

MOJAVE MONKEYFLOWER

Mimulus mohavensis Lemmon

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Management Status: Federal: USFWS Species of Concern
California: S2.2, G2 (CDFG, 1998)
CNPS: List 1B, R-E-D code 2-2-3 (Skinner and Pavlik, 1994)

General Distribution:

Mojave monkeyflower is found only in the Mojave Desert of California. Its highest population densities are in areas just south of Daggett and Barstow; and it has also been found within the Barstow city limits (CDFG, 1997b). An historic record of this species at Calico Ghost Town, ten miles northeast of Barstow (Lemmon, 1884), represents the northernmost reported location, while the easternmost population occurs at Kane Springs in the Newberry Mountains. It is uncertain whether the species still occurs at those two sites. Several occurrences were noted in the Mitchell Range near Fort Irwin Road about five miles north of Barstow in 1992 (CDFG, 1997b). There are numerous extant small populations east of the Mojave River drainage and west of Interstate 15 between Victorville and Barstow. The Mojave monkeyflower has not been reported from west of the Mojave River. CNDDDB (CDFG, 1997b) reports a population at Old Woman Spring east of Lucerne Valley, but the plants have not been seen there since 1936. This is the southernmost reported occurrence of this species (CDFG, 1997b).

Distribution in the West Mojave Planning Area:

All of the known range of this species lies within the WMPA.

Natural History:

The Mojave monkeyflower is a member of the figwort family (Scrophulariaceae). These annual plants have purplish-red stems and leaves, and are covered with minute glandular hairs that are visible when magnified (10X). This species tends to grow erect and branch from the base, reaching a height of 1-6 in. (3-15 cm). The opposite leaves are from 0.3-1.1 in. (7-27 mm) long with an elliptic shape and acute tips. They are sessile on the upper stem, but may have petioles on the lower stem. The flowers are on 0.1 in. (2-3) mm long pedicels that arise from upper leaf axils. The bell-shaped red-purple calyx has unequal, pointed, ciliate lobes and minute hairs along the veins. It enlarges when fruits form, reaching 0.4-0.5 in. (10-12 mm) in length. Unique maroon corollas are radial with five spreading lobes with irregularly-toothed to ragged white margins, distinguishing it from other species (Hickman, 1993; Munz, 1974; Grant, 1924).

The Mojave monkeyflower blooms from April to June (Munz, 1974). The time of germination and requirements for germination are unknown, although amount of precipitation is probably a major factor, given the variation in population sizes from year to year (Bagley, 1991; CDFG, 1997b). There is no information available about the pollination ecology of this species. The showy flowers suggest biotic pollen vectors, most likely hymenopteran or lepidopteran (Faegri and van der Pijl, 1979). The white margin of the corolla may reflect ultraviolet light, and

the maroon veins extending into this margin likely act as nectar guides. Other *Mimulus* species are insect-pollinated and mostly outcross (Vickery, 1964), but many are also self-compatible (Leclerc-Potvin and Ritland, 1994). Seed dispersal is probably mostly abiotic, since the seeds are small. Some populations are reported from rocky slopes above washes, and it is likely that gravity carries seeds down into the washes. Intermittent water flow may carry seeds further down washes. Biotic vectors of seed transport are unknown. However, there is a possibility that granivorous ants or rodents could carry seeds, and birds might be important in transporting seed longer distances.

Habitat Requirements:

The Mojave monkeyflower is found in Joshua tree woodland and creosote bush scrub communities. Occurrence reports show associations with creosote bush (*Larrea tridentata*), desert senna (*Senna armata*), cheese bush (*Hymenoclea salsola*), rattany (*Krameria* sp.), cholla (*Opuntia* sp.), burro bush (*Ambrosia dumosa*), indigo bush (*Dalea* sp.), cat-claw acacia (*Acacia greggii*), Bigelow's monkeyflower (*Mimulus bigelovii*), desert bells (*Phacelia campanularia*), and desert trumpet (*Eriogonum inflatum*).

This species occurs primarily in granitic soils on gravelly banks of desert washes, in sandy openings between creosote bushes and along rocky slopes above washes, areas that are not subject to regular water flows. The elevation range at which this species occurs varies from 2000-3300 ft. (600-1000 m) (CDFG, 1997; Hickman, 1993).

There is plenty of apparently suitable habitat for this species, yet it is quite restricted geographically. Where it is found, population sizes can greatly vary from year to year (CDFG, 1997b). The amount and timing of precipitation are probably important factors affecting population size (Bagley, 1991; CDFG, 1997b). It is possible that this species has some unusual germination and establishment requirements that are unknown.

Population Status:

The 25-30 occurrences of Mojave monkeyflower between the Mojave River and Interstate 15 between Victorville and Barstow were first reported to CNDDDB in 1992 (West, 1992). Some of these locations are very close together, even within a few hundred meters of each other. It is unclear whether each reported location represents a distinct interbreeding population, since the distance of pollen dispersal and reproductive strategy of this species are not known. Most of these locations have 100 plants or less, some as few as two plants, with an average of about 40 plants per location. There are no available data indicating current trends in numbers and fluctuation, although subsequent data have been collected. From the 1992 data, it appears that this region is not one supporting a dense concentration of these plants, but, since some populations occurring elsewhere have been known to fluctuate widely (Bagley, 1991; CDFG, 1997b), all that is really known is that the species is present; further assessment and monitoring are needed.

The highest population densities occur in areas south of Barstow and Daggett, especially along Camp Rock Road. The status of many of these populations was assessed in 1986 (CDFG, 1997b). At least four of the populations in the vicinity of Camp Rock Road contained more than 1000 plants. Several smaller populations of less than 50 plants were reported from the same area. Three populations reported in the late 1970s were not found again in the 1986 surveys, possibly due to dry conditions (CDFG, 1997b). Surveys of five Mohave monkeyflower sites from the

Newberry Mountains to Stoddard Valley conducted in 1991 (Bagley, 1991) revealed only dried remains at one site, while no plants of this species, not even dried remains, were found at the other four sites. It was concluded that the year was too dry, and that perhaps the surveys had been conducted too late in the season (June) for the plants to be apparent. A few plants had been observed by others in some of these areas earlier in the season (Bagley, 1991). A population of 200 plants was found in Daggett Wash in May of that year (Rutherford and Bransfield, 1991). Over 1000 plants were observed at one Camp Rock Road location in 1993, a year with more precipitation. Evidently more data have been collected since 1993 at many of these locations, but these data are stored in BLM files, and are not currently available.

Some historic locations have likely been extirpated, and the status of many populations is unknown. The type locality population, at Calico (Ghost Town; Lemmon, 1884), has not been seen since, but the CNDDDB reports (CDFG, 1997b) assume that it is extant. This locality has heavy recreational use, and it seems likely that it would have been reported to CNDDDB since 1884 if this species was still present. The population at Old Woman Springs, south of Highway 247, was first collected in 1937. It is presumed extant (CDFG, 1997b), but again, there are no subsequent reports of this species from that location. The Kane Springs population in the Newberry Mountains was last seen in 1906 but is presumed extant, as is another population last seen in 1941, located five miles south of Barstow, at Bloody Gulch mine. A mine by this name has not been documented in this area, but there is a Bloody Gulch mine in the San Bernardino Mts. near Big Bear. Location data were most likely incorrect, so it can't be certain if this population has been seen since 1941. Several collections of Mojave monkeyflower were labeled as being from Barstow in several years from 1904-1937. Populations were last seen there in 1941. The species may have been extirpated from Barstow due to urban development (CDFG, 1997b). Some of the collections may have been from the hills near Barstow (Grant 1924), while others indicate the location as the sandy banks of the Mojave River in Barstow (CDFG, 1997b). It is possible that all of these older collections were actually from the vicinity of Barstow, and not from within what is now the town. Collection labels in the past were often much less detailed than modern labels: earlier collectors were not as concerned with precise localities as botanists are today. To label a plant as coming from Barstow was considered sufficiently precise, even if the specimen came from ten miles away; Barstow was the nearest named locality.

Threats Analysis:

Although there are numerous locations where the Mojave monkeyflower is known to occur, population sizes are quite variable annually. In 1986 known population sites were surveyed (CDFG, 1997b), and no plants were found at several of the locations. It was speculated that conditions may have been too dry that year for the plants. This species may experience major population fluctuations in response to environmental conditions including: 1) how much water is available, 2) when the precipitation occurs, and 3) in what form the precipitation occurs, and 4) what temperatures occur. It is presumed that seeds survive bad years and germinate when conditions are more favorable, but a series of harsh years may decrease the seed bank to a point where it is difficult to recover. When population sizes are small it is possible that inbreeding may contribute to a reduction of number of seeds set or of seed viability, although some rare species are known to self-pollinate with no detrimental effects (Barrett and Kohn, 1991; Carr and Dudash, 1996; Huenneke, 1991). Pollination vectors may be limited if plant populations are insufficiently large to attract them (Karron, 1991), and random fluctuations in environmental

conditions can lead to pollinator unreliability (Menges, 1991). Genetic bottlenecks may occur due to small population sizes during a series of harsh years, thus limiting genetic variability in subsequent years, especially if the seed bank is not long-lived. Loss of genetic variability can lead to further negative impacts on populations (Huenneke, 1991; Hartyl and Clark, 1989). Pollination studies, population genetic studies, and seed bank studies could help determine which of these factors have the most potential to impact Mojave monkeyflower populations.

The populations of Mojave monkeyflower occurring between the Mojave River and Interstate 15 north of Victorville are situated on a patchwork of private and BLM lands. The region contains many quarries and test pits, some of which are adjacent to known populations (West, 1992). The area is also dotted with developed home sites, which could potentially impact these plants. The BLM is at present attempting to dispose of some of its land in that area, and some has already been sold to the private sector (West, 1992). The San Bernardino County Transportation Department has recently paved many of the dirt roads in this area, using ground asphalt removed from the renovation of Interstate 15. These roads include Rodeo Road, Corral Road, and Bonanza Trail, along which Mojave monkeyflowers have been found (West, 1992). Paving the road will increase traffic to this area, and will likely promote development. Even though the 1992 population sizes of Mojave monkeyflower reported from this area were not large, those between the Mojave River and Interstate 15 represent a substantial proportion of the known range of this species; substantial populations may be present here in some years. The major threat to these populations is that some of them are already on private lands, and more soon will be. Since this species has no legal status, a private land owner is not legally required to protect it. If the amount of relatively protected habitat on public land is continually diminished by transfer of these lands to the private sector, it is much more likely that this species will require listing in the future. Alternatively, if BLM could maintain control of the lands in this area, it may be possible to control the loss of Mojave monkeyflower habitat so that future listing might not be necessary.

Continued urbanization around Barstow, Dagget, and Newberry Springs may destroy habitat, and most likely has already had negative impacts on any populations that occurred within the Barstow city limits. South of Barstow and Daggett, off-highway vehicles pose a considerable threat to this species; several populations are located in or adjacent to the Stoddard Valley off highway vehicle (OHV) open area. This is a BLM managed area, and in some sites OHV competition events are staged. One reported population of the Mojave monkeyflower is bisected by Stoddard Valley Road, and several populations are known from areas adjacent to the heavily used Camp Rock Road. OHV tracks were observed at several known population sites along Camp Rock Road during a recent survey to assess habitat integrity (MacKay and Thomas, 1997). Multiple tracks were concentrated in a wash located at one location along Camp Rock Road where a considerable population was observed in 1995.

In addition to threats by OHVs, this area is currently being used for livestock grazing (D. Fisher allotment), and signs of recent grazing were observed during the habitat integrity survey in 1997. Trampling would most likely have negative impacts on populations, but it is not known if this species is palatable to livestock.

Current mining probably does not pose much of a threat to these populations. One population at Azucar gold mine lies about one mile east of Camp Rock Road. Except for old mine tailings, the habitat here appears intact, and plants were found there in 1986 (CDFG,

1997b). This mine never produced, and has been idle since 1945. However, there could be future impacts from mining in the event that new mining activities are approved within the species' range.

The Barstow pipeline project is currently under construction. Even though the pipeline does not run through known Mojave monkeyflower populations, it travels through potential habitat within the known range of this species (Brandman, 1994). The second phase of the pipeline, scheduled to be constructed soon, will cross to the east side of the Mojave River just south of Silver Lakes near Helendale. It will continue north between the National Trails Highway and the Mojave River on the west side of National Trails Highway. Mohave monkeyflower has not been found on the west side of this highway, with the exception of one occurrence northwest of the highway near Main Street in Lenwood. However, it is found just across the highway on the east side, and suitable habitat is available on the west side of the highway. Later phases of the pipeline are to be constructed starting on the north side of the Mojave River north of Barstow, and cutting south to cross the river just west of the Marine Corps supply center near Daggett. It will continue east along railroad easements between Interstate 40 and the Mojave River. Even though the Mohave monkeyflower has not been found along the pipeline route (Brandman, 1994), there is potential habitat for this species there, and it is found nearby just south of Interstate 40. Focused surveys for the Mojave monkeyflower were not conducted for the environmental report for this project (Brandman, 1994).

There are only a few known populations of Mojave monkeyflower which do not appear to be affected by significant human impacts: these occur along the powerline road just south of Daggett off Camp Rock Road. Although there is some vehicular traffic along this road, there were no signs of livestock grazing, OHV travel, or mining activity in these areas during the habitat assessment survey in September 1997. Kane Springs, at the edge of the Newberry Mountains Wilderness Area, should be protected from OHV impacts, although grazing is a permitted activity in wilderness areas. The status of the population there is unknown.

Biological Standards:

To maintain viable populations of the Mohave monkeyflower, it is important to afford protection to the areas where the species is known to occur. Few known populations are protected at present. Protective efforts could include the elimination of OHV use and livestock grazing at known population sites south of Barstow and Daggett, and maintenance of BLM ownership of lands located between the Mojave River and Interstate 15 between Victorville and Barstow. Focused surveys for this species should be conducted along the proposed Barstow pipeline route. Reducing or removing these potential hazards would not, however, eliminate population fluctuations, which are probably induced by random variations in precipitation affecting germination and seedling establishment.

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