PROVIDENCE MOUNTAINS
and the
KELSO DUNES

Background Information

Desert Studies Center
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GEOLOGICAL BACKGROUND

Prepared by

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GEOLOGY OF THE MOJAVE DESERT REGION
IN THE VICINITY OF ZZYXZ, CA

Introduction

The Mojave Desert region in the vicinity of Zzyzx is an outstanding area for field-based geology studies. An exceptional range of rock types and structures with ages ranging from well over 1 billion to less than a few thousand years are exposed within easy driving distance of the Soda Springs facility. During the day-long excursion planned, we will have the opportunity to observe only a few of the many outstanding geologic features. Even so, we will hopefully get an appreciation for the geology of the region and the interrelation between the geology and the biology and archeology of the region.

The guide is organized into small regions along our planned route for the day (figure 1). Each of the regions will be described briefly, and as time permits, we will stop to investigate some of them.

Zzyzx

The Desert Studies Center at Zzyzx is located between the Soda Mountains to the north and west and Soda Lake to the south and east. The springs and seeps in the area have long been a focal point of human activity in the otherwise very arid area.

The Soda Mountains are composed of Mesozoic (see geologic time scale in figure 2) granitic rocks and minor older metamorphic rocks. The granitic rocks generally form the highest parts of the mountains behind the study center. Metamorphic rocks are scattered throughout the range; however some are visible just behind the buildings where blue-gray metamorphosed fossiliferous limestone of Paleozoic age forms large outcrops. The granitic rocks are part of a very broad belt of Mesozoic igneous rocks that crop out through much of California, including much of the Mojave Desert and parts of the Transverse Ranges and the Sierra Nevada. We will see more examples of both granitic and metamorphic rocks throughout the day.

Soda Lake is a desert playa which, for most of the time is dry. Of course, it has not always been dry. Soda Lake was one of the major lakes along the Mojave River during Pleistocene pluvial periods (figure 3). Runoff from the Transverse Ranges supplied water to the Mojave River which traversed through the Victorville, Barstow, and Afton Canyon areas before reaching Soda Lake and then, at times, continuing northward through Baker and Silver Lake and even to Death Valley at times. Coring of the lake bed in Soda Lake and radiocarbon dating of strata from the lake indicate that the lake sediments accumulated during high-water stands between about 22,000 and 8,000 years BP. Several major fluctuations in lake levels during the period have been attributed to changes in precipitation and runoff in the Transverse Ranges. Within historic times, floods on the Mojave River have filled the playa with up to 6 m of water at least nine different times. The most recent flooding of the lake was in 1983.
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*Absolute ages of boundaries are based on radiometric dating. The origins of some of the names of the time divisions are given.

**Figure 2. Geologic Time Scale**
Figure 3. Pleistocene drainage in the Mojave Desert (modified from Blackwelder, 1954).
Kelbaker Road between Baker and 17-mile Point

Kelbaker Road traverses rather gentle topography as it leaves Baker, but it does rise slightly as it leaves Baker. The road cuts across distal alluvial fans (see figure 4 for a summary of desert geomorphic features and their origins) with very low surface relief. Most of the fans head in the vicinity of the Cima volcanic field some 25 km to the east and drain into Soda Lake. The fan surfaces are dotted with boulders of basalt (with conspicuous desert varnish) in granitic grus (decomposed granite fragments).

The most conspicuous features in the area, particularly after the sharp turn in the road, are the basalt cinder cones and lava flows of the Cima volcanic field (figure 5). The cinder cones and lava flows represent the youngest volcanic activity in this part of the Mojave Desert. Radiometric dating of the lava flows indicate that they range in age from about 6.5 Ma (late Miocene to about 0.16 Ma (Pleistocene); however, at least one flow is too young to date by radiometric methods and may be less than 25,000 years old.

The eruptive cycle of each of the vents followed a similar pattern. Early explosive pyroclastic eruptions cleared the conduit of pre-existing rock material, mostly underlying granitic rock, and formed small pyroclastic rings around the vent. Pyroclastic eruption of fluid basalt mantled the early eruptive products and created the readily visible cinder cones around the vent. In this case the cinders are composed of tapered volcanic bombs, angular blocks of congealed basalt, scoria, and some fine-grained material. At some vents, lava flows eruptions alternated with pyroclastic eruptions. The lava flows were erupted from vents from either outside the cinder cone or within the cinder cone where ponded lava formed lava lakes. Some of the vents erupted a culminating lava flow of considerable volume that spread from the vent westward down the slope.

The basalt cinder cones and lava flows overlie a gently westward sloping surface cut onto deeply weathered Mesozoic granitic rocks. If the protruding cinder cones and lava flows are ignored, you may notice that the surface on the granitic rocks is gently domed. This surface is caused by long-term erosion of the granitic rocks. Broad surfaces with very low local relief form only where there is little fault activity (figure 4, late stage). So at least for this part of the desert, fault activity has been very low. From looking at the granitic rocks below the basalt flows, one can see that the erosional surface was developed prior to eruption of the basalt. However, by looking at the elevation of the surface underneath lava flows of different ages, it is possible to conclude that erosion continued throughout eruption of the basalt over the last 6.5 million years. Stream channels cut down through even the youngest lava flows indicate that the rocks are still being eroded. In spite of the fact that stream flow is an infrequent event in the desert, stream erosion is still the dominant agent of erosion in the desert.

The road passes through the western end of three basalt lava flows just before dropping down into Willow Wash (figure 5). The road cut and stream banks give very good cross-sectional view of the lava flows. In these views, you can see that the flows are composed of a massive interior which was at one time molten lava. The top of the flow is capped by rubbly material which formed because the top surface of the flow was very viscous and could not flow like the more mobile interior of the flow.

Typically, you would expect the oldest lava flow to be on the bottom and each overlying flow to be successively younger. Although this is the case in the flows exposed along the road, there is a single flow at considerably higher in elevation than the other flows. This single flow is actually older than those surrounding. This seemingly contradictory situation is a classic case of topographic reversal (figure 6). In this case, the oldest lava flow was extruded onto the granitic rocks (figure 6a). This lava flow then acted as a protective surface that prevented significant erosion. Erosion of granitic rocks continued on either side of the lava flow and lowered the
**Early Stage**
1. Maximum relief occurs in the initial stage owing to block faulting or folding. If recurrent movement along the faults does not take place, relief will diminish through time.
2. Alluvial fans build outward from the mountain front and basins become filled with erosional debris.
3. Shallow temporary lakes (playas) may form in the central part of the basin and expand or contract with fluctuations in climate.

![Block diagram of the early stage](image)

**Middle Stage**
1. The mountain mass is dissected into an intricate set of canyons, divides, and peaks. The mountain front has retreated from its original position.
2. Pediments develop along the mountain front.
3. Local relief diminishes.
4. Alluvial fans merge to form an alluvial slope called a bajada.

![Block diagram of the middle stage](image)

**Late Stage**
1. Intermontane basins are continually filled by erosional debris.
2. Pediments enlarge, and the mountain topography becomes smaller.
3. Ultimately, only small, islandlike remnants (Inselbergs) of the mountains remain, and most of the area is covered by debris.

![Block diagram of the late stage](image)

*Figure 4.* Block diagrams illustrating the stages of erosion in arid regions.
Location map of Cima volcanic field showing distribution of three ages of volcanic rocks (diagonal lines, late Miocene flows; large dots, Pliocene flows; stippled, Pleistocene flows).

**Figure 5. CIMA VOLCANIC FIELD**
Figure 6. Topographic Reversal. See text for explanation.
surface on the granitic rocks (figure 6B). The younger flows were then erupted onto this lower surface such that they are topographically lower than the older flow; hence topographic reversal (figure 6C).

After crossing Willow Wash, we will turn left off the main road (if time permits) on a small dirt road and head east to the youngest lava flow in the area. We will park before crossing the wash again and walk up onto the flow from the north side.

Here we will be able to view the top rubbly surface of the flow (very rough and very hazardous walking). If you look carefully across the surface of the flow, you should note that there are some curious mounds on the surface that are considerably redder than the flow. With careful observation, you should be able to recognize that these mounds are composed of different material—they contain abundant basalt scoria and a few bombs. If they are different than the lava flow, how did they get here? It may be hard to believe, but these mounds are part of the cinder cone some 2-3 km to the east. They were rafted along on top of the flow that erupted from a vent in the cinder cone and flowed out under the cinder cone and carried part of it away. If you look carefully at the cinder cone to the east, you will note that the west side of it is missing. This missing part was once there, yet was carried away by the later lava flow.

The surface of the lava flows shows an even more curious feature. Look in depressions in the lava flow surface and you will see that there are a few plants growing on the flow. This would not be surprising if the climate was wet and there was rapid development of soil. Yet the climate is very arid here and the rate of soil formation is so slow that there is no soil development on this basalt flow which may be less than 25,000 years old. So what are the plants growing in? If you look carefully at the soil around the plants, you should be able to see that it is composed of light-colored quartz and feldspar grains which can not have been derived from the basalt. Where did the soil come from then? The soil in this case is wind-borne silt-sized fragments that have been blown in from the surrounding areas and it has accumulated in depressions where. If you have ever been in the desert when a strong storm moves through, you will appreciate how much material can be carried in the air and how a deposition of this material could eventually lead to formation of a soil.

After viewing the basalt flow, we will return to Kelbaker Road and follow it towards Kelso. The road is on a deeply weathered surface cut onto the granite. Irregularities in the surface such as the hills on both sides of the road are in large part also due to erosion. The hills are generally underlain by rock that is more resistant to weathering. As the whole region was being eroded away, the granitic rocks weathered at a reasonably uniform rate resulting in the broad surfaces with little local relief; more resistant rocks were not weathered as rapidly and were left behind as high-standing erosional remnants (figure 4, late stage).

**Kelso Dunes**

The Kelso Dunes are a spectacular example of sand dunes. These dunes are extremely interesting both from a geologic standpoint and from a biologic one. We will have the opportunity to walk on the dunes where we will be able to view some of their geologic and biologic features.

Sand dunes may form in nearly any environment where there is an abundant supply of sand. We may think of sand dunes as being a desert feature, but they also form near beaches or even in glacial areas where there is a supply of sand. So where is the supply of sand to form these dunes? Studies of the dunes by Robert P. Sharp of Cal Tech led him to the conclusion that sand from the dunes was derived from the Mojave River some 30-40 km to the west. The sand was carried in on the wind and has accumulated here in the valley over the past 10-20,000 years.
The Kelso dunes are complex dunes because three or more dune shapes have been recognized. Longitudinal (parallel to prevailing wind direction) and transverse (perpendicular) dunes suggest southwesterly prevailing wind directions. If you stand on the highest part of the dune (some are 215 m above the underlying surface), you may be able to see a radial distribution of dune ridges extending from the highest part of the dune. This radial distribution of dune ridges is characteristic of star dunes. The presence of star dunes provides a key as to why the dunes are here. Star dunes are believed to form where there are variable wind directions throughout the year and hence no significant migration of the dune. The suggestion is that the dune sand has been transported eastward from the Mojave River by prevailing winds. Once the sand reaches the vicinity of the Kelso Dunes area, prevailing winds die out, the sand is deposited, and then is worked by local winds with variable directions which cannot transport sand out of the area, but rework the sand into star and other dune forms. Robert Sharp has suggested that some of the major dune forms present today may actually have formed 10-20,000 years ago and they have been little modified since.

The Kelso Dunes are often referred to as "singing dunes". The "singing" is actually more a low-pitched vibrating sound. The sound is typically made when you walk on the steepest part of the dunes (lee side of the dune) and cause avalanches of dune sand. Movement of the sand grains and subsurface compaction of loosely packed sand grains causes the low-pitched sound.

Like most sand dunes, the Kelso Dunes are composed primarily of light-colored quartz and feldspar grains. Other minerals are present, however. If you look at the ridges of many small dunes or on the windward sides of the dunes, you might notice concentrations of dark-colored grains. These grains are primarily magnetite, an iron oxide. Magnetite is so abundant in the dune sand that experimental studies were done to see whether magnetite could be recovered as an iron ore. Considering the unique biologic community on the dunes, it is fortunate that the magnetite contained too much titanium to be usable and the mining operation was abandoned.

Granite Pass

After leaving the dunes, we will travel south on Kelbaker Road between the Providence Mountains on the east and the Granite Mountains on the west to the summit known as Granite Pass.

The Providence Mountains are a very impressive mountain range because of their steep western flank. Not only is the western flank steep, but the whole appearance of the range is different than what we have seen previously or can see in the distance in the Granite Mountains. The range has a darker color and has a much more rugged topography than surrounding ranges.

The topographic features of the range are due to the type of rock in the range. The highest and most rugged part of the range is underlain by stratified Paleozoic marine sedimentary rocks. Although the stratification has been deformed from the horizontal by subsequent folding and faulting, it can be clearly seen. The great bulk of the stratified rocks are fossiliferous limestones. Fossils and sedimentary structures in the limestone indicate that these rocks were deposited on the stable edge of the continent in broad shallow seas. During the Paleozoic, the western part of the continent was very much different than what we now see in Southern California. Instead of being a very dynamic area with active faulting and extreme topographic relief as we see today, the entire western part of the continent from Mexico to Montana (figure 7) during the Paleozoic was extremely stable, had little topographic relief, and was covered by shallow seas. The limestones we see today were once marine sediments deposited from Paleozoic seas covering the continental margin which was Precambrian igneous rocks deeply eroded to a nearly planar surface. Rock units deposited from these seas can readily be correlated all the way from northern Mexico through the Mojave Desert to points as far north as Montana and even Canada.
Figure 7. Distribution of Devonian (Middle Paleozoic) rocks.
The Paleozoic limestones figure prominently in mineral resources of the Providence Mountains. A partially paved road branching southeast from Kelbaker Road leads to the Vulcan iron mine and Foshay Pass. The Vulcan iron mine, owned by Kaiser Steel Company, operated from 1941 until the 1950’s. The iron-ore body is a contact metasomatic magnetite-hematite body formed at the contact between Mesozoic granitic rocks and the Paleozoic limestones. Fluids emanating from the igneous intrusion permeated the limestone and led to replacement of the limestone with the magnetite-hematite ore. About 5.7 million tons of ore containing about 50 percent iron were present in the body and about 40 percent of the body was mined. Ore from the mine was trucked to Kelso where it was loaded into train cars and shipped to the Kaiser Steel mill in Fontana. The mine was abandoned when Kaiser Steel found a much larger and higher grade body in the Eagle Mountains near Desert Center.

Granite Pass is a low divide between the Providence and Granite Mountains. The relatively low pass is a result of more rapid differential weathering of Mesozoic granitic rocks in the pass. These rocks weather more readily than in ranges on either side due to the presence of a shear zone passing northward through the pass. Shearing of the rock makes them more susceptible to weathering, hence their relatively low elevation.

The Granite Mountains to the west are a favorite area for rock-climbers. The spectacular granite outcrops to the west of the pass are a result of differential weathering of the underlying late Mesozoic granitic rock. The granitic pluton in the Granite Mountains is relatively resistant to weathering. Weathering is most rapid along joints which are fractures developed in a cooling and shrinking igneous body. The pluton in the Granite Mountains was cut by relatively few joints that are widely spaced. Accelerated weathering along the joints has led to the large crack between boulders and accelerated erosion of the corners of granite blocks has rounded the corners, thus resulting in the spectacular land forms which are referred to as spheroidal boulders (figure 8).

There are outstanding erosional features on the east and southeast sides of the Granite Mountains as well. The road leading from Granite Pass down to I-40 is on a large erosional surface called a pediment cut into the granitic rock. During the Miocene, the area east and southeast of the Granite Mountains was at a much higher elevation. Miocene volcanic and sedimentary rocks were deposited in a basin. Off to the south, remnants of the Miocene tuffs (pyroclastic eruptive products) overlain by basalt lava flows cap Van Winkle Mountain. The volcanic rocks formed a protective layer over the granite (exposed near the base of the mountain) which prevented downward erosion. Where the protective volcanic rocks were thin or absent, weathering eroded away the granite to form a low-standing pediment surface (note the presence of granite outcrops on the pediment surface). This topographic inversion of the land surface is much like that observed around the Cima volcanic field but it is much more spectacular and pronounced here. The pediment surface, primarily between Van Winkle Mountain, I-40, and the southeastern Granite Mountains is probably a Pleistocene feature that has been recently exhumed. It most likely formed by a mechanism such as that outlined in figure 4 and formed at the same time topographic reversal was taking place.

I-40

The Interstate highway cuts eastward through the northern end of the Marble Mountains and north of the Clipper Mountains. Underlying rocks in the area are Mesozoic and possibly Precambrian granitic rocks that were deeply eroded. These are capped by stratified volcanic rocks of Miocene age.

During the Miocene, the Mojave Desert was the locus of considerable volcanic activity. Volcanic activity did not occur everywhere in the area, rather it was restricted to volcanic centers spaced some tens of kilometers apart. Each of the centers were slightly different in terms of their eruptive history, but each are characterized by a complex range of rock compositions and
FIGURE B
Spheroidal weathering of extensively jointed rock. Water moving through the joints begins to enlarge them. Since the rocks are attacked more on the corners and edges, they take on a spherical shape.
in porous zones. Subsequent downward erosion of the tuff and possible climatic changes decreased the amount of water available and stopped cave formation. Surficial features on the cavern walls, ceilings and floors represent later deposition from downward percolating groundwater that was saturated with calcium carbonate. Evaporation or splashing of water drops caused precipitation of calcium carbonate and formation of the spectacular features we see in the caverns.

**Hole-in-the-Wall**

The road from the Mitchell Caverns area to Hole-in-the-Wall traverses through low-lying areas floored by deeply weathered granitic rocks of either Mesozoic or Precambrian age. Scattered outcrops of tuff in the valley and thick piles of tuff on high-standing ridges on either side of the road indicate that this area was once entirely covered with tuff. After deposition of the tuff in middle Miocene time, streams on the surface of the tuff eroded down through the tuff. The tuff is readily eroded downwards, so once a stream was established, it rapidly cut downward with only minor widening of the drainage. The principal drainage off this surface was probably much like the current one we have just driven up. Water flowing from higher ground in the north headed southward towards Essex (south of I-40) and cut a deep gorge in the tuff. Through time, the gorge has been widened to its present width and filled with debris in the form of an alluvial fan.

We will be stopping in the vicinity of Hole-in-the-Wall to look at some of the features exposed here. Exposed tuff in the area consists primarily of weakly lithified volcanic ash. The fine-grained bulk of the rock was once magma that was violently erupted from the Woods Mountain volcanic center due to release of pressure and exsolution of gases dissolved in the magma. Immense pyroclastic eruptions (considerably larger than Mt. St. Helens) spewed out dense clouds of ash that flowed outward from the center, filling in topographic depressions at first, and then blanketed the entire landscape.

The violence of the eruption can be hardly appreciated by looking at the tuff; however, we can get some indication from looking at the tuff in a little more detail. You should notice that the tuff contains material other than volcanic ash which is relatively easy to transport because of its fine grain size. Many outcrops of tuff contain fragments of hydrated obsidian (perlite) and volcanic rock fragments up to 10 cm or more in diameter. These fragments were derived from older lava flows and domes in the Woods Mountain volcanic center that were violently ripped apart during the pyroclastic eruption and carried in the dense ash cloud some 10 km or more from the center. Granitic rock fragments in some tuff outcrops indicate that the powerful pyroclastic eruption was able to vertically transport fragments from depths beneath the volcano as well as blast apart surficial volcanic rocks. Once you appreciate the fact that the ash cloud was able to transport these fragments for this distance, you can begin to appreciate the power of these types of eruptions.

The role of stream erosion in creating the spectacular topography can be readily appreciated by taking an excursion from the Hole-in-the-Wall campground (or from Wild Horse Canyon Road west of the campground). Near the north end of the campground there is a trail leading down one of the gorges that was formed and then abandoned during erosion of the area. The trail is rather demanding because of numerous dry waterfalls that can only be negotiated with aid of rings placed in the cliffs. The hike is certainly worthwhile, because it is easy to visualize how running water could have cut this gorge, and, by analogy, many of the gorges in the vicinity.

If you stand back and take a long distance view of the tuff cliffs, you will notice that they are stratified and there appear to be many layers in the tuff. Layering in the tuff is present because there were several eruptions of tuff from the volcanic center that were separated by periods of volcanic inactivity. Even though the composition of the tuff does not vary significantly from bottom to top, cooling of the tuff between eruptions has led to subtle differences. Subsequent
ersion as accentuated these differences and makes recognition of different layers and different tuff eruptions more readily visible. Even though the top of the volcanic sequence looks very similar to the tuff we are able to see, the uppermost layers are lava flows rather than tuffs. They are very similar to the tuffs in chemical composition; however, magma erupted during the later stages of the Woods Mountain volcanic center contained less much less dissolved gas and as a consequence erupted as relatively quiet lava flows rather than explosive tuffs.

**Round Valley and Cedar Canyon**

We will leave the Hole-in-the-Wall area and travel northward to Round Valley and join with the Cedar Canyon Road. Much of this area is similar to what we have seen before. Tuff probably blanketed all but the highest peaks during the middle Miocene; however, subsequent erosion has stripped the tuff and exposed Mesozoic granitic rocks.

Many of the outcrops along the road are of the Mesozoic granitic rocks. At least three different intrusions are known in the area. At least from a distance, they can be easily recognized by variation in color from buff to medium gray and by variation in outcrop pattern from spheroidal boulders to low rolling hills. High-standing ridges are either protected by volcanic rock (such as that exposed on Pinto Mountain north of Cedar Canyon Road) or are underlain by rock that is relatively resistant to weathering. Round Valley is similar to the eastern side of the Granite Mountains in that it is a pediment surface cut onto the underlying granitic rocks.

As we drive through the narrowest parts of the canyon and before we reach the summit, you will notice some very dark rocks that weather to a black color. (These rocks are the origin of the Black Canyon Road name.) These rocks are almost entirely composed of a dark-green to black mineral called amphibole. As a result, these rocks are named amphibolite. These are some of the oldest rocks in the region and they were present prior to emplacement of the granitic plutons. Their age and origin is not well understood, but they may have once been basaltic rocks that have been metamorphically recrystallized by deep burial and heating by granitic magma intrusion. Several small gold mines (visible to the east of the road) were developed in quartz veins in the metamorphic rocks, but none are active today.

Upon leaving Cedar Canyon, you should look off to the northwest to the skyline. The immense rounded land surface you see is Cima dome, the largest of the pediment surfaces developed in the Mojave Desert. We have looked at similar pedimented surfaces on the west side of the Cima volcanic field, but this view is far more spectacular and clearly shows the lack of local relief on the surface. The only relief is the prominent hill on the east flank which is Kessler Mountain. Kessler Mountain is underlain granitic rock that is more resistant to weathering than that underlying Cima Dome. The origin of domes such as Cima dome is controversial, but it must be related to deep weathering of a relatively homogeneous rock in a geologically stable environment.

As we travel south on the Kelso-Cima road, you should look at the western flank of the Mid Hills and Providence Mountains. Drainages on the west side of the mountains have deposited debris at the mouths of the canyons in alluvial fans. Coalescence of alluvial fans from adjacent drainages has led to development of flanking apron of erosional debris which are referred to as a bajada (figure 4). These bajada are some of the best in this part of the Mojave Desert.

We will now return to the Desert Studies Center via Kelbaker Road to a much deserved dinner and night of sleep.

des.std
ANTHROPOLOGICAL BACKGROUND

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CULTURAL SETTING OF THE PROVIDENCE MOUNTAINS AREA

ETHNOGRAPHIC BACKGROUND

During the ethnographic period, the central portion of the Mojave Desert, possibly including portions of the Mojave River sink, apparently was claimed by the Vanyume Serrano. In addition, the Kawaiisu appear to have traveled into the central and eastern Mojave Desert on occasion. However, the Chemehuevi claimed the Providence Mountains. Both the Vanyume and Chemehuevi are discussed below.

Vanyume

Little is known about the Vanyume, a division of the Serrano living in the Mojave Desert, called the "Serrano of the Mohave River" by Kroeber (1925:614). Sources of data on the Vanyume include Coues (1900), Kroeber (1925), Strong (1929), Bean and Smith (1978), and Harrington (1986). Some of the data on the ethnographic occupation of the Afton Canyon area were summarized by Schneider (1989).

Territory and Language. The area of Afton Canyon seems to have been Vanyume territory (Bean and Smith 1978:Fig. 1), although the Chemehuevi may also have had claims for the area. It is possible that the Vanyume occupied a portion of the Mojave River sink, just west of the Providence Mountains.

The Vanyume spoke a Takic language, related to the Kitanemuk to their west and to the Serrano to the south. Kroeber (1925:614) considered their dialect to be closer to Kitanemuk than to Serrano.

External Relations. Kroeber (1925:614) reported that the Vanyume sometimes were friendly with the Mohave and Chemehuevi but were hostile to the Serrano of the San Bernardino Mountains.

Social Organization. Kroeber (1925:614) reported that the population of the Vanyume was very small at the time of historic contact. The "chief" of the Vanyume was said to have lived in one of the villages at the upper reaches of the Mojave River, near Victorville.

Subsistence. Very few specifics are known about Vanyume subsistence, other than they were hunters and gatherers. The Vanyume generally are viewed as having been quite "poor" (e.g., Kroeber 1925:615; Bean and Smith 1978:570), although it is not clear what that means.

Subsistence data for the Vanyume are generalized from that of the Serrano as a whole (Bean and Smith 1978:571). Kroeber (1925:615) reported that mesquite (Prosopis) was eaten but that the inhabitants of one location "had nothing but tule roots to eat."
Material Culture. Kroeber (1925:615) reported that the Vanyume had "blankets of rabbit and otter fur" and snares made of "wild hemp." Shell beads and milling stones also are known to have been used.

Chemehuevi

The Chemehuevi are a band of Southern Paiute that (apparently) entered the eastern Mojave Desert from the north in fairly recent times. As such, they are very closely related, in many aspects, to the Southern Paiute in the Death Valley and southern Nevada regions. Sources of data on the Chemehuevi include Kroeber (1925), Kelly (1934, 1936), Drucker (1937), Stewart (1968), Van Valkenburgh (1976), Laird (1976, 1984), Fowler and Fowler (1971), Kelly and Fowler (1986), and Harrington (1986).

Territory and Language. At the time of ethnographic contact, the Chemehuevi claimed a large portion of the eastern and central Mojave Desert, perhaps as far west as Afton Canyon on the Mojave River (see Schneider 1989) and Daggett (Laird 1976:24). Kroeber (1925:594) reported Chemehuevi territory as

...off the lower Colorado River westward. It commenced in the Kingston Range, south of Death Valley, where they met the Koso [Panamint], and stretched southward through the Providence Mountains and other stony and sandy wastes, to about the boundary of Riverside and Imperial Counties. Roughly, this is the eastern half of the Mohave Desert.

Kelly (1934:Map 1, 556) reported that the Chemehuevi territory adjoined

the Las Vegas [band of Southern Paiute] to the south. On the northeast they were bounded by the Mohave and on the east by the Colorado river. Chemehuevi territory extended from the west shore south to the Palo Verde mountains, from which point the line separating them from other California peoples ran north, passing Ironwood [McCoy] mountains on the east side and, crossing the Maria mountains, swung northwest along the Iron mountains, thence between Old Woman mountain and Cadiz dry lake.

Laird (1976) defined Chemehuevi territory as it pertained to mythology, hunting songs, and trails. The general area outlined by Laird is similar to that of Kroeber and Kelly, but includes more of western Arizona. In all cases, the Providence Mountains clearly are within Chemehuevi territory at the time of ethnographic contact and frequently are noted (Laird 1976:passim). Laird (1976:132, map inside back cover) identified Arrowweed Spring on the southern end of the Providence Mountains as an important location. However, Kelly and Fowler (1986:Fig. 1) indicated that the Providence Mountain area was within Las Vegas (band of Southern Paiute) Territory.

It is unclear how long the Chemehuevi have occupied the eastern Mojave Desert. Rogers (1936:38), based on archaeological data, concluded that they entered the Mojave Desert sometime in the seventeenth century.
This group, which was probably the last Shoshonean one to enter southern California, came in without pottery. From Nevada, they [the Chemehuevi] drifted down in small bands into the eastern half of the Mohave Desert after the region had been abandoned by the Mohave. Archaeological evidence would seem to indicate that this invasion began some time during the seventeenth century.

The presence of "Desert Mohave" in the eastern Mojave Desert prior to the occupation of the Chemehuevi is of great interest. The question centers on whether the "Desert Mohave" actually existed, and if they did, when and why they left the area, and if the Chemehuevi had anything to do with the departure.

The Chemehuevi appear to have displaced the Mohave (speaking a Yuman language) in the Mojave Desert in eastern California and along portions of the western bank of the Colorado River (Lerch MS; also Kelly 1934:556; Rogers 1936:38; Kroeber 1959:262; Stewart 1968:13; and Van Valkenburgh 1976:228). Kroeber (1959:294) contended that the Chemehuevi recently had (in the late 1700s) moved south from the Las Vegas area and that this movement had occurred "within the desert." Only later (ca. between 1830 and 1840), owing to disruptions caused by warfare between the Mohave and the Halchidhoma, did the Chemehuevi occupy portions of the western bank of the Colorado River and become farmers (Kroeber 1959). An analysis (Kroeber and Kroeber 1973) of the Chemehuevi-Mohave hostilities (from Mohave sources) suggested that the Chemehuevi may have taken advantage of a Mohave decline to further their interests.

The Desert Mohave question was addressed by Lerch (MS) using J. P. Harrington’s field notes probably not available to Kroeber, and argued that the Desert Mohave lived in the Mojave Desert west of the Colorado River. Lerch then argued that the Chemehuevi invaded the Mojave Desert (also see Sutton 1986), and after much warfare, succeeded in killing nearly all of the Desert Mohave. Support for this contention is found in Harrington’s notes.

The Chemehuevi originally came from the north—they must have for the country up by n vagant Mtn. [Spring Mountain] is their story country. They used to be mountain people but kept drifting down south. The Desert-Mohaves lived at Providence Mts., Old Woman Mountain and clear out to Soda Lakes [about 80 miles west of the Colorado River]. The Chemehuevis fought these Desert-Mohaves in a long warfare of many years and killed nearly all of them, but a few escaped and lived among the River Mohaves. The reason for this fight was that the Desert Mohaves held the springs and the Chemehuevi wanted them [Harrington 1986:reel 146; frame 144].

The Chemehuevi seem to have moved east to the Colorado River from the desert (Kroeber 1959:294) and the River Mohave still were fighting the Chemehuevi at contact (also see Kroeber and Kroeber 1973). The Chemehuevi apparently also received some aid from other Southern Paiute to the north (Kroeber 1959:262). In the meantime the
Chemehuevi had succeeded in moving even further south, partly due to the decline of the Halchidhoma, whose apparent formidable military power earlier had blocked their progress (Kroeber 1959:262). Chemehuevi territory also extended on the eastern bank of the Colorado River (Laird 1976:7).

The Chemehuevi speak a Northern Uto-Aztecan (NUA) Numic language (Southern Paiute), related to the Kawaiisu to the west and the Nevada Shoshoni to the north. Groups to the south (Serrano, Cahuilla) also speak related languages (NUA, Takic).

External Relations. The Chemehuevi appear to have had generally poor relations with most of their neighbors, although "the people on the north and west [the Southern Paiute and Serrano respectively, both NUA linguistic groups] were generally friends [. . . however, the Chemehuevi] were never friendly with the Mohave and fought with them many times" (Van Valkenburgh 1976:230; but see Kroeber 1925:596). Van Valkenburgh (1976:230) further noted that: "The traditional foes of the Chemehuevi of the Providence and New York Mountains were a people called the Turat Aiyet or Land Mohave, i.e., "the Desert Mohave."

Social Organization. The Chemehuevi were organized into three primary groups (Laird 1976:8). The "northerners" (Tantlitsiwi) inhabited the northern portion of the western bank of the Colorado River down to Fort Mohave. The "southerners" (Tantivaitsiwi) inhabited the southern portion of the western bank of the Colorado River from just south of Fort Mohave to the Maria Mountains. The third subdivision consisted of the people inhabiting the desert away from (west of) the Colorado River, the "Desert People" (Tiiraniwiwi).

The Chemehuevi appear to have had two primary social divisions, Mountain Sheep and Deer, but it is not clear if these were moieties or large clans (Laird 1976:9, 10, 21). Further, it is not clear if these large divisions were exogamous but the smaller subdivisions, possibly clans or lineages, "were strictly so" (Laird 1976:21; but see Drucker 1937:27, element 1028). Matrilocality ordinarily was practiced and resulted in the formation of small bands (Laird 1976:9, 22).

The political organization was based on the band. Each band (niwiavi), regardless of size, had at least one spokesman (Laird 1976:22), larger bands had two. Powell and Ingalls (Fowler and Fowler 1971:104) identified at least five Chemehuevi "tribes" (likely bands), one of which (Tim-pa-shau'-wa-go-tsits) claimed the Providence Mountains and was led by a man named Wa-gu'-up. The population of the band was not reported but likely was less than 50.

A fairly strict sexual division of labor existed (Laird 1976:6). Women were responsible for all things having to do with the gathering of plants and the preparation of seeds and weaving. Men dealt with matters of hunting, although men made buckskin clothing for the entire family.
Subsistence. Few specifics are known about Chemehuevi subsistence, other than they primarily were hunters and gatherers. Large game (deer and mountain sheep) were hunted, along with rabbits and hares, rodents, lizards, and other game (Kroeber 1925:597). Plant foods were of great importance. Those used commonly included a variety of grass seeds, pinyon, and mescal (yucca).

Kroeber (1925:597) noted that the Chemehuevi "now and then farmed small patches where they could." The specific crops appear to have been "corn, beans, melons, and pumpkins" (Laird 1976:23), and wheat (Laird 1976:23, 109), obviously a late introduction. Crops were grown in the floodplain of the Colorado River with flood irrigation techniques (Laird 1976:8, 23).

Material Culture. Chemehuevi material culture was varied and complex. Unfortunately, little is known of it. Brief descriptions of some Chemehuevi material culture was presented in Kroeber (1925), Van Valkenburgh (1976), and Laird (1976).

Basketry was described by Kroeber (1925:597) as including twined "Caps, triangular trays, and close-woven carrying baskets... with an inclination to paint designs on instead of working them in." Willow (Salix) was the most commonly used plant for the construction of baskets (Laird 1976:106).

Although Kroeber (1925:597) noted the presence of some pottery among the Chemehuevi, he characterized them (1925:597) as "a tribe that made baskets and not pottery."

The Chemehuevi constructed four types of structures, depending on the purpose and time of year. A large flat house (takaganí; also known as a shade house or havaganí) was constructed at the site of a mourning ceremony (Laird 1976:42-43). The structure consisted of four notched posts with a flat roof, with "another 'roof' sloping downwards on the west side to provide shade in the afternoon" (Laird 1976:43). A family sometimes built a smaller version of such a structure for their own use (Laird 1976:246, note 18).

A small temporary circular brush house (tcuupik'ányì) was built by leaning poles together at the top to form a tepee-like framework. Such a structure was easily and quickly made as the poles were not driven into the ground. Brush, never skins, was used to cover the structure (Laird 1976:104-105).

A more carefully constructed house was the samarók'waí (or samarók'waík'ányì), intended to last several weeks or months (Laird 1976:105). The structure was built by embedding willow poles into the earth in a circular pattern then twisting the opposite members so that a dome framework some six feet high was constructed. This framework then was covered with brush, preferably sage or arrowweed (Laird 1976:105).

An earth house (tivik'ányì) was built "for old people or by families with the firm intention of wintering in one locality" (Laird 1976:105). The structure was built by
implanting four (possibly eight) posts, placing a layer of brush against the posts, then filling the thatch with earth (Laird 1976:105). Presumably, this structure would have to be fairly large in order to accommodate a family.

Other Groups

The eastern Mojave Desert undoubtedly was utilized by a variety of ethnographic groups, including the Chumash, Mohave, Kawaiisu, and Kitanemuk. Unfortunately, eastern Mojave Desert groups are mentioned infrequently in the ethnographic literature.

ARCHAEOLOGICAL BACKGROUND

A fairly small number of formal archaeological investigations have been conducted in the eastern Mojave Desert. As a result, few specific data on the regional prehistory currently are available. General summaries are present in King and Casebier (1976), Warren (1984), and Warren and Crabtree (1986). The following generalized periods are presented to provide a temporal framework.

Paleo-Indian (to 10,000 B.P.)

There have been a variety of terms used to classify known and postulated early human occupations in the Mojave Desert and the Arid West. These include Lithic (Willey and Phillips 1958), Paleo-Indian (e.g., Davis 1978; Chartkoff and Chartkoff 1984), Early Systems Period (e.g., Stickel and Weinman-Roberts 1980), Early Humans (e.g., Davis et al. 1980), and the Pleistocene Period (e.g., Warren et al. 1980). Warren and Crabtree (1986) began their chronology with the terminal Pleistocene, placing fluted point material into the beginning of their Lake Mojave Period (1986:184). At this point in our understanding of the record, the term Paleo-Indian is used as a catch-all to refer to material belonging to the Fluted Point Tradition or earlier, including any remains belonging to a hypothesized "Pre-projectile Point Period" (also see Dicauze 1984).

The earliest agreed upon archaeological culture in the New World is Clovis, typified by a particular type of fluted projectile point. The general view is that there are no projectile point forms antecedent to Clovis in the New World and that any New World archaeological remains dating prior to Clovis must belong to a "Pre-projectile Point Period" (see Krieger [1964], Willey [1966], and Davis [1978] for reviews of the arguments for an "early" human occupation of the New World).

Immediately following a hypothesized "Pre-projectile Point Period," that possibly could include Clovis antecedents, is the Fluted Point Tradition consisting of Clovis (no Folsom points are known from California; Moratto 1984:87) and some other possible (i.e., unidentified) fluted points. These remains are generally viewed as representing a Big Game Hunting Tradition exploiting Pleistocene megafauna (e.g., Willey 1966; Davis 1978; Chartkoff and Chartkoff 1984; Moratto 1984).
There have been a variety of claims for archaeological sites or assemblages, or purported archaeological sites or assemblages, in the Mojave Desert dating to the Pre-projectile Point Period. There is no evidence to even suggest the presence of such early materials in the Providence Mountains area.

**The Fluted Point Tradition.** Evidence for occupation by people possessing a fluting technology is limited to a relatively few finds of fluted Clovis or Clovis-like projectile points. These finds are widely distributed across the Mojave and are rarely dated by other than typological means. While there are several isolated Clovis points known from the Mojave Desert and the immediately surrounding area, only one major Clovis "occupation" site(s) is known, at Lake China.

Four examples of isolated Clovis projectile points have been documented from the (primarily central) Mojave Desert (Davis and Shutler 1969; Brott 1966; Glennan 1971; Sutton and Wilke 1984) and all have been dated based on their typological similarity with dated specimens from the Plains. Only one of the four localities has been reinvestigated more recently.

An obsidian Clovis point was collected (by Malcolm Rogers in 1936) from the Tiefort Basin (CA-SBR-5350). The point was noted by Davis and Shutler (1969:Fig. 3f), by Brott (1966:170), by Glennan (1971:29), and most recently by Sutton and Wilke (1984). Sutton and Wilke (1984:115) identified the geologic source of the material (the Coso Volcanic Field) and they noted that the flute channels had purposefully been scarred, perhaps to facilitate the use of an adhesive (see Fagan 1984:2-3).

Further work recently was undertaken in the Tiefort Basin but no additional Clovis points were recovered, and the bulk of the occupation of the site appears to date from the Lake Mojave Period (Jenkins 1987).

Except for the fair possibility of a considerable Clovis occupation at Lake China (Davis 1978), Clovis material is quite rare in the Mojave Desert. This could indicate several possibilities: 1) there was a minor Clovis occupation of the Mojave Desert; 2) Clovis material has not yet been found in quantity due to research design flaws (e.g., regarding geomorphology); and 3) the early material was destroyed during the Holocene.

Typically viewed as reflecting a Big Game Hunting Focus, the Fluted Point Tradition more likely represents a particular diagnostic tool (projectile point) whose importance to the overall subsistence pattern has been overstated (cf. Davis and Panlaqui 1978a:31, 1978b:81-83). Clovis peoples undoubtedly utilized a great variety of resources, including plants and small game, and occupied a diversity of ecosystems. The work at Lake China (Davis 1978) has brought out this important point.

**General Holocene Chronology**

The following periods generally are defined by marker artifacts, primarily projectile points, thought to be temporally sensitive. These projectile points represent three major
weapons systems: the thrusting spear; the atlatl; and the bow and arrow. It is clear that thrusting spears remained in the cultural inventory of native peoples until historic times, thus perhaps diminishing their utility as temporal markers.

It has been argued (Flenniken and Wilke 1989) that atlatl dart projectile points (e.g., Pinto and Elko series) have no real temporal significance. They argued that because of rejuvenation of broken points, archaeologically recognized "styles" could change, and so confusing the temporal placement of the points. Thus, they proposed that atlatl dart points should not be considered temporally sensitive within dart point times.

With this potential problem in mind, the following traditional view of Holocene chronological periods is presented to provide some background in which to place the materials from the Providence Mountains.

Lake Mojave (10,000 to 6,000 B.P.). Following the Fluted Point Tradition are more generalized remains falling under the broad designation of the Western Lithic Co-tradition (Davis et al. 1969) or the Western Pluvial Lakes Tradition (Bedwell 1973). Included in these definitions are the Playa and Malpais cultures (Rogers 1939), the San Dieguito complex (e.g., Rogers 1966), and Lake Mojave (e.g., Campbell et al. 1937; Wallace 1962; Warren and Crabtree 1988). The designation Lake Mojave is preferred to refer to this cultural complex as it was clearly oriented toward the exploitation of Late Pleistocene/Early Holocene lakes and was first identified at Lake Mojave by Campbell et al. (1937).

The Lake Mojave Period is associated with the early Holocene occupation of lakeside environments. The hallmark of the period is the presence of Lake Mojave or Silver Lake projectile (thrusting spear ?) points found in association with old lakeshores. Hunting and utilization of lacustrine resources presumably formed the subsistence base.

While no Lake Mojave Period sites are known in the immediate vicinity of the Providence Mountains, a number of Lake Mojave Period sites are known from the shore of Pleistocene Lake Mojave, located just to the northwest. Other sites possibly dating to this time also are in the general vicinity (e.g., Davis 1973).

One such possible site consists of a large grouping of rock cairns in the foothills above the southern shore of Lake Mojave (Taylor et al. 1987). Few artifacts were associated with the cairns and no temporally diagnostic artifacts were recovered. Based on the location of the site (on a gravel terrace) and the relatively heavy patina present on the rocks, Taylor et al. (1987:109) suggested that the site dated to the Lake Mojave Period. They further speculated (1987:98-99) that the function of the site may have been as a water control device, perhaps for agricultural activities.

The lack of chronometric data or firm geomorphological association means the Lake Mojave Period age of the site cannot be substantiated, although it remains plausible since the site certainly appears "old." The functional interpretation formulated by Taylor et al. (1987) must be rejected as not plausible, as domestication did not take place in the
New World until after the assumed age of the site, even if later than Lake Mojave. Some other explanation must be proposed.

**Pinto (6,000 to 4,000 B.P.).** The Pinto Period follows the Lake Mojave Period and is characterized by the presence of "Pinto" projectile points (presumably used on atlatl darts). The definition of "Pinto" points still is not agreed upon (e.g., Thomas 1981; Vaughan and Warren 1987) and so using Pinto projectile points as temporal markers is problematical. The Pinto Period reflects an occupation of the desert after the desiccation of the lakes and presumably is related to the use of stream and spring habitats.

Pinto appears to be a broadly generalized cultural pattern developed in response to the desiccation of the Pleistocene lakes and climatic movement toward a more xeric environment. It is possible that Pinto developed directly from Lake Mojave at the end of the Pleistocene and ushered in the Archaic in the Mojave Desert. No Pinto materials are known from the immediate vicinity of the project area.

**Gypsum (4,000 to 1,500 B.P.).** The Gypsum Period is marked by the presence of Elko series projectile points (dart points), although Humboldt Concave Base points also occur. Very little is known regarding the subsistence base or social organization of Gypsum populations as few sites dating to that period have been excavated.

Archaeological remains dating from the Gypsum Period are relatively uncommon in the Mojave Desert, although Elko series points appear to have been recovered from the lower levels of Rustler Rockshelter to the northeast of the SRA (Davis 1962; Warren 1984:Fig. 8.19) and possibly at Mitchell Caverns (Pinto 1989). It is not clear if sites from this period are rare or underrepresented in the known archaeological record. Locating and examining such sites is an important research goal.

**Rose Spring (1,500 to 800 B.P.).** Warren (1984:420) identified what is herein called the Rose Spring Period as the Saratoga Springs Period (originally proposed by Wallace [1962]). Rose Spring is used in this report due to the diagnostic projectile point series (arrow points), originally named at Wagon Jack Shelter (Heizer and Baumhoff 1961:123), based on the materials from the Rose Spring site (Lanning 1963). The Rose Spring site currently is being reinvestigated by Yohe (1988a, 1988b).

Sites dating from this period are fairly common in the Mojave Desert, but few have been investigated. Rose Spring projectile points appear to reflect the introduction of the bow and arrow, replacing the dart (e.g., Elko series) points used in conjunction with the atlatl.

**Late Prehistoric (800 B.P. to Historic Contact).** The Late Prehistoric Period (Warren’s [1984:424] Protophistic Period), is characterized by Desert series (Desert Side-notched and Cottonwood Triangular) projectile points (and ceramics in some areas). The period presumably reflects the late prehistory of the ethnographic groups inhabiting the region, although this assumption may not always have merit. Southwestern Pueblo groups likely were present in the eastern Mojave during this time but their influence is
unknown. Puebloan materials are known from the Cronese Lakes (Drover 1979), the Mojave Sink (Warren 1984), and Afton Canyon (Schneider 1989).

Another important question is the length of time the Chemehuevi (speaking a Numic language) have occupied the central and eastern Mojave Desert and what their relationship with the Serrano (Vanyume) was. Although in control of the eastern Mojave at the time of historic contact, the Chemehuevi apparently are recent entrants (Sutton 1986, 1987). Understanding who they replaced and how it was done is an important research goal.

The Late Culture History of the Providence Mountains

Based on the excavations at Rustler Rockshelter (Davis 1962) and Southcott Cave (Donnan 1964; also see Sutton et al. 1987), Donnan (1964) formulated a basic culture history (chronology) for the Providence Mountains (not particularly different from that outlined above). The latter part of this chronology was called the Providence Mountains Complex (see Davis 1962) and included three phases: I) a pre-ceramic Yuman (to A.D. 800); II) a ceramic Yuman (ca. A.D. 800-1400); and III) a Shoshonean Horizon (A.D. 1400-1850). Such titles clearly are linguistic in meaning but whether the archaeology reflects linguistic reality is unclear (also see Warren 1984:392-393). Warren (1984:393) did not believe that a pre-ceramic Yuman phase was represented at Rustler Rockshelter.

Warren (1984:395) noted that the cultural sequence of the Providence Mountain area diverged "from that of the northeastern Mojave Desert at the end of Amargosa I" (early Rose Spring Period), as defined by Rogers (1939, 1945). Warren (1984:395) believed that

The Providence Complex, possibly preceded by a "nonceramic Yuman" assemblage, appears to represent the Hakataya influence in the southeast Mojave Desert.

ARCHAEOLOGICAL RESEARCH IN THE PROVIDENCE MOUNTAINS

In comparison with nearby areas, the Providence Mountains region is fairly well known. Formal archaeological investigations have been conducted at Rustler Rockshelter (Davis 1962), Southcott Cave (Donnan 1964; Sutton et al. 1987), in the general New York-Providence-Granite Mountains region (True et al. 1966; Meister et al. 1966), Wild Horse Canyon (Desautels and McCurdy 1969), Counsel Rocks (Cameron and Rafter 1983), Cave No. 5 (Sutton and Yohe 1988), Mitchell Caverns (Pinto 1989), and several other sites.
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BIOLOGICAL BACKGROUND

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1. Zzyzx. The artificial ponds at Zzyzx were developed from the original Soda Springs. Their configurations have been changed several times, most recently by the Bureau of Land Management. However, the large pond with the water fountain is "Lake Tuendae" of Doc Springer's health resort that existed from the mid 1940's to 1974. The edges of the ponds support a growth of cat-tail (Typha sp.) that provides habitat for marsh wrens (Cistothorus palustris). American Coots (Fulica americana) also are resident on the ponds, and a variety of migratory waterfowl may visit them. During evenings in the warm seasons, several species of bats may be seen flying over the water's surface as they forage for insects. Bullfrogs (Rana catesbeiana) were introduced many years ago and, together with the native Pacific treefrogs (Hyla regilla), they may produce an enjoyable serenade on spring and summer evenings. The small to medium-sized fish in the ponds are Mojave chubs (Gila mojavesis). The Mojave chub is an endangered species of minnow endemic to the Mojave River. Due to habitat changes and the introduction of a closely related chub species from coastal California, populations of the Mojave chub have dwindled. The population at Zzyzx is one of only two or three genetically pure populations that remain.

The "streets" of Zzyzx are lined by tamarisk trees (Tamarix aphylia). These hardy trees, which are native to Eurasia and also known as Athel, frequently are used as windbreaks in desert regions of the southwestern United States. Another species of tamarisk, the shrubby saltcedar (T. chinensis), is scattered around the ponds at Zzyzx. This introduced east Asian shrub has become widely established at water sources in our deserts where it aggressively competes with native plants. Saltcedar is regarded as a serious pest because a stand of the transpiring shrubs can suck a spring or watercourse dry and deprive both native plants and wildlife of a water supply. On the grounds of Zzyzx, one may expect to see such common reptile species as the zebra-tailed lizard (Callisaurus draconoides) and side-blotched lizard (Uta stansburiana). Gopher snakes (Pituophis melanoleucus) and common kingsnakes (Lampropeltis getulus) occasionally may be seen here, though they are more likely to occur on the nearby rocky hillsides. (Keep in mind that desert reptiles are most active during the spring months and may be difficult to find at other times of the year. Also, note that most small mammals of the desert, except for the ground squirrels and rabbits, are primarily nocturnal in their activity patterns.)

The rocky hillsides of the Seda Mountains just west of Zzyzx are sparsely vegetated with a Creosote Bush Scrub plant community. The indicator species for this community, creosote bush (Larrea tridentata) and white bursage (Ambrosia dumosa), are mixed here with a variety of other shrubs and springtime annuals. Finding a preferred habitat on these rocky hillsides are a number of desert animals, including the desert woodrat (Neotoma lepida), canyon mouse (Peromyscus erinaceus), rock wren (Salpinctes obsoletus), desert collared lizard (Crotaphytus insularis), chuckwalla (Sauromalus obesus), and speckled rattlesnake (Crotalus mitchelli). Driving up the sloping alluvial deposit toward I-15, we may see some conspicuous whitish shrubs along the road. These are desert holly (Atriplex hymenelytra), a species of saltbush with unusually large leaves shaped like holly leaves. Along the braided washes in this area are a few small smoke trees (Dalrea spinosa), so called because the dense mass of slender branches with their covering of gray pubescence makes the trees look like puffs of smoke from a distance. Smoke trees are restricted to washes because germination of their seeds can occur only after the
hard seed coats are broken by pebbles rolling in a flowing wash bed. Mammals commonly seen while driving through this area are the white-tailed antelope ground squirrel (Ammospermophilus leucurus) and black-tailed hare (Lepus californicus).

2. VICINITY OF BAKER. Along I-15 and Kalbaker Road we see a typical example of the Creosote Bush Scrub community that covers vast areas of the Mojave Desert, especially the valleys, rolling hills and bajadas, to an elevation of at least 3,500 feet. The dark green leaves and scraggly, dark grey branches of the creosote bush make it easy to recognize from a distance. Creosote bush (also known as greasewood) is named for its strong, resinous odor that is suggestive of creosote. Its sweet, resinous scent is particularly noticeable after a rain. Creosote bush is the most widespread and successful shrub in the arid regions of North America, showing a composite of several adaptations that have independently evolved in many desert shrubs and trees. For example, its leaves are small to reduce the surface area through which water may be lost to the atmosphere. A waxy leaf surface further reduces evaporation. Two root systems are present—a tap root that may be 40 feet long obtains water from deep in the ground while numerous small surface roots enable the plant to immediately utilize precipitation. Several years ago, it was discovered that some creosote bushes may be more than 10,000 years old and, thus, the oldest living things in the world. This is possible because, as old creosote bushes die, new ones sprout from the radiating surface roots producing a ring of younger bushes. As these die in turn, they give rise to a larger ring of bushes, and the process may continue for many generations. Each bush is connected by its roots to its neighbors in the ring and, of course, each is a clone of the original parent bush. Creosote bush clone rings are common in some areas and the largest known ring, called the "King Clone", is about 60 feet in diameter.

Although monotonous in appearance, the Creosote Bush Scrub community may produce colorful displays of wildflowers (annuals) in March and April of years that receive adequate amounts of winter precipitation. However, few of the people speeding on their way to Las Vegas realize that the creosote bush scrub community also is home to a great diversity of animals. In addition to the antelope ground squirrel and black-tailed hare (California jackrabbit), mammals one may find here include the deer mouse (Peromyscus maniculatus), southern grasshopper mouse (Onychomys torridus), several species of pocket mice (Perognathus spp.) and kangaroo rats (Dipodomys spp.), desert cottontail (Sylvilagus auduboni), kit fox (Vulpes macrotis), coyote (Canis latrans), and bobcat (Felis rufus). Birds that occur on or near the ground are the greater roadrunner (Geococcyx californianus), black-throated sparrow (Amphispiza bilineata), sage sparrow (Amphispiza belli), and burrowing owl (Athene cunicularia). Soaring overhead may be the common raven (Corvus corax), red-tailed hawk (Buteo jamaicensis), ferruginous hawk (Buteo regalis), prairie falcon (Falco mexicanus), and golden eagle (Aquila chrysaetos). In addition to the side-blotched and zebra-tailed lizards, and gopher and common kingsnakes, reptiles occurring here include the desert iguana (Dipsosaurus dorsalis), common leopard lizard (Gambelia wislizeni), western whiptail (Cnemidophorus tigris), glossy snake (Arizona elegans), coachwhip (Masticophis flagellum), Mojave rattlesnake (Crotalus scutulatus), and desert tortoise (Xerobates agassizii). Due to the cumulative impacts of many factors (eg. livestock grazing, off-highway vehicle use, agricultural developments, mining, road kills, vandalism, raven predation, and disease), populations of the desert tortoise have declined substantially and the species recently has been listed as threatened.

3. Cima Lava Flows. Here we are still in the Creosote Bush Scrub community and can see how it is developed on and among the lava flows. The species of vertebrate animals expected at this site are the same as those on the rocky hillsides near Zzyzx. However, the chuckwallas and collared lizards will be much darker in color here to blend in with the dark basaltic lava.
4. VICINITY OF THE MARL I AND KELSO MOUNTAINS. In this area we may see a
transition from the Creosote Bush Scrub community to a Joshua Tree Woodland community. The
Joshua tree (Yucca brevifolia) may be considered an indicator species for the Mojave Desert,
though it does not occur throughout this desert and is not entirely restricted to it. (The species
also occurs in parts of the Sonoran Desert of west-central Arizona.) This plant is found on
well-drained soils of the Mojave’s periphery and interior at elevations of 2,000 to 6,000 feet.
It generally does best at elevations of 3,000 to 4,500 feet where the woodland community may
develop. In the Eastern Mojave Desert, where we are, we see the variety Yucca brevifolia
jaegeriana, named in honor of the famous desert naturalist, Dr. Edmund C. Jaeger. This variety
of Joshua tree is characterized by relatively short leaves, dense branching, and small size
compared to Joshua trees of the Western Mojave.

The Joshua Tree Woodland that covers much of the nearby Cima Dome area is the most extensive
and dense example of this community seen anywhere. In addition to the Joshua tree, we may find
two other species of yucca here — Spanish bayonet (Yucca beccata) and Mojave yucca (Yucca
schidigera). Spanish bayonet is a rather low-growing yucca with long bluish leaves while
Mojave yucca usually has trunks up to several feet tall with occasional branches and
yellowish-green leaves. Mixed in with the yuccas are a number of other desert perennials
commonly found at moderately high elevations. These include Great Basin sagebrush (Artemisia
tridentata), antelope bitterbrush (Purshia glandulosa), pygmy cedars (Pseudocyphellum schottii),
bladder sage or paper-bag bush (Salazaria mexicana), and Mormon tea (Ephedra sp., a shrubby,
leafless conifer). It is the yuccas, however, that give character to the community and provide
for the needs of a number of desert animals.

Except for certain reptiles (the desert iguana, zebra-tailed lizard, leopard lizard, and desert
tortoises), which probably find this area a bit too high, most of the vertebrate animals occurring
in the Creosote Bush Scrub community also may be expected to occur here. In addition there are
others that specifically utilize the yuccas in some way. For example, the desert night lizard
(Xantusia vigilis) generally requires the fallen leaves and trunks of yuccas for shelter. The
desert spiny lizard (Sceloporus magister) commonly climbs on the yuccas, foraging for insects
and finding lookout points from which to survey its territory. The desert woodrat (also known
as the packrat for its habit of carrying objects to decorate its nest) often builds its nest of sticks
and cactus joints among the trunks and lower leaves of yuccas, and it uses the leaves as sources
of food and water. Scott’s oriole (Icterus parisorum) uses long fibers peeled from yucca leaf
margins to weave an intricate, pendulant nest among the yucca leaves. The ladder-backed
woodpecker (Picoides scalaris) carves out a hole in the trunk of a dead yucca for its nest, and a
vacated woodpecker hole may be taken over by the ash-throated flycatcher (Myiarchus cinerascens). The yuccas also have a close symbiotic relationship with yucca moths (Tegiptilia
spp.). Each species of yucca is pollinated by a particular species of Tegiptilia. In return, the
seed pods of the yuccas provide a home and food for the developing moth larvae, which eventually
fall to the ground, pupate and wait for the following spring when they will emerge as adult moths
to complete the cycle.

5. KELSO DUNES. Although it seems unlikely, water often is stored in the sand of dunes at
depths of a few inches to a few feet for long periods. Due in part to this supply of water, more
than 100 different species of plants live on or near the Kelso Dunes. Common perennials include
the creosote bush, salt bush (Atriplex sp.), pincushion cactus (Cylindropuntia), and galleta grass
(Hilaria rigida). A much greater variety of annuals may appear in the spring, but the species
represented and their abundance in a given year will depend on the amount and timing of the
preceding winter’s rains. Following a good winter, annual flowers may cloak the periphery of
the dunes in late March and April with a spectacular display of color. Especially common species include desert primrose (Calanthenella deltoideae), sand verbena (Abronia sp.), and desert lily (Hesperocallis undulata).

Although rather inhospitable to vertebrate animals, at their fringes the dunes provide habitat for several species of reptiles and mammals. These include the Mojave fringe-toed lizard (Uma scoparia), zebra-tailed lizard, western whiptail, desert iguana, desert horned lizard (Phrynosoma platyrhinos), sidewinder (Crotalus cerastes), shovel-nosed snake (Chionactis occipitalis), glossy snake, desert kangaroo rat (Dipodomys deserti), antelope ground squirrel, black-tailed hare, kit fox, and coyote. The Mojave fringe-toed lizard and sidewinder are sand-dwelling specialists and may be found even in the more central parts of the dune field. The desert kangaroo rat occurs only in areas of soft sand, but it is further restricted to sites where there are some perennial plants to provide food and shelter. We will see its conspicuous burrows here. A number of beetles and other insects also occur on the dunes and serve as a source of food for the lizards. If the day is not windy, tracks of many of the dune animals may be seen clearly on the surface of the sand. Early morning is a particularly good time to look for tracks, and sometimes one can interpret the story of the previous night's happenings (eg. a kit fox stalks and captures a kangaroo rat, or a sidewinder searches for a place to partially bury itself and wait for passing prey).

6. MITCHELL'S CAVERNS AND WILDHORSE CANYON. On rocky slopes at midlevel elevations in the Providence Mountains, we should find a high desert plant community characterized by a variety of shrubs, cacti, and yuccas. This plant association sometimes is called a "devil's garden". Among the cacti we may see are buckhorn cholla (Opuntia acanthocarpa), silver cholla (Opuntia schizocarpa), pencil cholla (Opuntia ramosissima), beavertail cactus (Opuntia basilaris), old man cactus (Opuntia engelmannii), prickly pear cactus (Opuntia sp.), barrel cactus (Ferocactus acanthodes), hedgehog cactus (Echinocereus sp.), and nipple cactus (Mammillaria tetrancistra). The vertebrate fauna here is essentially the same as in the Joshua Tree Woodland, plus some of the rock specialists from lower elevations. Also, we are most likely to find the cactus wren (Campylorhynchus brunneicapillus) here because it prefers the protection of the chollas for its nests.

7. MID HILLS CAMPGROUND. In the Mojave Desert, Pinyon-Juniper Woodland communities generally occur at elevations of 4,500 to 7,000 feet. The species of pine involved usually is the one-leaf pinyon (Pinus monophylla), but two species of juniper commonly are co-dominants with the pinyon. Which juniper species is present depends on the location. Around the western margin of the Mojave, it is the California juniper (Juniperus californica). The Pinyon-Juniper Woodland community in the Mid Hills is dominated by one-leaf pinyon and Utah juniper (Juniperus osteosperma), and in the campground the trees of both species are of unusually large size and full form. As understory plants, we find the Great Basin sagebrush and some other shrubs characteristic of even cooler, moister habitats. Because they occur at moderately high elevations and generally receive 15-20 inches of rainfall annually, Pinyon-Juniper Woodlands are not true desert communities. Rather, they are essentially montane islands of a more mesic biota surrounded by desert. They probably represent relics of the mixed woodlands and grasslands that covered much of what is now desert during the Pleistocene Epoch that ended about 10,000 years ago.

Few, if any, strictly desert species of vertebrates will be found here. Most of the reptiles, mammals and birds are the wide-ranging species that occur also in coastal and/or desert habitats, eg. side-blotched lizard, western fence lizard (Sceloporus occidentalis) western
PLANT LIST
SODA SPRINGS, MOJAVE DESERT CALIFORNIA

+ = Common names from Edmund Jaeger's Desert Wild Flowers
* = Common names from LeRoy Abrám's Illustrated Flora of the Pacific States

AIZOACEAE CARPET-WEED FAMILY
Semenium verrucosum *Western Sea-purslane
Tranthera portulacastrum *Horse-purslane, +Lowland Purslane

AMARANTHACEAE AMARANTH FAMILY
Tidestromia oblongifolia *Arizona Honey-sweet, +Honey-sweet

APOCYNACEAE DOGBANE FAMILY
**Nerium oleander +Oleander

ARECACEAE
**Phoenix reclinata Senseless Date Palm
**Washingtonia filifera +Desert Palm, California Fan Palm
**Washingtonia robusta Mexican Fan Palm

ASCLEPIADACEAE MILKWEED FAMILY
Enchloeias erosa *Desert Milkweed
Sarcostemma cymbaloides hartwegii *Climbing-milkweed, Townula, +Purple
Climbing-milkweed

ASTERACEAE SUNFLOWER FAMILY
Ambrosia dumosa *White Bur-sage, +Burrobush
Asphodelus fremontii spinosus *Cheffbush, +Etyelia
Aster subulatus ligulatus +Ela Aster
Aster intricusus *Shrubby Alkali-Aster
Bailey's pauciradiata *Colorado Desert-marigold, +Lax-flower
Baileya pleniradiata +Woolly-marigold
Bebbia juncea +Sweetbush
Brickellia incana +Woolly Brickellia, Brickellbush, +Woolly Brickellia
Chenactis carphoclinia +Pebble-pincushion
Chenactis fremontii +Fremont-pincushion
Chenactis steviolides *Broad-flowered Chenactis, +Estate-pincushion
Encelia farinosa +Brittlebush, Encinco
Encelia frutescens +Bush Encelia, +Rayless Encelia
Eriophyllum ambiguum +Woolly-daisy, +Yellow-frocks
Filago depressa +Dwarf Filago
Geraea canescens +Desert-sunflower
Haliartus annuus jaegeri *Common Sunflower, +Annual Sunflower
Hymenocles saisola saisola *White Burrobush, +Cheesebush
Isocoma venetus vernonoides *Coastal Isocoma
Machaeranthera arida +Silver Lake-daisy
Malacothrix coulteri +Snakes-head
Pectis papposa +Chinch-weed
Prenanthella exigua *Annual Lygodesmia, +Eqbertia
RESEDAEAE  MIGNONETTE FAMILY
Oligomeris linifolia *Oligomeris, *Linear-leaved Camphor

Rubiaceae
Galium stellatum  eremicum *Desert Bedstraw

SAURURACEAE  LIZARD’S-TAIL FAMILY
Anemonopsis californica *Yerba Mansa

"ROPHULARIACEAE  FIGWORT FAMILY

Solanaceae  POTATO FAMILY
Physalis crassifolia crassifolia *Thick-leaved Ground-cherry

Tamaricaceae  TAMARIX FAMILY
**Tamarix aphylla Tamarisk, Achel **Tamarix ramosissima Tamarisk

TYPHACEAE  CAT-TAIL FAMILY
Typha domingensis *Narrow-leaved Cat-tail

VISCACEAE  MISTLETOE FAMILY
Phoradendron californicum *California Mistletoe, *Desert Mistletoe

ZYGOPHYLLACEAE  CALTROP FAMILY
Larrea divaricata tridentata *Cresote Bush, *Cresote Bush, Covillea

** Introduced Species

CAPARACEAE  CAPPER FAMILY
Cleome obtusifolia *Bushy Cleome, *Bushy Capper

CARYOPHYLLACEAE  CHICKWEED FAMILY
Achyranthes cooperi *Onyx Flower, *Frost-mat, Chaff-nail

CHENOPODIACEAE  GOOSEFOOT FAMILY
Cycloloma atriplicifolium *Winged-pigweed Nitrophila occidentalis *Nitrophylla, *Alkali-weed Salicornia utahensis *Glasswort


CONVOLVULACEAE  MORNING-GLORY FAMILY
Cressa truxillensis minima Alkali Weeds, *Cressa Cuscuta denticulata *Desert Dodder, Toothed Dodder, *Toothed Dodder

CUCURBITACEAE  GOURD FAMILY
Cucurbita palmera *Palmate-leaved Gourd, Coyote Melon, *Palmate-leaved Gourd

CYPERACEAE  SEDGE FAMILY
Scirpus americanus *Olney’s Bulrush

EUPHORBIACEAE  SPURGE FAMILY

FABACEAE  PEA FAMILY

**P wichtigia aculeata *Palo Verde Prosopis glandulosa torreyana *Mesquite Prosopis pubescens *Tornillo, Screw-bean Prosopis spinosa *Smoke Tree
<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
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<tr>
<td>Fringillidae/Emberizidae</td>
<td>Chipping Sparrow, Black-Chinned Sparrow, Harris' Sparrow, White-Crowned Sparrow, Golden-Crowned Sparrow, Lincoln's Sparrow, Song Sparrow</td>
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<tr>
<td>Podicipedidae</td>
<td>Horned Grebe, Eared Grebe, Western Grebe, Pied-Billed Grebe</td>
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<td>Pelecanidae</td>
<td>White Pelican</td>
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<td>Phalacrocoracidae</td>
<td>Double-Crested Cormorant</td>
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<tr>
<td>Ardeidae</td>
<td>Great Blue Heron, Green Heron, Little Blue Heron, Cattle Egret, Great Egret, Snowy Egret, Black Crowned Night Heron, American Bittern</td>
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<td>Threskiornithidae</td>
<td>White-Faced Ibis</td>
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<td>Anatidae</td>
<td>Canada Goose, Ross' Goose, Mallard, Gadwall, Pintail, Green-Winged Teal, Blue-Winged Teal, Cinnamon Teal, European Widgeon, American Widgeon, Northern Shoveler, Wood Duck, Ring-Necked Duck, Canvasback, Lesser Scap, Bufflehead, Ruddy Duck, Hooded Merganser, Common Merganser</td>
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<td>Cathartidae</td>
<td>Turkey Vulture</td>
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<td>Accipitridae</td>
<td>Northern Goshawk, Red-Tailed Hawk, Cooper's Hawk, Sharp-Shinned Hawk, Swainson's Hawk, Rough-Legged Hawk, Ferruginous Hawk, Golden Eagle, Bald Eagle, Northern Harrier</td>
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<td>Pandionidae</td>
<td>Osprey</td>
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<td>Falconidae</td>
<td>Prairie Falcon, Pigeon Hawk, American Kestrel</td>
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<td>Phasianidae</td>
<td>Gambel's Quail, Chukar</td>
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<td>Charadriidae</td>
<td>Killdeer</td>
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<tr>
<td>Scolopacidae</td>
<td>Common Snipe, Spotted Sandpiper, Solitary Sandpiper, Willet, Greater Yellowlegs, Lesser Yellowlegs</td>
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TROGLODYTIDAE
Bewick's Wren
Cactus Wren
Long-Billed Marsh Wren
Rock Wren

NIMIDAE
Northern Mockingbird
Cathbird
Le Conte's Thrasher

TURIDAE
American Robin
Swainson's Thrush
Western Bluebird
Townsend's Solitaire

Sylviiidae
Black-Tailed Gnatcatcher
Ruby-Crowned Kinglet

NOTACILLIDAE
Water Pipit

BOMBYCILLIDAE
Cedar Waxwing

PTILOGONATIDAE
Phainopepla

Laniidae
Loggerhead Shrike

STURNIDAE
Starling

VIREONIDAE
Bell's Vireo
Grey Vireo
Solitary Vireo

Parulidae
Nashville Warbler
Lucy's Warbler
Yellow Warbler
Black-Throated Gray Warbler
MacGillivray's Warbler
Yellowthroat
Yellow-Breasted Chat
Wilson's Warbler
American Redstart

Ploceidae
House Sparrow

Icteridae
Bobolink
Western Meadowlark
Yellow-Headed Blackbird
Red-Winged Blackbird
Hooded Oriole
Northern Oriole
Brewer's Blackbird
Great-Tailed Grackle
Common Grackle
Brown-Headed Cowbird

Thraupidae
Western Tanager
Hepatic Tanager

Fringillidae/Emberizidae
Rose-Breasted Grosbeak
Black-Headed Grosbeak
Indigo Bunting
Lazuli Bunting
Cassin's Finch
House Finch
Lesser Goldfinch
Brown Towhee
Vesper Sparrow
Lark Sparrow
Black-Throated Sparrow
Sage Sparrow
Oregon Junco

Scolopacidae (continued)
Pectoral Sandpiper
Least Sandpiper
Long-Billed Dowitcher
Semipalmated Sandpiper
Sanderling

Recurvirostridae
American Avocet
Black-Necked Stilt

Phalaropidae
Wilson's Phalarope
Northern Phalarope

Laridae
Herring Gull
Ring-Billed Gull
Forster's Tern
Black Tern

Columbidae
Band-Tailed Pigeon
Rock Dove
White-Winged Dove
Mourning Dove

Cuculidae
Road Runner

Tytonidae
Barn Owl

Strigidae
Great Horned Owl

Caprimulgidae
Common Poorwill
Lesser Nighthawk

Apodidae
White-Throated Swift

Tachycinetae
Costa's Hummingbird
Broad-Tailed Hummingbird

Alcedinidae
Belted Kingfisher

Picidae
Common Flicker
Yellow-Bellied Sapsucker
Ladder-Back Woodpecker

Tyrannidae
Eastern Kingbird
Western Kingbird
Cassin's Kingbird
Ash-Throated Flycatcher
Black Phoebe
Say's Phoebe
Trail's Flycatcher
Gray Flycatcher
Western Wood Pewee
Olive-Sided Flycatcher
Vermilion Flycatcher

Alaudidae
Horned Lark

Mirounga

Violet-Green Swallow
Tree Swallow
Bank Swallow
Rough-Winged Swallow
Barn Swallow
Cliff Swallow

Corvidae
Common Raven
Pinyon Jay

Paridae
Verdin
InSectivora

Soricidae
Sorex marriani (Marriani Shrew)

Chiroptera

Vespertilionidae
Antrozous pallidus (Pallid Bat)
Nyctis californicus (California Myotis)
Nyctis subulatus (Small-footed Myotis)
Nyctis thysanodes (Fringed Myotis)
Nyctis volans (Hairy-winged Myotis)
Nyctis yumanensis (Yuma Myotis)
Nectesicus fuscus (Big Brown Bat)
Lasius cinereus (Hoary Bat)
Pipistrellus hesperus (Western Pipistrelle)
Plecotus townsendi (Lump-nosed Bat)

Molossidae
Tadarida brasiliensis (Brazilian Freetail Bat)

Lagomorpha

Leporidae
Lepus californicus (Blacktail Jackrabbit)
Sylvilagus auduboni (Desert Cottontail)

Rodentia

Sciuridae
Ammospermophilus leucurus (Whitetail Antelope Squirrel)

Heteromyidae
Dipodomys lasiurus (Rabbit)
Dipodomys deserti (Desert Kangaroo Rat)
Perognathus spinatus (Spiny Pocket Mouse)
Perognathus formosus (Long-Tail Pocket Mouse)
Perognathus longimembris (Little Pocket Mouse)
Perognathus nelsoni (Desert Pocket Mouse)

Cricetidae
Neotoma lepida (Desert Woodrat)
Onychomys torridus (Southern Grasshopper Mouse)
Peromyscus maniculatus (Deer Mouse)
Peromyscus australis (Cactus Mouse)
Peromyscus cribrinus (Canyon Mouse)
Heteromyidae megafelis (Western Harvest Mouse)

Muridae
Mus musculus (House Mouse) **

Canidae
Urocyon cinereoargenteus (Gray Fox)
Vulpes macrotis (Kit Fox)
Canis latrans (Coyote)

Procyonidae
Bassariscus astutus (Ringtail Cat)

Mustelidae
Mephitis mephitis (Striped Skunk)
Spilogale putorius (Spotted Skunk)
Taxidea taxus (Badger)

Felidae
Lynx rufus (Bobcat)
Felis concolor (Mountain Lion) **

Perissodactyla

Equidae
Equus asinus (Wild Burro) **
Equus caballus (Wild Horse, Mustang) **

Artiodactyla
Antilocapridae
Antilocapra americana (Pronghorn Antelope) **

Cervidae
Odocoileus hemionus (Mule Deer) **

Bovidae
Ovis canadensis (Big-Horn Sheep) **

* Migratory
** No longer occur at the Desert Studies Center
*** Introduced

Names based on: Ingles, Lloyd G. 1965, "Mammals of the Pacific States (California, Oregon, Wash...)"
Some Common Invertebrates of the Mojave Desert

Class Chilopoda (centipedes)

Class Arachnida (arachnids)

Order Araneae (spiders)
- Desert Tarantula (*Aphonopelma chalcodes*)
- California Trapdoor Spider (*Bothriocyrtum californicum*)
- Desert Loxosceles (*Loxosceles deserta*)
- Orb Weavers (*Araneus* sp.)
- Elongate Long-jawed Orb Weaver (*Tetragnatha elongata*)
- Grass Spiders (*Agelenopsis* sp.)
- Burrowing Wolf Spiders (*Geolycosa* sp.)
- Thin-legged Wolf Spiders (*Pardosa* sp.)
- Jumping Lynx Spider (*Oxyopes* sp.)
- Flower Spider (*Hismena vatia*)
- Inconspicuous Crab Spiders (*Philodromus* sp.)
- Metaphid Jumping Spiders (*Metaphidippus* sp.)

Order Scorpionida (scorpions)
- Yellow Vaejovis Scorpion (*Vaejovis flavus*)
- Giant Hairy Scorpion (*Hadrurus* sp.)

Order Opiliones (daddy-long-legs)
- Brown Daddy-long-legs (*Phalangium opilio*)

Order Acarina (mites and ticks)

Order Uropygi (whipscorpions)
- Giant Vinearone (*Hastigoproctus giganteus*)

Order Solpugida (sun spiders)
- Windscorpion (*Eremobates* sp.)

Class Insecta (insects)

Order Thysanoptera (silverfish)
- Sand Dune Silverfish (*Leucoepisema arenaria*)
- Rockhopper (*Mesomachlis pedontus*)

Order Odonata (dragonflies and damselflies)
- Common Ruby Spot (*Hetaerina americana*)
- Bluets (*Enallagma* sp.)
- Vivid Dancer (*Argia vivida*)
- Big Red Skimmer (*Libellula saturata*)
- Pastel Skimmer (*Sympetrum corruptum*)
- Common Green Darner (*Anax junius*)
Order Blattodea (cockroaches)
  Sand Roaches (Arrenivaga sp.)
  Hairy Desert Cockroach (Eremobia subdiaphana)

Order Orthoptera (grasshoppers, katydids)
  Red-Winged Grasshopper (Dissostera pictipennis)
  Paillid-winged Grasshopper (Trimerotropis palidipennis)
  Creosote Bush Grasshopper (Booitettix punctatus)
  Creosote Bush Katydid (Insara covilleae)
  Splendid Shield-backed Katydid (Neobuda ovata)
  Brown-winged Shieldback (Capnobleates fuliginosus)
  Sand Treader (Macrobametes sp.)
  Ant Cricket (Myrmecophila oregonensis)
  California Mantid (Stagonomantis californica)
  Minor Ground Mantid (Litaneutria minor)
  Gray Walking Stick (Pseudostermyle straminea)

Order Dermaptera (earwigs)
  Toothed Earwig (Spongovostox apicentatus)

Order Isoptera (termites)
  Western Drywood Termite (Kalotermez minor)
  Desert Dampwood Termite (Paraneoptermes simplicornis)

Order Embioptera (webspiners)
  Black Webspinner (Oligotoma nigra)

Order Hemiptera (true bugs)
  Green Stink Bug (Chlorochroma sp.)
  Western Leaf-footed Bug (Leptoglossus clypealis)
  Large Milkweed Bug (Oncopeltus fasciatus)
  Pacific Ambush Bug (Phymata pacifica)
  Western Bloodsucking Conenose (Triatoma protracta)
  Western Corsair (Rasamus thoracicus)
  Robust Assassin Bug (Apipiurus sp.)
  Four-spurred Assassin Bug (Zelus tetracanthus)
  Black Shore Bug (Saldula sp.)
  Water Strider (Gerris sp.)
  Toad Bug (Gelastocoris oculatus)
  Single-banded Backswimmer (Notonecta unifasciata)
  Western Creeping Water Bug (Ambrusus occidentalis)
  Salt Marsh Water Boatmen (Tricorixa reticulata)
  Toe Biter (Abadius indentatus)
  Little Toe Biter (Belostoma flumineum)
  Desert Water Scorpion (Ranatra brevicollis)

Order Homoptera (leafhoppers, planthoppers and cicadas)
  Annulate Spittle Bug (Aphrophora annulata)
  Leafhoppers--Blue Sharpshooter (Hordnia circellata)
  Three Cornered Alfalfa Leafhopper (Spissistilus festinus)
  Cochineal Scale (Dactylopius coccus)
  Desert Cicada (Diceroprocta sp.)
Order Thysanoptera (thrips)
  Western Flower Thrips (*Frankliniella occidentalis*)

Order Neuroptera (lacewings and ant lions)
  Green Lacewing (*Chrysopa carnea*)
  Brown Lacewing (*Hemerobius sp.*)
  Brown Mantispid (*Pleca signata*)
  Ant lions (*Brachynemurus, Myrmoleon*)
  Desert Scorpionfly (*Boreus notoperates*)

Order Diptera (true flies)
  Sagebrush Gall Midge (*Asplondybia artemisiae*)
  Cactus Fruit Midge (*Asplondybia opuntiae*)
  Punkies (*Culicoides sp.*)
  Mosquitoes (*Culex sp.*)
  Common Midges (*Chironomus sp.*)
  Spotted Soldier Fly (*Stratiomya maculosa*)
  Horse Fly (*Tabanus sp.*)
  Deer Fly (*Chrysops sp.*)
  Flower Loving Fly (*Aplocera sp.*)
  Common Robber Flies (*Efferia, Machimus and Stenopogon*)
  Greater Bee Fly (*Bombylius major*)
  Cactus Fly (*Volucella mexicana*)
  Common Hover Flies (*Empedes, Syrphus, Scaeva, Allograpta and Metasyrphus*)
  Eye Gnat (*Hippelates sp.*)
  House Fly (*Musca domestica*)
  Green Bottle Fly (*Phaenicia sericata*)
  Black Blow Fly (*Phormia regina*)
  Common Blow Fly (*Eucalliphora lilaea*)
  Common Flesh Fly (*Sarcophaga sp.*)
  Caterpillar Destroyer (*Lespedia archippivora*)
  Rodent Bot Fly (*Cuterebra sp.*)

Order Lepidoptera (moths and butterflies)
  Yucca Moth (*Teseticula sp.*)
  Creosote Bush Bagworm (*Thyridopteryx meadi*)
  Diamond Back Moth (*Plutella xylostella*)
  Clearwing Moth (*Paranthrene sp.*)
  Carpenterworm (*Prionoxystus robiniae*)
  Pyralid moths - Several common genera (our most common desert moths)
  Fragile Gray (*Anacaenoptodes fragilaria*)
  Looper (*Eupithecia sp.*)
  Tent Caterpillar (*Malacosoma sp.*)
  Arizona Desert Miller (*Conocharus arizonae*)
  Palm Moth (*Liograpthus coachella*)
  Mexican Tiger Moth (*Apantesis proxima*)
  Saltmarsh Caterpillar or Acrea Moth (*Estigmene acrea*)
  Painted Tiger Moth (*Arachnis picta*)
  Hera Moth (*Hemileuca hera*)
  White Lined Sphinx Moth (*Hyles lineata*)
  Common Checkered Skipper (*Pyrgus communis*)
  Fiery Skipper (*Hylephila phyleus*)
Pigmy Blue (Brepheidium exilis)
Square Spotted Blue (Pseudophilotes battoides)
Monarch (Danaus plexippus)
Common Checkerspot (Euphydryas chalcidona)
Painted Lady (Vanessa cardui)
Sara Orange Tip (Anthocaris sara)
Southern Dogface (Colias cesonia)

Order Coleoptera (beetles)
  Tiger Beetle (Cicindela sp.)
  Bombardier Beetle (Brachinus tschernikhi)
  Desert Carabid (Pterostichus brunnea)
  Yellow Spotted Diving Beetle (Thermonectus marmoratus)
  Whirling Beetle (Gyrinus sp.)
  Giant Black Water Beetle (Hydrophilus triangularis)
  Scavenger Water Beetle (Tropisternus sp.)
  Hairy Rove Beetle (Staphylinus maxillosus)
  Silphid Beetle (Silpha ramosa)
  Common June Beetle (Phylophaga sp.)
  Ten Lined June Beetle (Polyphila decimlineata)
  Green Fruit Beetle (Cotinus texana)
  Spotted Flower Buprestis (Acmaeodera sp.)
  Green Osmotid (Teneochila chloridia)
  Cactus Flower Beetle (Carpophilus pallipenis)
  Desert Spider Beetle (Cysteodemis armatus)
  Stink Beetle (Eleodes sp.)
  Ironclad Beetle (Phloeodes diabolicus)
  Red Milkwax Beetle (Tetraopes sp.)
  Yucca Weevil (Scyphophorus yuccae)

Order Hymenoptera (wasps and bees)
  Common Braconid (Apanteles sp.)
  Common Ichneumonid (Ophion sp.)
  Tiger Tiphid (Myzinius sp.)
  Nocturnal Tiphid (Brachycistis sp.)
  Velvet Ant (Dasyminella sp.)
  Kingfisher Wasp (Trilepis alcione)
  California Harvester Ant (Pogonomyrmex californicus)
  Mexican Honey Ant (Myrmecocystus mexicana)
  Tarntula Hawk (Pepsis sp.)
  Common Eumenid Wasp (Euodynerus annulatum)
  Paper Wasp (Polistes sp.)
  Mud Dauber (Scoliphron caemantarius)
  Golden Digger Wasp (Sphex ichneumonis)
  Thread-waisted Digger Wasp (Ammophila sp.)
  Sand Wasp (Bembix sp.)
  Green Cricket Hunter (Chlorion aerarium)
  Common Burrowing Bee (Andrena sp.)
  Alkali Bee (Nomia melanderi)
  Metallic Sweat Bee (Agapostemon sp.)
  Semisocial Sweat Bee (Halictus sp.)
  California Carpenter Bee (Xylocopa californica)
PLANTS OF THE GRANITE MOUNTAINS RESERVE

FERNs

Pteridaceae
Adiantum capillus-veneris
Cheilanthes covillei
Cheilanthes viscidia
Cheilanthes wootoni
Notolaena californica
Notolaena parryi
Pellaea mucronata
Pityrogramma triangularis
Venus-Hair Fern
Lip Fern
Parry Cloak Fern
Bird's Foot Fern
Goldenback Fern

CONIFERS

Cupressaceae (Cypress Family)
Juniperus californica
Juniperus osteosperma
California Juniper
Utah Juniper

Pinaceae (Pine Family)
Pinus monophylla
Single-needle Pinyon

Ephedraceae (Ephedra Family)
Ephedra aspera
Ephedra californica
Ephedra nevadensis
Ephedra viridis
Mormon Tea

FLOWERING PLANTS (DICOTS)

Aizoaceae (Carnet-weed Family)
Mollugo cerviana
Indian-Chickweed

Amaranthaceae (Amaranth Family)
Amaranthus fimbriatus

Anacardiaceae (Sumac Family)
Rhus trioloba
Squaw Bush, Lemonade-Berry Bush

Apiaceae (Carrot Family)
Cymopterus panamintensis var. acutifolius
Lomatium parryi
Wild Parsley

Apocynaceae (Dogbane Family)
Amsinckia brevifolia var. brevifolia
ver. tomentosa

Asclepiadaceae (Milkwed Family)
Asclepias aroha
Sarcostemma cyanoides ssp. hartwegii
Desert Milkweed
Asteraceae (Sunflower Family)

Acamptopappus sphaerocephalus
Agarista herbacea
Ambrosia dumosa
Ambrosia ericinacea
Amphithegus fremontii ssp. spinosus
Anisocoma acutis
Artemisia dracunculus
Artemisia ludoviciana
Artemisia tridentata ssp. tridentata
Atriplex argyraea
Baccharis dracophylla
Baccharis glutinosa
Baccharis sergiloides
Bassia planifolia
Bebbii juncea
Brickellia arguta
Brickellia californica
Brickellia desertorum
Brickellia incana
Brickellia oblongifolia var. linifolia
Calycochis parryi
Chenopodium carphoclinia
Chenopodium fremontii
Chenopodium macrantha
Chenopodium steviiodes
Chrysanthemum depressus
Chrysanthemum paniculatus
Chrysanthemum teretifolius
Cirsium neomexicanum
Dyssodia cooperi
Dyssodia prophylloides
Encelia farinosa
Encelia frutescens
Encelia virginiana var. actoni
Erigeron diversiis
Erigeron pumilus ssp. concinnoides
Erigeron breviflorus var. porphyricus
Eriogonum proline
Eriogonum wallacei
Filago californica
Geraea canescens
Glyptopleura marginata
Graptopappus palustre
Gutierrezia microcephala
Gutierrezia sarothrae
Haploppappus cooperi
Haploppappus cuneatus var. spathulatus
Haploppappus laticollis
Haploppappus linearifolius ssp. interior
Hymenoclea saziosa var. saziosa
Layia glandulosa ssp. glandulosa
Golden Head
Burro Bush
Wooly-Fruited Burbush
Eyetea
Scale Bud
Pinyon Wormwood
Green Basin Sagebrush
Tobacco Weed
Mule Fat
Squaw Waterweed
Desert Marigold
Chuckwalla's Delight
Brickellbush

Tackstem
Pebble Pincushion
Fremont Pincushion
Mojave Pincushion

Rabbit Brush
New Mexico Thistle

Brittlebush, Inclinso

Tidy Fleabane

Desert Sunflower
Cudweed
Matchweed
Goldenbush
Desert Rock Goldenbush
Turpentine Brush
Linear-Leaved Goldenbush
Cheese Rush
White Tidy-tips
Machaeranthera tortifolia
Malacothrix coulteri
Malacothrix glabrata
Microseris linearifolia
Monopetalon bellidiforme
Monopetalon bellidodes
Nicoletia occidentalis
Palafoxia arida
Pectis papposa
Perityle emoryi
Pleuracorusis pluriseta
Porophyllum gracile
Prenanthes elegans
Psilostrophe coeperi
Rafinesquia californica
Rafinesquia neomexicana
Senecio douglassii
Senecio multilobatus
Soliopea continuus
Sanchus aspar
Stephanomeria exigu var. pantacheta
Stephanomeria parryi
Stephanomeria pauciflora
Styloclina micropoides
Sytrichochepalus ramontii
Tetradymia argyraea
Tetradymia stenolepis
Trichiophitum incisum
Trixis californica
Vigourea deltoidea var. parishii

Berberidaceae (Barberry Family)
Berberis haematocarpa

Bignoniaceae (Bignonia Family)
Chilopsis linearis

Boraginaceae (Borage Family)
Amsinckia tessellata
Cryptantha angustifolia
Cryptantha barbigera
Cryptantha circumcissa
Cryptantha decipiens
Cryptantha dumetorum
Cryptantha gracilis
Cryptantha maritima
Cryptantha micrantha

Desert Aster
Snakes' Head
Desert Dandelion
Silver Puffs

Mojave Desert-star
Hole-in-the-Sand Plant
Spanish Needles
Chinch Weed
Rock Daisy
Rock Daisy
Odora

Paper Flower
California Chicory
Desert Chicory
Sandy Wash Groundsel
Ragwort
Goldenrod
Sow-Thistle
Wire-Lettuce

Desert-Straw
Desert Nest-Straw
Striped Horsebush
Mojave Horsebush
Yellow Head

Goldeneye

Barberry

Desert Willow

Fiddleneck

Cryptantha nevadensis var. nevadensis
Cryptantha pterocarya
Cryptantha racemosa
Cryptantha utahensis
Pectocarya heterocarpa
Pectocarya platycarpa
Pectocarya racavula
Pectocarya setosa
Plagiobothris arizonicus

Brassicaceae (Mustard Family)
Arabis glaucovelula
Arabis perennans
Arabis pulchra var. gracilis
Brassica ganiculata
Caulanthus cooperi
Caulanthus lasiophyllum
(Thelypodium lasiophyllum)
Descurainia pinnata ssp. glebra
Descurainia sophia
Dillwynia californica
Draba cuneifolia var. integrifolia
Lepidium fremontii
Lepidium lasiocarpum
Stanleya pinnata ssp. pinnata
Thysanocarpus lacianatus

Cactceae (Cactus Family)
Echinocactus polycephalus
Echinocereus engelmannii var. chrysocentrum
Echinocereus triglochidiatus var. mojavensis
Ferocactus acanthodes
Ferocactus polycephalus
Mammillaria tetrancistra
Opuntia acanthocarpa var. coloradensis
Opuntia basiliaris var. basiliaris
Opuntia chlorotica
Opuntia echinocarpa var. echinocarpa
Opuntia arinacea var. ursina
Opuntia phaeocantha
Opuntia ramostissima

Campanulaceae (Bellflower Family)
Nomecladus glanduliferus var. orientalis
Nomecladus rubescens
Nomecladus sigmoides

Capparidaceae (Caper Family)
Isomeris arbores

Caryophyllaceae (Pink Family)
Achyranchia cooperi
Areanaria macradenia var. parishorum
Silene antirrhina
Silene verecunda ssp. andersonii

Chenopodiaceae (Goosefoot Family)
Astriplex polycarpa
Caroideae lanata
(Eurotia lanata)
Chenopodium fremontii
Grayia spinosa

Arizona Popcorn Flower
Rock Cress
Prince’s Rock Cress
Mustard
California Mustard
Yellow Tansy Mustard
Spectacle-Pod
Desert Alyssum
Peppergrass
Prince’s Plume
Cottontop Cactus
Hedgehog Cactus
Mojave Mound Cactus
Barrel Cactus
Many-Headed Barrel Cactus
Nipple Cactus
Buckhorn Cholla
Beavertail Cactus
Pancake-Pear
Silver Cholla
Grizzly-Bear Cactus
Pencil Cholla
Thread Stem
Bladderpod
Frost-Mat
Desert Sandwort
Catchfly
Cattle Spinach
Winter Fat
Hop-Sage
Convolvulaceae (Morning-Glory Family)
  Cuscuta californica
    Dodder

Crassulaceae (Stonecrop Family)
  Dudleya arizonica
  Dudleya saxosa ssp. aloides

Cucurbitaceae (Gourd Family)
  Cucurbita maxima
    Coyote Melon

Euphorbiaceae (Spurge Family):
  Euphorbia albomarginata
  Euphorbia incisa
  Euphorbia micromera
  Euphorbia serpyllifolia
  Euphorbia santillana
  Stillingia linearifolia
    Rattlesnake Weed
    Spurge
    Tooth-Leaf

Fabaceae (Pea Family)
  Acacia graggei
  Astragalus acutirostris
    Catch clava, Wait-a-Minute Bush
  Astragalus didymocarpus var. dispermus
    Locoweed
  Astragalus gynaece
  Astragalus lentiginosus var. fremontii
  Astragalus mohavensis var. mohavensis
  Astragalus nutans
  Astragalus nuttallianus var. imperfectus
  Astragalus pursilti var. tinctus
  Cassia armata
  Dalea fremontii var. minutifolia
  Dalea moxistma
  Dalea spinosa
  Lotus humistratus
  Lotus rigidus
  Lotus tomentulis
  Lupinus arizonicus
  Lupinus concinnus ssp. arcutili
  Lupinus sparsiflorus ssp. mohavensis
  Prosopis glandulosa var. torreyana
    Mojave Rattleweed
    Desert Senna
    Indigo Bush
    Smoke Tree
    Rock-Pea
    Arizona Lupine
    Mesquite

Fagaceae (Beech Family)
  Quercus chrysolepis
    Canyon Oak

Garryaceae (Silk-Tassel Family)
  Garrya flavescens ssp. flavescens
    Silk-Tassel Bush

Gentianaceae (Gentian Family)
  Centaurium exaltatum

Geraniaceae (Geranium Family)
  Erodium cicutarium
    Filaree
### Hydrophyllaceae (Waterleaf Family)
- *Emmenanthe penduliflora*
- *Eriodictyon argyrophyllum*
- *Eucrypta chrysanthemifolia var. dipinnatifida*
- *Eucrypta micrantha*
- *Nama demissum var. demissum*
- *Nemophila menziesii ssp. integrifolia var. annulata*
- *Phacelia affinis*
- *Phacelia campanularia ssp. vasiiformis*
- *Phacelia cranulata var. ambigua*
- *Phacelia cryptantha*
- *Phacelia curvipes*
- *Phacelia distans*
- *Phacelia fremontii*
- *Phacelia lemmonii*
- *Phacelia pachyphylla*
- *Phacelia pedicellata*
- *Phacelia rotundifolia*
- *Phacelia vallis-mortae var. vallis-mortae*
- *Photostoma membraneum*

### Krameriaeeae (Krameria Family)
- *Krameria grayi*
- *Krameria pervirilis var. imparata var. glandulosa*

### Lamiaceae (Mint Family)
- *Monardella lindseyi ssp. lindseyi*
- *Salvia mexicana*
- *Salvia columbariae var. columbariae*
- *Salvia dorrii ssp. dorrii*
- *Salvia mohavensis*
- *Salvia pachyphylla*
- *Salvia sp.: S. mohavensis X S. pachyphylla?*

### Lenoaceae
- *Pholisma arenarium*

### Linaceae (Flax Family)
- *Linum lewisi*

### Loasaceae (Loasa Family)
- *Mentzelia albicans*
- *Mentzelia involucrata ssp. involucrata*
- *Petalonyx thurberi ssp. thurberi*

### Malvaceae (Mallow Family)
- *Eremalche exilis*
- *Eremalche rotundifolia*
- *Sphaeralcea ambiguus ssp. ambiguus*

### Nyctaginaceae (Four-O’Clock Family)
- *Whispering-Bells*
- *Yerba Santa*
- *Purple Mat*
- *Baby-Blue Eyes*
- *Wild Canterbury-Bells*
- *Wild-Heliotrope*
- *Yellow Throats*
- *White Fiesta-Flower*
- *White Rotany*
- *Rotany*
- *Horsemint*
- *Paper-Bag Bush, Bladder-Sage*
- *Chia*
- *Purple Sage*
- *Mojave Sage*
- *Rose Sage*
- *Blue Flax*
- *Small-Flowered Blazing Star*
- *Sand Blazing Star*
- *Sandpaper Plant*
- *Desert Five-Spot*
- *Desert Mallow*
Allionia incarnata
Boerhaavia triquetra
Mirabilis bigelovii var. bigelovii, aspera and retrorsa

Oleaceae (Olive Family)
Forestiera neomexicana
Metrosideros spinescens

Onagraceae (Evening Primrose Family)
Camissonia boothii ssp. condesata
Camissonia bravoipes ssp. bravoipes
Camissonia cheaqueerioides
Camissonia claviformis ssp. claviformis and aurantica
Camissonia palida ssp. palida
Camissonia refracta
Camissonia walkerii ssp. tortilis
Epilobium canum ssp. garrettii
(Chaucheria garrettii)
Oenothera evita ssp. evita
Oenothera caespitosa var. marginata
Oenothera primaveris
Oenothera longissima ssp. Clutei

Orobanchaceae (Broom-Rape Family)
Orobanche parishii ssp. parishii

Papaveraceae (Poppy Family)
Eschscholzia glyptosperma
Eschscholzia minutiflora

Plantaginaceae (Plantain Family)
Plantago fastigata
Plantago major
Plantago pubescens var. oblonga

Polygalaceae (Plox Family)
Eriastrum diffusum ssp. diffusum
Eriastrum aericicum
Eriastrum sparsiflorum ssp. harwoodii
Gilia filiformis
Gilia hutchinsonia
Gilia latifolia
Gilia ochroleuca ssp. ochroleuca
Gilia opthalmoides
Gilia scopulorum
Gilia sinuata
Gilia stellata

Langloisia matthewsii
Langloisia punctata
Leptodactylon pungens ssp. heliiii
Linanthus aureus var. decorus
Linanthus bigelovii
Linanthus demissus

Windmills
Desert Four-O’Clock

Desert-Olive

Bottle Cleaner
Yellow Cups

Evening Primrose

Broom-Rape

Desert Gold Poppy
Pigmy Poppy

Wooly Plantain
Common Plantain

Desert Calici
Lilac Sunbonnet
Granite-Gilia, Prickly-Plox
Golden-Gilia
Linanthus jonesii
Phlox viridis ssp. compacta

Polygonaceae (Buckwheat Family)
Chorisanthem brevicornu ssp. brevicornu
Chorisanthem thurberi
Chorisanthem rigida
Chorisanthem watsonii
Eriogonum brachypodium
Eriogonum davidsonii
Eriogonum deflexum
Eriogonum fasciculatum ssp. potifolium
Eriogonum hermanii ssp. argens
Eriogonum hermanii ssp. floccosum
Eriogonum inflatum var. inflatum
Eriogonum maculatum
Eriogonum noduleanum
Eriogonum panamintense ssp. panamintense
Eriogonum plumatella
Eriogonum pusillum
Eriogonum raniforme
Eriogonum thomasii
Eriogonum triquespes
Eriogonum umbellatum ssp. farrissii
Eriogonum wrightii ssp. wrightii
Oxytaca pervaeiata
Placostegia drymarioioides
Rumex hymenosepalus

Portulaciaceae (Purslane Family)
Calyptrisum monandrum
Claytonia perfoliata var. utahensis

Ranunculaceae (Crowfoot Family)
Aquilegia Hookerdi
Anemone tuberosa
Delphinium parishii ssp. parishii
Myosurus cupulatus

Rhamnaceae (Buckthorn Family)
Rhamnus ilicifolia

Rosaceae (Rose Family)
Amelanchier utahensis ssp. covillei
Coeleogynae ramosissima
Fallugia paradox
Holodiscus microphyllus ssp. microphyllus

Potentilla saxosa
Prunus fasciculata
Purshia glandulos

Rubiaceae (Madder Family)
Galium munzi

Skeleton Weed
California-Buckwheat

Desert Trumpet
Whisk-Broom
Flat Top
Yellow Turban

Saucer Plant
Refrigerator Plant, Wild-Rhubarb

Sand-Cress
Miners Lettuce

Columbine
Windflower
Parish Larkspur
Mouse-Tail

Evergreen Buckthorn

Service-Berry
Blackbrush
Apache Plume
Cream-Bush

Cinquefoil
Desert Almond
Antelope Bush

Bedstraw
Calium parishii
Calium stellatum

Rutaceae (Rue Family)
Thamnosma montana

Salicaceae (Willow Family)
Populus fremontii ssp. fremontii
Salix exigua
Salix goodingii
Salix lasiolepis

Saxifragaceae (Saxifrage Family)
Ribes velutinum var. glanduliferum

Scrophulariaceae (Figwort Family)
Antirrhinum filipes
Castilleja chromosa
Castilleja linariifolia
Kacelia antirrhinoides ssp. microphylla
Mimulus bigelovii var. bigelovii
Mimulus guttatus ssp. guttatus
Mimulus nasutus
Mimulus parishii
Mimulus pilosus
Mimulus rubellus
Penstemon bridgesii
Penstemon eatonii ssp. undosus
Penstemon pseudospectabilis

Solanaceae (Nightshade Family)
Datura meteloides
Lycium andersonii
Lycium cooperi
Nicotiana trigonophylla
Physalis crassifolia var. crassifolia
Physalis nectarifolia var. corifolia

Tamaricaceae (Tamarisk Family)
Tamarix ramosissima

Urticaceae (Nettle Family)
Urtica dioica ssp. horsericea

Viscaceae (Mistletoe Family)
Phoradendron californicum
Phoradendron juniperinum ssp. juniperinum

Zygophyllaceae (Caltrop Family)
Larrea divaricata ssp. tridentata

FLOWERING PLANTS (MONOCOTS)
Agavaceae (Agave Family)

Desert Bedstraw
Turpentine Broom
Cottonwood
Arroyo Willow
Plateau Gooseberry
Twining Snapdragon
Indian Paintbrush
Monkey Flower
Beard Tongue
Jimson Weed
Buxthorn
Wolf-Berry
Desert Tobacco
Ground-Cherry
Tamarisk, Salt Cedar
Desert Mistletoe
Creosole Bush
<table>
<thead>
<tr>
<th>Family</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agave deserti</td>
<td>Desert Agave</td>
</tr>
<tr>
<td>Yucca baccata var. vespertina</td>
<td>Banana Yucca, Spanish Bayonet</td>
</tr>
<tr>
<td>Yucca schidigera</td>
<td>Mojave Yucca</td>
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<tr>
<td>Cyperaceae (Sedge Family)</td>
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<tr>
<td>Carex alma</td>
<td>Sedge</td>
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<tr>
<td>Eleocharis montevidensis var. parishii</td>
<td>Spike-Rush</td>
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<tr>
<td>Iridaceae (Iris Family)</td>
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<tr>
<td>Sisyrinchium halophillum</td>
<td>Blue-Eyed-Grass</td>
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<tr>
<td>Juncaceae (Rush Family)</td>
<td></td>
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<tr>
<td>Juncus bufonius</td>
<td>Toad Rush</td>
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<tr>
<td>Juncus mexicanus</td>
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<tr>
<td>Juncus xiphiodes</td>
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<tr>
<td>Liliaceae (Lily Family)</td>
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<tr>
<td>Allium nevedense var. cristatum</td>
<td>Nevada Onion</td>
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<tr>
<td>Calochortus kennedyi var. kennedyi var. muniti</td>
<td>Desert Mariposa</td>
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<tr>
<td>Dichelostachys pulchella var. pauciflora</td>
<td>Wild Hyacinth</td>
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<td>Zigadenus brevibracteatus</td>
<td>Desert Zigadene</td>
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<tr>
<td>Poaceae (Grass Family)</td>
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<tr>
<td>Agropyron trachycaulm</td>
<td>Wheat Grass</td>
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<tr>
<td>Agrostis semiverticillata</td>
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<tr>
<td>(Polypogon semiverticillata)</td>
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<tr>
<td>Aristida ascensionis</td>
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<td>Aristida glauca</td>
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<tr>
<td>Aristida parishii</td>
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<td>Bouteloua aristidoideae</td>
<td>Grama Grass</td>
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<tr>
<td>Bouteloua barbata</td>
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<td>Bromus diandrus</td>
<td>Ripgutgrass</td>
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<tr>
<td>Bromus rubraeus</td>
<td>Foxtail Chess</td>
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<td>Bromus tectorum</td>
<td>Cheat Grass</td>
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<tr>
<td>Bromus triniti</td>
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<td>Eragrostis cilianensis</td>
<td>Lovegrass</td>
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<tr>
<td>Eriophorum pulchellum</td>
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<tr>
<td>Hilaria rigida</td>
<td>Fluffgrass</td>
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<tr>
<td>Melica frutescens</td>
<td>Gallata Grass</td>
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<td>Melica imperfecta</td>
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<tr>
<td>Muhlenbergia microspersperma</td>
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<tr>
<td>Muhlenbergia porteri</td>
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<tr>
<td>Muhlenbergia rigens</td>
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<td>Oryzopsis hymenoides</td>
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<td>Phragmites australis</td>
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<tr>
<td>Poa bigelovii</td>
<td>Ricegrass</td>
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<tr>
<td>Poa faderiana</td>
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<td>Poa scabraella</td>
<td>Reed</td>
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<td>Polypogon monspeliensis</td>
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<tr>
<td>Schismus barbatus</td>
<td>Bluegrass</td>
</tr>
<tr>
<td>Silktian tuberum</td>
<td>Muttongrass</td>
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<tr>
<td>Squirrellail</td>
<td></td>
</tr>
<tr>
<td>Schismus barbatus</td>
<td></td>
</tr>
<tr>
<td>Silktian tuberum</td>
<td></td>
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</tbody>
</table>
Silanion longifolium
Sporobolus cryptandrus
Stipa parishii
   (S. coronata Thurb. var. depauperata)
Stipa speciosa
Tridens muticus
Vulpia myuros
Vulpia octoflora

Typhaceae (Cattail Family)
   Typha domingensis

Dropseed
Speargrass
Fescue
Six-Weeks Fescue
Cat-Tail
THE AMPHIBIANS AND REPTILES OF THE GRANITE MOUNTAINS

taken from Larry Minden in Granite Mountains Resource Survey, Publication No. 1, Environmental
Field Program, University of California, Santa Cruz, California, 1979.

AMPHIBIANS

Bufonidae

*Bufo punctatus*
Red-Spotted Toad

REPTILES

Gekkonidae

*Caleanyx variegatus variegatus*
Desert Banded Gecko

Iguanidae

*Dipsosaurus dorsalis dorsalis*
Desert Iguana

*Saurophus obesus obesus*
Western Chuckwalla

*Callosaurus draconoides*
Zebra-Tailed Lizard

*Uma scoparia*
Mojave Fringe-Toed Lizard

*Crotaphytus bicinctores*
Collared Lizard

*Gambelia wislizenii wislizenii*
Leopard Lizard

*Sceloporus magister uniformis*
Yellow-Backed Spiny Lizard

*Sceloporus occidentalis biserialis*
Great Basin Fence Lizard

*Uta stansburiana stansburiana*
Desert Side-Blotched Lizard

*Urosaurus gratiosus gratiosus*
Western Brush Lizard

*Phrynosoma platyrhinos calidarium*
Southern Desert Horned Lizard

Xantusidae

*Xantusia vigilis vigilis*
Desert Night Lizard

Scinidae

*Eumeces gilberti rubricaudatus*
Western Red-Tailed Skink

Tritidae

*Chameleophorus tigris tigris*
Great Basin Whiptail

Leptotyphlopidae

*Leptotyphlops humilis*
Western Blind Snake

Boidae

*Licheneura trivirgata gracilis*
Desert Rosy Boa

Colubridae

*Phyllophthorus decurtatus perkinsi*
Spotted Leaf-Nosed Snake

*Masticophis flagellum piceus*
Red Racer

*Masticophis taeniatus*
Desert Striped Whipsnake

*Salvadora hexalepis mojavensis*
Mohave Patch-Nosed Snake

*Arizona elegans aburnata*
Desert Glossy Snake

*Pituophis melanoleucus deserticola*
Great Basin Gopher Snake

*Lampropeltis getulus californiae*
California Kingsnake

*Sonora semiannulata*
Western Ground Snake

*Chionactis occipitalis occipitalis*
Mojave Shovel-Nosed Snake

*Tantilla hoffsmithi*
Utah Black-Headed Snake

*Trimorphodon bisculus vandenburghii*
Sonora Lyre Snake

*Hyposlena torquata deserticola*
Spotted Night Snake

Viperidae

*Crotalus mitchelli pyrrhus*
Southwestern Speckled Rattlesnake

*Crotalus cerastes cerastes*
Mojave Desert Sidewinder

*Crotalus scutulatus scutulatus*
Mojave Rattlesnake

Testudinidae

*Gopherus agassizi*
Desert Tortoise
MAMMAL SPECIES OF THE GRANITE MOUNTAINS RESERVE


Insectivora (Shrews)
Soricidae
*Notothrix crawfordii crawfordii*
Desert Shrew

Chiroptera (Bats)
Vespertilionidae
*Myotis volans interior*
Long-legged Myotis
*Myotis californicus stephensi*
California Myotis
*Pipistrillus hesperus hesperus*
Western Pipistrelle
*Eptesicus fuscus pallidus*
Big Brown Bat
*Lasiurus cinereus*
Hoary Bat
*Antroracus pallidus pallidus*
Pallid Bat
*Phyllostis townsendii*
Lump-Nosed Bat

Molossidae
*Phaedia brasiliensis mexicana*
Mexican Free-tailed Bat

Leporidae
*Lepus californicus deserticola*
Black-tailed Jackrabbit
*Sylvilagus auduboniarizanes*
Desert Cottontail

Rodentia

Sciuridae (Squirrels)
*Spermophilus tereticaudus tereticaudus*
Round-tailed Ground Squirrel
*Spermophilus variegatus grammurus*
Rock Squirrel
*Ammospermophilus leucurus leucurus*
White-tailed Antelope Ground Squirrel
*Eutamias panamintinus panamintinus*
Panamint Chipmunk

Bassaricidae
*Bassariscus astutus nevadensis*
Ringtail Cat, Cacomistle

Mustelidae (Weasels)
*Tayra arctos urioneri*
Badger
*Spilogale putorius gracilis*
Spotted Skunk

Equidae (Horses)
*Equus asinus*
Burro

Cervidae (Deer)
*Odocoileus hemionus callifornica*
Mule Deer

Geomyidae (Gophers)
*Thomomys talpoides providentialis*
Valley Pocket Gopher

Heteromylidae (Pocket Mice)
*Perognathus longimembriis longimembriis*
Little Pocket Mouse
*Perognathus formosus majevensis*
Long-tailed Pocket Mouse
*Perognathus spinatus spinatus*
Spiney Pocket Mouse
*Dipodomys merriami merriami*
Merriam's Kangaroo Rat
*Dipodomys deserti deserti*
Desert Kangaroo Rat

Cricetidae (Mice)
*Peromyscus crinitus stephensi*
Canyon Mouse
*Peromyscus eremicus eremicus*
Cactus Mouse
*Peromyscus maniculatus sonoriensis*
Deer Mouse
*Peromyscus boylesi rowleyi*
Brush Mouse
*Peromyscus truei truei*
Pinyon Mouse
*Onychomys torridus pluchei*
Southern Grasshopper Mouse

Neotoma lepida lepida*
Desert Woodrat
*Neotoma fuscipes*
Dusky-footed Woodrat

Canidae (Dog Family)
*Canis latrans maernsi*
Coyote

Vulpes macrotis arsipus*
Kit Fox
*Urocyn cinereargenteus scotti*
Gray Fox

Felidae (Cats)
*Felis concolor californica*
Mountain Lion
*Lynx rufus baileyi*
Bobcat

Bovidae (Cattle, Sheep, and Goats)
*Ovis canadensis nelsoni*
Desert Bighorn Sheep
A CHECKLIST OF BIRDS
FOR GRANITE MOUNTAINS RESERVE

by Teresa A. Norris

The following list of birds was taken from Kent Johnson in The Granite Mountains Resource Survey, Publication No. 1, Environmental Field Program, University of California, Santa Cruz, 1979. I have added to the species list from personal observations as well as personal communications with Dr. Wilbur W. Mayhew who has been bringing spring field classes out annually since 1979.

The following explains the abbreviations used to list distribution and abundance of birds:

Distribution:
A Abundant: more than 50 likely to be seen in a day in appropriate habitat.
C Common: 26-50 likely to be seen in appropriate habitat.
FC Fairly Common: 6-25 likely to be seen in a day in appropriate habitat.
U Uncommon: 1-5 likely to be seen in a day in appropriate habitat.
R Rare: no more than 1-2 likely to be seen in a day in appropriate habitat, often not seen at all.

Appearance:
R Resident: occurs in the area all year and breeds in the Granite.
SR Summer Resident: occurs in the area in summer and breeds in the Granite, migrates to wintering grounds elsewhere.
WR Winter Resident: spends the winter in the Granite, migrates to breeding grounds elsewhere.
SM Spring Migrant: passes through the area in spring, but does not breed or winter in the Granite.
FM Fall Migrant: passes through the area in the fall, but does not breed or winter there.
M Migrant: passes through in both fall and spring.

BIRDS

Cinnamon Teal
ANATIDAE (Ducks)
R, SM
Anas Cyanoptera

American Coot
RALLIDAE (Rails, Gallinules, Coots)
R, SM
Fulica Americana

Spotted Sandpiper
SCOLOPACIDAE (Sandpipers)
R, SM
Actitis Macularia

Solitary Sandpiper
R, SM
Tringa Solitaria

Turkey Vulture
CATHARTIDAE (American Vultures)
U, SM
Cathartes aura (teter)

Golden Eagle
ACCIPITRIDAE (Kites, Hawks, Eagles)
U, R
Aquila Chrysaetos

Sharp-Shinned Hawk
U, R
Accipiter Stratus

Cooper's Hawk
R, FM
Accipiter Cooperii

Red-Tailed Hawk
R, WR
Buteo Jamaicensis

Rough-Legged Hawk
R, SM
Buteo Lagopus

American Kestrel
FALCONIDAE (Falcons)
U, R
Falco Sparverius

Prairie Falcon
U, R
Falco Mexicanus
<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHASIANIDAE (Quail and Pheasants)</td>
<td>U, R</td>
</tr>
<tr>
<td></td>
<td>R, R</td>
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<tr>
<td></td>
<td>U, R</td>
</tr>
<tr>
<td></td>
<td><strong>Lophortyx gambelii</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Ornortyx pictus</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Alectoris chukar</strong></td>
</tr>
<tr>
<td>COLUMBIDAE (Pigeons and Doves)</td>
<td>A, SR</td>
</tr>
<tr>
<td></td>
<td>R, SM</td>
</tr>
<tr>
<td></td>
<td><strong>Zeaena macroura</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Zenaida australis</strong></td>
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<tr>
<td>CUCULIDAE (Cuckoos and Anis)</td>
<td>U, R</td>
</tr>
<tr>
<td></td>
<td><strong>Geococcyx californianus</strong></td>
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<tr>
<td>STRIGIDAE (Owls)</td>
<td>R, R</td>
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<tr>
<td></td>
<td>R, R</td>
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<tr>
<td></td>
<td><strong>Tyto alba</strong></td>
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<td></td>
<td><strong>Asio otus</strong></td>
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<td></td>
<td><strong>Bubo virginianus</strong></td>
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<td></td>
<td><strong>Otus asio</strong></td>
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<tr>
<td></td>
<td><strong>Athene cunicularia</strong></td>
</tr>
<tr>
<td>CAPRIMULGIDAE (Nightjars)</td>
<td>U, SR</td>
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<tr>
<td></td>
<td><strong>Phaenoptilus nuttallii</strong></td>
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<tr>
<td>APOIDAE (Swifts)</td>
<td>R, SM</td>
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<tr>
<td></td>
<td>C, R</td>
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<td><strong>Chaetura vauxi</strong></td>
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<td><strong>Aeronautes saxatalis</strong></td>
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<td>TROCHILIDAE (Hummingbirds)</td>
<td>R, SM</td>
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<tr>
<td></td>
<td><strong>Archilochus alexandri</strong></td>
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<td><strong>Calyptomenes castae</strong></td>
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<td><strong>Calyptomenes annae</strong></td>
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<td><strong>Selasphorus calliope</strong></td>
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<tr>
<td>ALCIDINIDAE (Kingfishers)</td>
<td>R, SM</td>
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<td><strong>Megaceryle alcya</strong></td>
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<tr>
<td>PICIDAE (Woodpeckers)</td>
<td>R, WR</td>
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<tr>
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<td><strong>Colaptes auratus</strong></td>
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<tr>
<td></td>
<td><strong>Picoides scalaris</strong></td>
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<td><strong>Sphyrapicus ruber</strong></td>
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<tr>
<td>TYRANNIDAE (Tyrant Flycatchers)</td>
<td>R, SM</td>
</tr>
<tr>
<td></td>
<td><strong>Tyrannus verticalis</strong></td>
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<td></td>
<td><strong>Tyrannus vociferans</strong></td>
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<td></td>
<td><strong>Myiarchus cinerascens</strong></td>
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<td><strong>Contopus sordidus</strong></td>
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<td><strong>Sayornis nigricans</strong></td>
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<td><strong>Sayornis phoebe</strong></td>
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<td><strong>Empidonax traillii</strong></td>
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<td><strong>Empidonax wrightii</strong></td>
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<td></td>
<td><strong>Empidonax olivaceous</strong></td>
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<tr>
<td></td>
<td><strong>Empidonax hammondii</strong></td>
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<td></td>
<td><strong>Empidonax difficilis</strong></td>
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<td><strong>Nuttalorhitis borealis</strong></td>
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<tr>
<td>Family</td>
<td>Species</td>
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<tr>
<td>-----------------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>ALAUDIDAE (Larks)</td>
<td>Eremophila alpestris</td>
</tr>
<tr>
<td>U, SR</td>
<td></td>
</tr>
<tr>
<td>HIRUNDINIDAE (Swallows)</td>
<td>Tachycineta thalassina</td>
</tr>
<tr>
<td>U, SR</td>
<td>Hirundo rustica</td>
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<tr>
<td>R, SM and FM</td>
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<tr>
<td>CORVIDAE (Crows, Ravens, and Jays)</td>
<td>Apherocoma coerulescens</td>
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<tr>
<td>Scrub Jay</td>
<td>Gynmnornis cyanocephalus</td>
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<tr>
<td>FC, R</td>
<td>Corvus cerax</td>
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<tr>
<td>Pinyon Jay</td>
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<tr>
<td>FC, R</td>
<td></td>
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<tr>
<td>Common Raven</td>
<td></td>
</tr>
<tr>
<td>U, R</td>
<td></td>
</tr>
<tr>
<td>PARIDAE (Titmice and Chickadees)</td>
<td>Perus inornatus (ridgwayi)</td>
</tr>
<tr>
<td>Plain Titmouse</td>
<td>Parus gemeli</td>
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<tr>
<td>FC, R</td>
<td>Auriparus flaviceps</td>
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<tr>
<td>Mountain Chickadee</td>
<td>Psaltriparus minimus</td>
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<tr>
<td>Verdin</td>
<td></td>
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<tr>
<td>Bushtit</td>
<td></td>
</tr>
<tr>
<td>R, WR</td>
<td>Sitta canadensis</td>
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<tr>
<td>Rod-Breasted Nuthatch</td>
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<tr>
<td>TROGLODYTIDAE (Wrens)</td>
<td>Troglodytes aedon</td>
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<tr>
<td>R, SM and FM</td>
<td>Thryomanes bewickii (eremophilus</td>
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<tr>
<td>House Wren</td>
<td>Campylorhynchus brunneicapillus (covenii)</td>
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<td>Bewick's Wren</td>
<td>Catherpes mexicanus (conspersus)</td>
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<tr>
<td>Cactus Wren</td>
<td>Sturnus obsoletus (obsoletus)</td>
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<td>Canyon Wren</td>
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<tr>
<td>Rock Wren</td>
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<tr>
<td>LANIIDAE (Shrikes)</td>
<td>Lanius ludovicianus</td>
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<tr>
<td>Loggerhead Shrike</td>
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<tr>
<td>MIMIDAE (Mockingbirds and Thrashers)</td>
<td>Mimus polyglottos (teveopterus)</td>
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<tr>
<td>Northern Mockingbird</td>
<td>Taxostoma boreale</td>
</tr>
<tr>
<td>U, SR</td>
<td>Taxostoma lecontei (lecontei)</td>
</tr>
<tr>
<td>Bendire's Thrasher</td>
<td>Oreoscoptes montanus</td>
</tr>
<tr>
<td>R, SM</td>
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<tr>
<td>LeConte's Thrasher</td>
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<tr>
<td>U, SR or R</td>
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<tr>
<td>Crissal Thrasher</td>
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</tr>
<tr>
<td>U, R</td>
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<tr>
<td>Sage Thrasher</td>
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<tr>
<td>R, SM</td>
<td></td>
</tr>
<tr>
<td>American Robin</td>
<td>Turdus migratorius</td>
</tr>
<tr>
<td>U, SM, and SR</td>
<td>Catharus guttatus</td>
</tr>
<tr>
<td>Hermit Thrush</td>
<td>Catharus ustulatus</td>
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<td>Carduelis lawrencei</td>
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whiptail, gopher snake, common kingsnake, deer mouse, Great Basin pocket mouse (*Perognathus parvus*), Panamint kangaroo rat (*Dipodomys panamintinus*), desert cottontail, coyote, bobcat, mule deer (*Odocoileus hemionus*), roadrunner, raven, red-tailed hawk, prairie falcon, and golden eagle. However, there are some species that are closely associated with the Pinyon-Juniper Woodland, eg, the pinyon mouse (*Peromyscus truei*) which frequently eats juniper berries and the pinyon jay (*Gymnorhinus cyanoccephalus*) which commonly eats pinyon nuts.

**Biology References**


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<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Other Names</th>
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<tr>
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