucca, desert shrubs, and grasses dominate the landscape. The canyons and washes support a more diverse flora. Common species include desert willow, rabbitbrush, and bitterbrush. Stands of cottonwood trees grow in Grapevine and Sacatone canyons. At higher elevations, the vegetative community is pinyon-juniper-blackbrush, with species such as juniper and blackbrush dominating the landscape, and a few pinyon pine scattered about. Other common species here include yucca, scrub oak, and catclaw acacia.

Nonnative Plants

Because virtually all of the wilderness areas have been grazed or otherwise affected by people, nonnative plants are present in all of the wilderness areas. With over 100 known species of nonnative plants in Lake Mead National Recreation Area, many of these plants probably occur in the wilderness areas. They are spread by hikers, illegal off-highway vehicles, and burros, as well as by wind, water, and birds.

The most common nonnative species in the wilderness areas are tamarisk (*Tamarix spp.*), Sahara mustard (*Brassica tournefortii*), red brome (*Bromus rubens*), and cheatgrass (*B. tectorum*). Other nonnative species found in the wilderness areas include African mustard (*Malcomia Africana*), London rocket (*Sisymbrium irio*), hedgemustard (*Sisymbrium orientale*), Arabian grass (*Schismus spp.*), and Russian thistle (*Salsola paulseni*).

Tamarisk is known to occur throughout the wilderness areas. Most of its occurrence is scattered individual plants along washes and at springs, such as Tule and Cottonwood springs. In addition, Boone (2007) noted that tamarisk is common along the Colorado River in Black Canyon.

Red brome, Sahara mustard, Arabian grass, and cheatgrass are invasive nonnative plants. These plants occur in many of the wilderness areas. Generally, Arabian grass tends to grow at lower elevations, red brome at low to middle elevations, and cheatgrass at mid to high elevations in the wilderness areas. These plants may alter the natural fire regime, increasing fire intensity and rate of spread, and decreasing fire return intervals. Because native plant species are poorly adapted to such conditions, alteration of the fire regime favors the establishment and growth of cheatgrass, red brome, Sahara mustard, and other nonnative plant species.

People and Vegetation

The activities of people have altered the vegetation of all of the wilderness areas, although to varying degrees depending largely on accessibility. In addition to introducing nonnative species, other activities that have altered the areas' vegetation include livestock and feral burro grazing, illegal off-highway vehicle driving, mining, and recreational use in certain high-use areas (e.g., camping at springs, the creation of unofficial trails). These activities have affected the distribution and abundance of native plants, as well as species composition and plant diversity. Climate change and air pollution may also be affecting

native plants, although this is unknown in the wilderness areas.

As noted previously, illegal off-highway vehicle use has disturbed soils in the wilderness areas. This activity also has been the source of one of the most evident impacts on vegetation in several of the wilderness areas, including Black Canyon and BLM lands in the Eldorado and Iretaba Peaks Wilderness areas. Off-highway vehicles crush and destroy plants including the lichens, fungus, and algae that make up the cryptogamic crust (NPS 1989). These areas are then vulnerable to wind, water, and mechanical erosion, which can indirectly result in additional losses of plants. Disturbances create opportunities for nonnative plants to become established in these areas. In addition, the vehicles can bring in nonnative seed sources with them. Airborne dust not only damages human and animal respiratory systems but also deposits on plant leaf area, reducing photosynthesis and productive habitat.

A potential for wildland fires also has increased in the wilderness areas. Fire is not believed to play a substantial role in the natural ecology of desert shrub communities. (An exception to this is Spirit Mountain, which has a fire history and periodically burns.) The Mojave shrub ecosystem is not believed to have had occurrences of large wildfires prior to the 19th century introduction of nonnative annual grasses, most notably red brome and Arabian grass (*Schismus arabicus*). These grasses are more flammable and fire-prone than native grasses and shrubs. Where areas are infested by these nonnative species, desert shrub communities are threatened by wildfire. Long response times and fire response delays are common in the eight wilderness areas due to the remote nature of the areas. If a wildfire occurs during dry and windy conditions in areas with buildup of red brome, Arabian grass, and cheatgrass, large fires could result.

Natural recovery of disturbed areas occurs slowly in the desert. It has been estimated that the recovery of vegetation on non-compacted

soils may require 60 years to reach pre-disturbance biomass, and up to 180 years for reasonable recovery of species diversity (NPS 1989). Over the past 10 years, NPS managers have been restoring disturbed areas in the wilderness areas, primarily vehicle tracks. Some of these areas are seeded or planted using native species. Management of non-native species, such as tamarisk and Sahara mustard, also is occurring in the wilderness areas.

TERRESTRIAL WILDLIFE

Although a detailed survey of wildlife has not been completed in the eight wilderness areas, the areas support a variety of wildlife. Their remote location, narrow canyons, and steep terrain provide habitat for many solitude dependent species.

Reptiles and birds are the most commonly seen species in the wilderness areas. As might be expected in a warm, desert area, reptiles are common throughout the region. For the most part, they prefer the rocky slopes and dry washes where boulders and brush furnish plenty of shelter and shade. A total of 41 species of reptiles have been identified in the national recreation area as a whole, including five species of turtles and tortoises, 16 lizard species, and 20 snake species (NPS 2004). Most of these species likely occur in the wilderness areas. Species likely to be found in the areas include chuckwalla (*Sauromalus obesus obesus*), collared lizard (*Crotaphytus bicinctores*), western whiptail lizard (*Cnemidophorus tigris*), side-blotched lizard (*Uta stansburiana*), long-nosed leopard lizard (*Gambelia wislizenii*), zebra-tailed lizard (*Callisaurus draconoides*), banded Gila monster (*Heloderma suspectum cinctum*), gopher snake (*Pituophis catenifer*), common king snake (*Lampropeltis getulas*), sidewinder (*Crotalus cerastes*), specked rattlesnake (*Crotalus mitchelli*), and Mojave rattlesnake (*Crotalus scutulatus*).

Birds that are likely to be found in the areas include prairie falcon (*Falco mexicanus*), red-

tailed hawk (*Buteo jamaicensis*), peregrine falcon (*Falco peregrinus*), turkey vulture (*Cathartes aura*), great horned owl (*Bubo virginianus*), common raven (*Corvus corax*), burrowing owl (*Athene cunicularia hypugea*) and greater roadrunner (*Geococcyx californianus*). A large number of smaller bird species use the wilderness areas as well, including Gambel's quails (*Callipepla gambelli*), a game bird, black-tailed gnatcatcher (*Poliophtila melanura*), Say's phoebe (*Sayornis saya*), white-crowned sparrow (*Zonotrichia leucophrys*), black-throated sparrow (*Amphispiza bilineata*), canyon wren (*Catherpes mexicanus*), cactus wren (*Campylorhynchus brunneicapillus*), rock wren (*Salpinctes obsoletus*), Phainopepla (*Phainopepla nitens*), and horned lark (*Eremophila alpestris*). It is also worth noting that Sacatone and Grapevine Washes, have been identified as part of an important bird area because of the density of Phainopepla and other species of concern that use these catclaw acacia washes (National Audubon Society 2008).

Ten species of amphibians are known to occur in the national recreation area, including five frog species and five toad species (NPS 2004). Several of these species likely occur in the wilderness areas near springs, including the red-spotted toad (*Bufo punctatus*), Woodhouse's toad (*B. woodhouseii*), and Arizona toad (*B. microscaphus*).

A total of 74 mammal species are listed as occurring in the national recreation area, of which 19 are bats. Most of these mammals likely occur in the wilderness areas. Small mammals including desert, Ord's and Merriam's kangaroo rats (*Dipodomys deserti*), *D. ordii*, and *D. merriami*), white-tailed antelope squirrels (*Ammospermophilus leucurus*), deer, cactus, and desert pocket mice (*Peromyscus maniculatus*, *P. eremicus*, and *Chaetodipus penicillatus*), black-tailed jackrabbits (*Lepus californicus*), and desert cottontail rabbits (*Sylvilagus audubonii*) likely inhabit the wilderness areas. Bat species may roost in caves and overhangs. Predators such as coyotes (*Canis latrans*), badger (*Taxidea*

taxus), desert kit fox (*Vulpes macrotis*), bobcat (*Lynx rufus*) and mountain lion (*Felis concolor*) are also likely residents.

Desert bighorn sheep (*Ovis canadensis nelsoni*) occupy most of the mountainous areas within the national recreation area, including all of the wilderness areas, where steep terrain provides protection from predators. The southern Nevada population of desert bighorn sheep is one of the premier populations in the nation (NPS 2003). Typical bighorn sheep habitat is rough, rocky and steep, broken up by canyons and washes. In the eight wilderness areas, desert bighorns could be described as nomadic; remaining mobile throughout their range to take advantage of variable rainfall patterns and available water sources (many of which are ephemeral). Nevada Department of Wildlife biologists have observed that desert bighorns usually limit summer activity to an area within two miles of water, although some summer movements can be greater (BLM and NPS 2007). Lambing habitat is present in most of the wilderness areas, particularly Pinto Valley, Black Canyon, Eldorado, Ireteba Peaks, and Spirit Mountain.

Bighorn sheep hunting occurs in all of the wilderness areas. The Nevada Department of Wildlife issues hunting tags for the areas, which are highly sought after. Ireteba Peaks, Boy Scout Canyon, Burro Wash, Cathedral Peaks, and Pinto Ridge are all popular places for sheep hunting. Hunting occurs from the second Saturday in November to the second Sunday in December.

Wild horses and feral burros, two nonnative species, occasionally occur in the wilderness areas, particularly in the Pinto Valley and Jimbilnan Wildernesses. Burros have likely overgrazed some areas, disrupted cryptogamic soil crusts, contributed to erosion, and competed with native species for forage and water. NPS staff completed a burro management plan in 1995 and have been removing burros from the national recreation area.

THREATENED AND ENDANGERED SPECIES

The only federally listed species known to occur in the eight wilderness areas is the desert tortoise (*Gopherus agassizii*). The desert tortoise, which is listed as threatened by both the U.S. Fish and Wildlife Service and state of Nevada, likely occurs in all eight wilderness areas. In addition, the U.S. Fish and Wildlife Service has designated desert tortoise critical habitat that includes Eldorado, a small part of Iretaba Peaks, Nellis Wash, Spirit Mountain, and Bridge Canyon Wilderness areas. Most of the national recreation area, including all of the wilderness areas, supports patchy, very low densities of tortoises, with a few hot spots of higher densities. Typically, tortoise densities are close to one tortoise per 100 acres. Desert tortoises are normally found below 4,500 feet, but may be found at elevations up to 5,000 feet. Desert tortoises occupy a variety of habitats from flats and slopes dominated by creosotebush scrub at lower elevations to rocky slopes in blackbrush and juniper woodland ecotones at higher elevations (USFWS 2008). Tortoises are most abundant in creosote-bursage communities and Mojave Desert shrub in valleys and on bajadas and hills. An important habitat requirement is the presence of annual wildflowers and native grasses as forage (RECON 2000). The native grass big galleta is often present where the desert tortoise is most abundant. Population trends for the desert tortoise in the wilderness areas are unknown, but in Clark County generally the desert tortoise is presumed to be declining due to a number of threats, including habitat modification and degradation, and wildlife mortality caused by off-highway vehicles (RECON 2000).

Two state listed animal and three state listed plant species are known to occur, or are likely occur, in the wilderness areas. The spotted bat (*Euderma maculatum*), listed as threatened, potentially occurs in the wilderness areas. This bat is found year round in a wide variety of habitats from low elevation desert scrub to high elevation coniferous forests and is highly

associated with rocky cliffs (Altenbach et. al, 2002).

Peregrine falcons (*Falco peregrinus*), also listed by the state as threatened, likely occur in the wilderness areas in open areas where there are cliffs or mountains. Ideal locations where the bird is likely to occur include undisturbed areas with a wide view, near water, and close to plentiful prey (Natureserve 2008). They often nest on ledges or holes on faces of rocky cliffs or crags.

The three plant species that occur in the wilderness areas are all classified as critically endangered by the state of Nevada (Nevada Revised Statutes 527.010). Las Vegas bearpoppy (*Arctomecon californica*) is an evergreen perennial herb known to occur in the Jimbilnan and Pinto Valley Wildernesses. It occurs in open, dry, spongy or powdery, often dissected (“badland”) or hummocked soils with high gypsum content, often with a well-developed soil crust, in areas of generally low relief on all aspects and slopes, at elevations from 1060 to 3642 feet. Although the species is relatively well protected in the wilderness areas, overall it is declining rapidly in numbers. Off-highway vehicle use is one of the threats to this species. (Nevada Natural Heritage Program 2001a).

Threecorner milkvetch (*Astragalus geveri* var. *triquetrus*) also occurs in the Jimbilnan and Pinto Valley Wildernesses. This annual plant, a member of the legume family, occurs on open, deep sandy soil or dunes, generally stabilized by vegetation and/or a gravel veneer, at an elevation from 1100 to 2400 feet. It is dependent on sand dunes or deep sand. The plant germinates only in wetter years. Off-highway vehicles and other recreational use of the habitat is identified as a threat to this species (Nevada Natural Heritage Program 2001b).

Sticky buckwheat (*Eriogonum viscidulum*) occurs in Pinto Valley and possibly Jimbilnan. Another annual plant, a member of the buckwheat family, sticky buckwheat occurs in deep loose sandy soils in washes, flats, steep

Aeolian slopes, and stabilized dune areas, at an elevation of 1200-2200 feet. It is dependent on sand dunes or deep sand (Nevada Natural Heritage Program 2001c).

NATURAL SOUNDSCAPE

Natural sounds and quiet are important characteristics of wilderness. The opportunity to experience natural sounds and quiet are an integral part of the visitor experiences in wilderness areas.

Natural soundscapes include wind, water, wildlife, and other sounds produced by the environment. The opportunity to hear natural sounds depends upon the natural ambient sound level, or the consistent background sound level that exists in the absence of noise. Noise is extraneous or undesired sound (Morfev 2001). The natural ambient sound level combines with the human threshold of hearing to set the threshold that sounds must exceed to be heard. However, the presence of sound energy from one source may be made inaudible (masked) by the presence of sound energy from another source (Kryter 1994). Low frequency noise is more effective at masking high frequency signals than the reverse. For example, transportation noise, which is concentrated in lower frequency bands (below 1250 Hertz), may mask bird songs in higher frequency bands.

Noises can have two impacts. Perceived noises can alter the quality of the soundscape and alter the behavior of visitors and wildlife. Noise also elevates ambient sound levels above the natural condition, and thereby reduces opportunities to hear the sounds of nature. Many factors affect how visitors and wildlife perceive and respond to noise. Primary acoustical factors include the level, duration, and spectral properties of the noise, as well as the rate of occurrence and its diurnal or seasonal schedule. Nonacoustical factors, such as experience, expectations, and adaptability, play a role in how visitors and wildlife respond to noise. The listener's

activity will also affect how he/she responds to noise.

Table 12 provides examples of A-weighted sound levels. Normal speech has a sound level of approximately 60 dBA. Sound levels above about 120 dBA begin to be felt inside the human ear as discomfort and eventually at still higher levels as pain.

Acoustical data is available for backcountry areas at Lake Mead National Recreation Area—specifically the Muddy Mountains/Pinto Valley, Ireteba, and Spirit Mountain Wilderness areas (see appendix F). The wilderness areas are considered to be relatively quiet, especially when focusing on truncated ambient levels (the levels that focus on frequencies affected by transportation noise). Table 13 shows natural and existing ambient levels at three Lake Mead acoustical monitoring sites in the wilderness areas (the sites area labled LAME009, LAME010, and LAME011). The table displays two exceedence values for each site at a variety of levels and times of day. In each cell, the top value, dBT, is a sum of the energy in the frequencies commonly affected by transportation noise, approximately 100-800 Hertz. This range does not correspond to a specific vehicle or type of transportation, but rather provides an indication of how transportation noise might be contributing to existing ambient levels. The bottom value in each cell is presented in dBA, A-weighted decibels. This value incorporates measurements from the full frequency spectrum, from 12.5-20,000 Hertz. While the A-weighted decibel scale has traditionally been used in sound studies as an approximation of human hearing, it falls short in evaluating the effects of transportation noise on a park's acoustic environment because it heavily discounts low frequencies.

Table 12: Common Noise Levels and Their Effects on the Human Ear

Source	Decibel Level (dBA)	Effect
Normal breathing	10	
Leaves rustling at Canyonlands National Park	20	
Soft whisper, quiet library (15 feet), Snake River (at 300 feet)	30	Very quiet
Crickets at Zion National Park (at 16 feet), Snake River (at 100 feet)	40	Moderate
Light auto traffic (100 feet)	50	Moderate
Conversational speech (3 feet), 4-stroke snowmobile (30 mph at 50 feet), automobile (45 mph at 100 feet)	60	Sound levels above 60 dB begin to interfere with close range conversational speech
Personal watercraft (82 feet)	68-76	Very loud
Vacuum cleaner, 2-stroke snowmobile (30 mph at 50 feet)	70	Intrusive
Off-highway Recreational vehicles	70-90	85 dB is the level at which hearing damage begins
V8 "muscle" boat (82 feet)	85-86	
Heavy truck or motorcycle (25 feet)	90	Extremely loud No more than 15 minutes of unprotected exposure recommended for sounds between 90-100 dB
Thunder	100	
Military jet at Yukon-Charley Rivers National Preserve (328 feet above ground level)	120	Threshold of sensation begins around 120 dB
Shotgun firing	130	Threshold of pain begins around 125 dB

Sources: Kormanoff and Shaw 2000, traffic noise background information (www.drnoise.com/PDF_files/Traffic%20Noise%20Primer.pdf), NPS 2007d, and Vicki McCusker, NPS Natural Soundscape Program, pers. comm. July 19, 2007

For instance, using the A-weighted decibel scale, one could conclude that the acoustic conditions in an urban environment (dominated by low-frequency sounds) are comparable to those of a wilderness area where birdsong and insects contribute high-frequency sound energy. The truncated scale, dBT, is appropriate to use for this study because it focuses solely on the frequencies which are affected by transportation noise.

Truncated data for the wilderness areas indicate daytime median existing ambient sound levels (L_{50}) ranged from 13.4 dBA in remote desert scrub to 30.7 dBA in areas closest to flight corridors for the Las Vegas McCarran International Airport. Existing ambient includes natural and non-natural sounds. Natural ambient sound levels (no human-caused sounds present) are slightly lower. Daytime median natural ambient sound levels (L_{nat}), at truncated frequencies, ranged from 11.8 to 20.0 dBA. In the early morning hours, sound pressure levels at some of the sites were very close to the noise floor (which is the lowest recording limit) of acoustical monitoring equipment. Sound levels as low as these are extremely rare and highly sensitive to the influence of extrinsic sound events.

The wilderness areas listed in Table 13 are relatively quiet in comparison to other portions of the park and even other parks. However, there were still significant amounts of human-caused sounds recorded in the wilderness areas. The human-caused sounds most commonly heard at the monitoring sites were high-altitude jets, helicopters, and vehicles.

The data collected from sites LAME009, LAME010, and LAME011 are an initial baseline for these inland wilderness areas. At Lake Mead, noise levels increase closer to the shores of both Lakes Mead and Mohave and near roads. Most of the natural sounds heard within the wilderness areas include the wind blowing across the landscape and wildlife calls (e.g., birds). Common human-caused sounds include engines from watercraft and other vessels, noise from vehicles on roads adjacent

to and near the wilderness areas, off-highway vehicles, aircraft overflights, and sounds from backcountry visitors.

On a year-round basis, the loudest and most frequent noise in several of the wilderness areas, specifically Pinto Valley and Black Canyon, is from aircraft overflights. Many of these aircraft fly from Las Vegas to Grand Canyon National Park. Estimates of air tour activity vary from over 68,000 to 80,000 flights per year. In addition, commercial jet traffic going to and from Las Vegas can be heard in the wilderness areas. Boat noise is most noticeable during the summer months in the portions of the wilderness areas directly adjacent to the lakes (i.e., Spirit Mountain, Pinto Valley, Jimbilnan, Eldorado, Black Canyon, and Ireteba Peaks); however, when there is intervening terrain, boat noise will be greatly attenuated. Noise from off-highway vehicles driving within or near the wilderness areas can be heard at times in several of the wilderness areas. At the boundary of the Black Canyon Wilderness area, off-highway vehicle noise is prevalent every afternoon and on the weekends in fall, winter, and spring (Pers. comm., Michelle Zuro-Kreimer, Lake Mead NRA, August 6, 2008). Limiting or mitigating these human-caused contributions of sound could improve the natural acoustical environment. Natural soundscapes offer visitors the opportunity to discover solitude and other wilderness values.

In addition to affecting visitor experience, soundscape preservation is also vitally important to overall ecosystem health. The peer reviewed literature widely documents that sound plays a critical role in intra-species communication, courtship and mating, predation and predator avoidance, and effective use of habitat. Additionally, similar studies have shown that wildlife can be adversely affected by sounds and sound characteristics that intrude on their habitats. While the severity of the impacts varies depending on the species being studied and other conditions, research strongly supports the fact that wildlife can suffer adverse behavioral and physiological changes from

intrusive sounds (noise) and other human disturbances. Documented responses of wildlife to noise include increased heart rate, startle responses, flight, disruption of behavior, and separation of mothers and young (Selye 1956; Clough 1982; National Park Service 1994; US Department of Agriculture 1992; Anderssen et al. 1993).

When noise elevates ambient sound levels, signals that might otherwise have been detected and recognized are missed. The noise is said to mask these signals. Masking degrades an animal's auditory awareness of its environment, and fundamentally alters interactions among predators and prey. There are many animal species that rely almost exclusively on sound to locate their prey (e.g. owls, bats). Masking also affects acoustical communication. Animals have been shown to alter their calling behavior and shift their vocalizations in response to noise (Brumm and Slabbekoorn 2005; Patricelli and Blickley 2006; Slabbekoorn and Ripmeester 2008; Warren et al. 2006). These shifts have been documented in a variety of signal types: begging calls of bird chicks (Leonard and Horn 2007), alarm signals in ground squirrels (Rabin et al. 2006), echolocation cries of bats (Gilman and McCracken 2007) and sexual communication signals in birds and anurans (Brumm and Slabbekoorn 2005; Patricelli and

Blickley 2006; Warren et al. 2006; Slabbekoorn and Ripmeester 2007, Parris et al. 2009). Vocal adjustment likely comes at a cost to both energy balance and information transfer; however, no study has addressed receivers. Some species are unable to adjust the structure of their sounds to cope with noise even within the same group of organisms (Lengagne 2008). These differences in vocal adaptability could partially explain why some species do well in loud environments and others do poorly (Patricelli and Blickley 2006; Slabbekoorn and Ripmeester 2007).

Some large herbivores have been observed to habituate to acoustic stimuli (Krausman et al. 1998; Weisenberger et al. 1996). Habituation is a decreased responsiveness to a stimulus upon repeated exposure. There are many reasons why reports of habituation to noise should be interpreted with caution. A reduction in one form of response may represent a shift to another, unobserved mode of response rather than development of complete tolerance. Observation of more tolerant population may be the result of sensitive individuals leaving the area (Bejder et al. 2006). Animals that remain may not have other viable options. Lastly, a completely habituated animal has learned to ignore a class of stimuli, some of which may signal biologically significant conditions.

Table 13: Natural and existing ambient levels at selected Lake Mead acoustic monitoring sites (LAME009, LAME010, and LAME011)

Site	Exceedence levels (dBA) 0700 to 1900		Exceedence levels (dBA) 1900 to 0700	
	L _{nat}	L ₅₀	L _{nat}	L ₅₀
LAME009 Callville Wash (Muddy Mountains and Pinto Valley Wilderness)	20.0	30.7	13.1	18.9
	21.4	31.2	16.6	20.4
LAME010 West Powerline Wash Road (Ireteba Peak Wilderness)	11.8	13.4	9.5	9.6
	16.2	17.1	15.0	15.2
LAME011 Pipe Spring Road (Spirit Mountain Wilderness)	13.6	16.2	9.6	10.0
	17.4	20.1	18.5	21.6

Each cell in the table shows two measurements: dBT (top) and dBA (bottom). The dBT measurements focus on general transportation noise (~100-800 hertz). These results allow park staff to confidently draw conclusions about human-caused sounds. The dBA measurements, on the other hand, include the full frequency spectrum (~10-20,000 hertz), and have historically been the unit of measurement in sound studies. However, conclusions drawn from these data may be less reliable. Wilderness areas where much of the sound energy comes from birds, frogs, and insects, even without much human-caused sound, could still appear as loud as a noisy urban environment.

WILDERNESS CHARACTER

The Wilderness Act speaks of wilderness as a resource in itself. A wilderness, in contrast to those areas where humans dominate the landscape, is defined by the qualities comprising its wilderness character. Wilderness character encompasses a combination of biophysical, experiential, and symbolic elements as described by four principal qualities: natural, undeveloped, untrammeled, and having outstanding opportunities for solitude or a primitive and unconfined type of recreation. These four qualities are of equal importance and can be defined in the following ways.

NATURAL

The Wilderness Act states that wilderness is “protected and managed so as to preserve its natural conditions.” In short, wilderness ecological systems are substantially free from the effects of modern civilization. This quality can be degraded by intended or unintended effects of modern people on the ecological systems inside the wilderness after the area is designated (Landres et. al 2008).

To most visitors the wilderness areas appear to be natural and undeveloped, covered largely by natural-looking desert vegetation. The natural character of the wilderness areas is mostly preserved. However, some changes in vegetation have occurred, most notably, the widespread presence of several nonnative species (e.g., red brome, Sahara mustard, and cheatgrass). Another change from the primeval character is the occasional presence of feral horses and burros; however, their presence has been very limited. There is no permanent human presence in any of the wilderness areas. Although parts of the lands comprising the wilderness areas were once grazed and several areas had mining sites, these activities no longer occur. Since the time that grazing ended, the vast majority of the

wilderness areas have been left to the forces of nature.

UNDEVELOPED

The Wilderness Act states that wilderness is “an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation...” “...where man himself is a visitor who does not remain” and “with the imprint of man’s work substantially unnoticeable.” This quality is degraded by the presence of structures, installations, habitation, and by the use of motor vehicles, motorized equipment, or mechanical transport that increases people’s ability to occupy or modify the environment (Landres et. al 2008).

Although roads existed in some of the wilderness areas, mainly to support mining activities or fire suppression activities, they are no longer maintained and many are overgrown. The NPS staff in a separate planning process decided which roads in the national recreation area, including the wilderness areas, would be closed and the landscape restored.

Signs of off-highway vehicle use are present in some areas. However, as noted previously, restoration efforts are underway in the wilderness areas to remove and restore areas with vehicle tracks and old roads.

No visitor facilities, including maintained hiking trails and campsites, are present in the wilderness areas.

UNTRAMMELED

The Wilderness Act states that wilderness is “an area where the earth and its community of life are untrammeled by man,” and “generally

appears to have been affected primarily by the forces of nature.” In short, wilderness is essentially unhindered and free from modern human control or manipulation. This quality can be degraded by modern human activities or actions that control or manipulate the components or processes of ecological systems inside the wilderness (Landres et. al 2008).

The vast majority of the wilderness areas are untrammled. However, trammeling activities have occurred in the past, some of which continue to occur, including fire control, control of nonnative species, and management of desert bighorn sheep. Active restoration activities also occur on NPS lands.

SOLITUDE OR A PRIMITIVE AND UNCONFINED TYPE OF RECREATION

The Wilderness Act states that wilderness has “outstanding opportunities for solitude or a primitive and unconfined type of recreation.” This quality is about the opportunity for people to experience wilderness; it is not directly about visitor experiences per se. This quality can be degraded by elements that reduce these opportunities, such as visitor encounters, signs of modern civilization, recreation facilities, and management of or restriction on visitor behavior (Landres et. al 2008).

Outstanding opportunities for primitive, unconfined recreation exist in each of the eight wilderness areas, including opportunities for hiking, backpacking, hunting, wildlife watching, and exploration.

Currently, no recreation uses in the wilderness areas require a permit. Recreation in the wilderness areas is largely unconfined. Hunting and trapping require the proper licenses in the proper seasons, and campfire restrictions might be in place if conditions warrant. Backcountry camping has certain

restrictions (e.g., camping is limited to a maximum of 15 days at one site on NPS lands), but access to and recreation in the wilderness areas is unregulated.

The eight wilderness areas offer outstanding opportunities for solitude. In the majority of the areas, a sense of remoteness and isolation is experienced. Numerous massive rocky outcrops, ridges, and mountainous topography combined with narrow canyons, ravines, and cracks create secluded locales and scenic vistas of land without visible human developments. The topography, the wilderness’ large area, and the need for route-finding skills, create outstanding opportunities for solitude. As noted in the soundscape section, most of the wilderness areas are quiet, although in the Pinto Valley and Black Canyon Wilderness areas natural quiet is periodically interrupted by high altitude commercial passenger plane overflights or low level helicopter air tour flights.

Very few people visit these wilderness areas and most who do visit spend short times there. The harsh desert environment, extreme heat, and lack of shade make these areas challenging and inhospitable, especially during the summer. There are a few places where relatively large groups of people (10-20+) may occur at times in the wilderness areas. Opportunities for solitude may be fewer at times due to high use levels at Hamblin Peak in Pinto Valley Wilderness, Boy Scout Canyon in the Black Canyon Wilderness, Spirit Mountain and Sacatone Canyon in the Spirit Mountain Wilderness, and Grapevine Canyon in the Bridge Canyon Wilderness.

Due to the remoteness and harsh desert environment of the wilderness areas, visitors tend to be day users. For those visitors willing to venture further into the wilderness areas there are many outstanding opportunities for solitude, even during the peak visitor season.

CULTURAL RESOURCES

OVERVIEW

Before the existence of Lake Mead, Lake Mohave, and Hoover Dam, early desert Native Americans, explorers, and pioneers occupied the area encompassing the one and half million acres of Lake Mead National Recreation Area.

Three of the wilderness areas (Eldorado, Ireteba, and Spirit Mountain) contain Bureau of Land Management lands where cultural resources also exist. BLM land surveys are characterized by similar cultural resources.

Cultural resources are the physical evidence of past and current use of the land by humans. These are found throughout Lake Mead National Recreation Area and include artifacts, archaeological sites, historic structures, cultural landscapes, ethnographic resources, and traditional cultural properties. They range in complexity from a single stone tool or bottle fragment to a large prehistoric village or historic-period town site. Cultural sites are the locations of human activities that are identifiable through inventory, historical documentation, oral history, and consultation with Native American tribes.

The 1986 *Lake Mead National Recreation Area General Management Plan* focused on the completion of cultural surveys in developed areas of the national recreation area. The 1986 plan proposed survey of 5% of all lands in the national recreation area to study and evaluate wilderness and backcountry. Park staff estimate approximately 5% of the designated wilderness areas has been surveyed for cultural resources. Despite this lack of information, significant cultural resources are known to occur in the national recreation area. Over 1,200 known cultural sites are in the recreation area as a whole, with approximately 100 of those sites located in wilderness. Most of these sites, including those documented in wilderness, are currently

unevaluated but considered potentially eligible for listing in the National Register of Historic Places. Initial efforts to identify and evaluate cultural resource properties within wilderness have demonstrated that there is high potential for the presence of national register-eligible cultural sites in some areas.

Prehistory

Archeologists have identified a series of Native American cultures that have occupied Lake Mead National Recreation Area and adjacent areas in southern Nevada and Western Arizona over the last 12,000 to 13,000 years. These cultures have been divided into discrete time periods based on various criteria, i.e. changes in technology, the types of animal and plant foods used, or the migration of peoples into and out of the area.

Occupation of the area began at the end of the late Pleistocene around 12,000 to 13,000 years ago with the Paleoindian period. The Paleoindian period lasted into the Holocene and ended around 7,000 years before present (BP). The Pleistocene was dominated by greater rainfall and moderate temperatures, which created an environment of vast lakes and humid conditions. During the Paleoindian period of the early Holocene, the environment was characterized by a general trend to warmer and dryer conditions. Paleoindian peoples lived in small, highly nomadic groups, utilized wild plant foods, and hunted now extinct big game. Physical remains from the Paleoindian period usually consist of flaked stone tools and the by-products of tool manufacture, e.g. flakes and spent cores.

The Archaic period (7,000 to 2,000 BP) is characterized by nomadic peoples living in small groups adapted to the mosaic of microenvironments created by the overall warmer and dryer conditions. Their subsistence was based on gathering wild plant

foods and hunting small game. Flaked stone tools and the by-products of tool manufacture, along with the common occurrence of ground stone artifacts, typify the Archaic period.

The arrival of Ancestral Puebloan peoples from the east marked the end of the Archaic period and the beginning of the Saratoga Springs period. The Saratoga Springs period (2,000 to 750 BP) was dominated by the expansion of Ancestral Puebloan peoples into the Lake Mead area, and their eventual withdrawal. These groups used pottery and lived in permanent structures. They practiced some horticulture but still depended heavily on wild plant and animal foods.

The Late Prehistoric lifeway, which began around 750 BP, was similar to Archaic adaptations. The people lived in small mobile groups, gathered wild plant foods, and hunted small game. They also practiced small scale horticulture. Archeologically, these people are indistinguishable from the Mojave, Quechan, Hualapai, and Havasupai (Yuman-speaking peoples) and the Southern Paiute (Numic-speaking peoples) who occupied the area during the Historic period.

Euro-American History

The Spanish and later the Mexicans were the first whites to explore the area. During the Spanish/Mexican period (1500s to 1840s), trade routes were established between the population centers in New Mexico and the colonies in California. These trade routes included the Mojave Trail and the Old Spanish Trail, which passed through Southern Nevada.

The Mormons were the first to establish permanent white settlements in Southern Nevada. These included Las Vegas, St. Thomas, and Callville; the latter two were inundated by the creation of Lake Mead. During the late 1800s and early 1900s, the prosperity of these communities and others in the area was determined by the boom and bust cycles of the mining and ranching industries that formed the economic base of the area.

The construction of Hoover Dam in the 1930s dramatically changed the landscape of southern Nevada and Western Arizona. It brought thousands of people to the area, put Las Vegas on the map, and helped develop the area's current economy based on recreation and tourism. The National Park Service obtained management responsibility for much of Lake Mead and the surrounding area in 1936 under a Memorandum of Agreement between the National Park Service and the Bureau of Reclamation (Rothman 2002).

ARCHEOLOGICAL SITES

Recent archeological investigations carried out to current professional standards have focused on the developed areas of the recreational area. Most of the archaeological sites located during these surveys are related to the making of stone tools.

Generally, in these eight wilderness areas for Lake Mead National Recreation Area and adjacent BLM lands, there is a great scarcity of water and food resources. This lack of resources would restrict permanent occupation. However, there is a high probability of finding prehistoric sites located near water sources. Some of the wilderness areas may have been better watered in the past, but at present time only seasonal water is contained in tinajas (very small independent basins) eroded in the sandstone bedrock and water-carved pockets within bedrock exposed in washes.

The following list is a general characterization of cultural resources found in the various wilderness areas, as well as an accounting of acres of completed archeological survey:

Jimbilnan Wilderness has had 31 acres surveyed for cultural resources to current professional standards. Another 489 acres were previously surveyed, but the documentation is considered unreliable. Of the documented sites, there are two: one prehistoric lithic scatter and one historic mine.

Pinto Valley Wilderness includes rock art found sporadically throughout the area. There have been 195 acres surveyed to current professional standards, and 3,600 acres surveyed under older methods with unreliable documentation. There are 3 documented sites, all prehistoric—2 rock art and 1 artifact scatter.

Black Canyon Wilderness contains some remnants of past mining. This wilderness area has had the most archeological survey completed. Archeological resources include rock art, lithic scatters, and an intaglio. Two thousand thirty acres have been surveyed to current professional standards; with another 100 acres surveyed where the documentation is considered unreliable. There are 18 documented sites: 3 historic, 15 prehistoric that include 11 artifact scatters, 1 rock art, and 3 other.

Eldorado Wilderness has had 30 acres surveyed for cultural resources to current professional standards. There have been documented two prehistoric sites – one lithic scatter and one habitation site.

Ireteba Peaks Wilderness has had 75 acres surveyed to current professional standards. Four sites have been documented: 1 historic mining and 3 prehistoric—1 lithic scatter and 2 rock art.

Nellis Wash Wilderness has had the least archeological survey completed. Only one acre has been surveyed to current professional standards. The only documented archeological site in this wilderness is a prehistoric rock art site.

Spirit Mountain Wilderness contains numerous archeological resources. There have been 150 acres surveyed according to current professional standards and 30 acres from older unreliable surveys. There are 11 documented sites in this wilderness area, including 7 prehistoric sites—3 artifact scatters and 4 rock art sites—and 4 historic sites—2 mines, 1 habitation site, and 1 road.

Bridge Canyon Wilderness displays an outstanding collection of rock art as well as a number of other archeological sites. Eight hundred twenty acres of this wilderness have been surveyed to current professional standards, and 55 acres were surveyed under older unreliable methods. The 63 documented sites include 3 historic sites, all mining, and 60 prehistoric sites—26 habitation, 12 rock art, 14 artifact scatters, and 8 other.

At present, with the exception of Spirit Mountain and the Grapevine Canyon areas adjacent to the Bridge Canyon Wilderness, cultural resources in the wilderness areas do not show significant impacts from visitation.

Archeological surveys from adjacent areas and anecdotal information indicate the potential for short-term use rockshelters, open campsites, hunting blinds, lithic procurement areas, and rock art. Where surveys and inventories have been completed, faunal remains recovered during the archeological investigations include bighorn sheep, rabbits, small rodents, and tortoises. Groundstone artifacts recovered during other investigations point to small seed processing characteristic of desert Archaic cultures. Ceramic types recovered in the vicinity of the eight wilderness areas include Virgin Anasazi, Lower Colorado, and Southern Paiute. Stone tools and projectile point styles date from the Archaic to the Protohistoric Period.

Rock art panels including petroglyphs and pictographs are scattered throughout the various wilderness areas. Rock art styles vary. There are curvilinear/abstract elements as well as representational designs including quadrupeds such as bighorn sheep and anthropomorphs. Designs interpreted as atlatls (throwing sticks) and riders on horseback provide evidence that the area was used over a long period of time.

ETHNOGRAPHIC RESOURCES

An ethnographic resource is identified by way of a specific contemporary human group or family using a particular place over time in accord with that group's traditional cultural heritage and social identity. More specifically, an ethnographic resource is "a site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it" (NPS 1998a). The rock art in the various wilderness areas are attributed to the ancestors of the traditional peoples still existing in the area. These sites could conceivably constitute ethnographic resources or may be considered part of a larger ethnographic landscape.

Ethnographic resources eligible for the national register are called traditional cultural properties (NPS 2006e). Traditional cultural properties are defined generally as ethnographic resources that are eligible for inclusion in the national register because of association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community. Spirit Mountain and the surrounding canyons have been identified as traditional cultural properties and are listed in the National Register of Historic Places because of their significance to the Yuman speaking tribes. This area is still sacred to the members of these tribes, and they continue to use the area according to their traditions.

VISITOR USE AND EXPERIENCE

No specific visitation or visitor use data exists for the NPS or BLM lands in the eight wilderness areas. The only visitor use information currently provided by the National Park Service for the wilderness areas is a brief description of the areas and a general map on the national recreation area's web site. No facilities, including trails and campsites, are provided in the wilderness areas, and most of the wilderness areas do not have parking areas or signed entrance points. However, private sector information is published in guidebooks and posted on the Internet. Specific hiking routes are described for several areas, such as Hamblin Peak, Cleopatra Wash, Boy Scout Canyon, and Spirit Mountain.

The following information is largely based on NPS staff observations and inferences.

VISITOR USE PATTERNS AND CHARACTERISTICS

The eight wilderness areas are generally within a 2-hour drive of Las Vegas. Visitor use of the desert lands in the Lake Mead area is highly seasonal: year round visitation is possible, but hot temperatures, normally over 100 degrees, limit summer visitation. Thus, visitor use patterns for the eight wilderness areas are substantially different from Lake Mead and Lake Mojave, which receive by far the bulk of visitation in the national recreation area. Wilderness area users are typically local residents who go into the wilderness areas in the spring, fall, and winter when temperatures are cooler. The peak season is October through March. Due to the lack of water in the wilderness areas, most people are believed to be day hikers, with a few backpackers going to locations like Boy Scout Canyon and Spirit Mountain. Most groups are small, approximately 2-4 people in a party (excluding NPS-led interpretive walks and the occasional group outing, which can have up to 12 people).

The wilderness areas are accessed at various points along roads. Most of the roads are dirt, while a few are paved. Some visitors also access the wilderness areas from Lake Mead and Lake Mohave, beaching their boats and then walking into the wilderness areas. (The wilderness area boundary is 300 feet from the high water mark.) Most people access the springs in Boy Scout Canyon from the water. Many of the secondary roads also are places where there are illegal vehicle intrusions into the wilderness areas.

Several destinations receive the bulk of the visitation in the wilderness areas. Grapevine Canyon in the Bridge Canyon Wilderness receives the highest level of use of the eight wilderness areas, with an estimated 600-900 visitors per month during the winter and spring months. Most of these visitors stop at the rock art panels just within the wilderness boundary. (Unlike the other wilderness areas, the Grapevine Canyon parking area has a traffic counter. Many of these visitors are from out of the area, from California. There is also a large segment of visitors from other states and countries. J. Tesar, Lake Mead NRA ranger, pers. com., 8-11-08). Pinto Valley and Hamblin Peak is the second most popular area (but with substantially less use than Grapevine). Other relatively popular destinations include Spirit Mountain, Sacatone Canyon and the Catacombs areas in the Spirit Mountain Wilderness, and Boy Scout Canyon area in the Black Canyon Wilderness.

VISITOR EXPERIENCES AND OPPORTUNITIES

All of the wilderness areas offer outstanding opportunities for primitive recreation due to their remoteness, isolation, and size, variety of topography, desert vegetation (including rare plants), scenery, wildlife, and in most areas, solitude. (This is discussed further in the

Wilderness Character section.) Activities that people pursue in the wilderness areas include day hiking, backpacking, camping, birding and nature viewing, photography, climbing and canyoneering, upland game and big horn sheep hunting, and mine and other cultural resource exploration. Rock climbing is not a popular activity, due to the nature of the rock resource, although localized climbing occurs. Camping is not popular in most areas due in part to the need to carry water and a lack of firewood. No permits are required to camp in the wilderness areas.

Equestrian use probably sporadically occurs in some wilderness areas, although the lack of water and inhospitable terrain limits this use. Other pack stock, such as llamas and goats, are not believed to be used in the wilderness areas now, but may be used in the future to carry water and supplies for people.

No commercial guiding trips occur in the wilderness areas, with the exception of hunting. Big game (sheep) hunting guides regularly use the wilderness areas during the hunting season. Guides usually take clients into the wilderness areas on a daily basis.

NPS staff periodically lead interpretive hikes into the wilderness areas, primarily the Pinto Valley and Cottonwood Springs areas, and occasionally into the Jimbilnan and Black Canyon (Boy Scout Canyon) Wildernesses. These are popular hikes, particularly for people who are not familiar with the desert areas. Group size is limited to a maximum of 12 people.

Following are some of the attractions at each of the wilderness areas.

Jimbilnan Wilderness. Visitor attractions in this wilderness area include hiking Cathedral Canyon, Cleopatra Wash, Mangonese Wash, and exploring sand dunes in the Middle Point area.

Pinto Valley Wilderness. This wilderness area provides opportunities for several scenic hikes, including hiking up Hamblin Peak,

Northshore Peak and along Pinto Valley. Other destinations include Bearing Peak; Boulder Wash; Cottonwood Spring; Saddle Peak; Razorback Ridge; Murphy's Peak; and Signature Rock.

Black Canyon Wilderness. The primary attraction in this wilderness are the hot springs in Boy Scout Canyon. Other destinations include Petroglyph Wash; overlook view at the end of the road at Canyon Point mesa; and Queho and Trunkman caves.

Eldorado Wilderness. Several hiking destinations are in this area, including Oak Creek Canyon and Lonesome Wash.

Ireteba Peaks Wilderness. Visitor attractions in Ireteba Peaks include Opal Mountain, the Ireteba Peaks, and Tule Springs.

Nellis Wash Wilderness. This open, flat area receives very little visitor use. Visitor attractions and destinations are not known in this area.

Spirit Mountain Wilderness. Spirit Mountain provides a variety of opportunities for visitors. Destinations include Spirit Mountain; lower Grapevine Canyon; Sacatone Wash; Pipe Spring Canyon; and the White Rock Mine. The area is popular for upland game hunters. In the spring people come here to see the wildflowers.

Bridge Canyon Wilderness. Visitor attractions here include the rock art in Grapevine Canyon; the Catacombs; Bridge Canyon; and Dripping Springs.

VISITOR SAFETY

The eight wilderness areas are exciting, challenging places to access and explore, but also are potentially hazardous. The wilderness areas experience extreme heat in the summer, generally lack shade and water, and are subject to lightning strikes and flash floods. Visitors run the risk of being caught off-guard

with changing weather conditions. Visitors sometimes also underestimate their need for food and water in such a harsh desert environment. Response times to handle emergencies in the wilderness areas can be far greater than for similar distances in non-wilderness areas due to a lack of cell phone coverage, few ranger patrols, limited emergency access routes, and a lack of information about where people are in the wilderness areas because permits are not required and there are no trailhead registers.

Other visitor safety concerns include potentially dangerous wildlife such as rattlesnakes, one type of scorpions, and the banded gila monster which are all venomous, but will leave visitors alone unless disturbed. A microscopic amoeba, *Naegleria fowleri*, can live in hot springs and can cause a rare infection and sometimes death. Abandoned mines and tunnels exist in some of the wilderness areas. With deep shafts and old, rotten supporting timbers, these old mines can be dangerous