ARIZONA GAME AND FISH DEPARTMENT
HERITAGE DATA MANAGEMENT SYSTEM

Plant Abstract **Element Code:** PDSCR1L070
Data Sensitivity: No

CLASSIFICATION, NOMENCLATURE, DESCRIPTION, RANGE

NAME: *Penstemon albomarginatus*
COMMON NAME: White-margined penstemon
SYNONYMS:
FAMILY: Scrophulariaceae

AUTHOR, PLACE OF PUBLICATION: M.E. Jones, Contributions to Western Botany. 12: 61. 1908.

TYPE LOCALITY: Near Yucca, Mohave Co., Arizona.

TYPE SPECIMEN: HT: POM. M.E. Jones, 29 April 1905.

TAXONOMIC UNIQUENESS: *Penstemon* is a very common plant genus in North America. There are over thirty-eight species of *Penstemon* found in Arizona (Kearney and Peebles, 1951).

DESCRIPTION: Low growing herbaceous perennial between 6-12 in (15.0–30.5 cm). Entire plant pallid, glaucescent and glabrous. Many stems arise from a 12-48 in (30.5-122.0 cm) long taproot that is sunk deep into the soil with the crown just above soil level. Leaves green with very thin line of white around margin, 1.0-3.0 cm (0.4-1.2 in.) wide; leaves of rosettes entire, leaves of inflorescence slightly serrate giving wavy appearance. Petioles 6.4 mm long, 3.2 mm wide. Bracts similar in shape to leaf, becoming smaller near top. Sepals 6.4 mm long and 1.6 mm wide with acuminate tips. Corolla pink-lavender, ventrally white, with purple guidelines, 1.27 cm (0.5 in.) long, 6.4 mm wide; light golden hairs on lower lip. Capsule about 7.0 mm long (McDougall 1973).

AIDS TO IDENTIFICATION: Only *Penstemon* with white lines on leaf. Purple anthers and small size when blooming, 6 inches, are distinguishing characters (McDougall 1973).

ILLUSTRATIONS:
Line drawing (Falk et al. 2001)
Color photo (Anderson, *In* Falk et al. 2001)
Photos: Calscape, https://calscape.org/Penstemon-albomarginatus-(White-margined-Beardtongue)?srchcr=sc58dccba5c9690.

TOTAL RANGE: Three widely disjunct locations: southeastern California (San Bernardino County), southern Nevada (Nye and Clark Counties), and northwestern Arizona (Mohave County). In California, there are only four known occurrences, two of which have not been documented for many years. The two meta-populations in Nevada are more than 100 miles apart (NatureServe 2018). In Nye County, there are three smaller population groups, and four population groups in Clark County. There is a single, but extensive, population in Arizona (The Nature Conservancy 2007).

RANGE WITHIN ARIZONA: Sacramento Valley and Dutch Flat areas, vicinity of Yucca, Mohave County. Area of occupancy: about 100 square miles (NatureServe 2018). There are also some historical collection records from the Kingman area, but these are too vague to map.

SPECIES BIOLOGY AND POPULATION TRENDS

GROWTH FORM: Herbaceous perennial, with large (1-4 foot) tap root

PHENOLOGY: Flowers March-May. It is believed that flowering may not always be dependent on the amount of rainfall. Established plants may bloom even in dry years by utilizing food and water resources in the large taproot. Seedlings were more numerous in areas in California that received more accumulated rainfall runoff, and it was concluded that germination and seedling survival may be rainfall dependent (Scogin 1989). Etyemezian et al. (2010) noted that 'recruitment events' were rare and episodic, and this is similar to Mojave Desert perennial plants. He believes that successive wet years favor seed production, seed germination and seedling growth.

A study by MacKay (2006) noted plants were absent in ecologically similar drainages to the one that was studied, and that this species' small seeds may not be dispersed long distances. This observation could be because suitable stabilized deep sand habitat was not available. Short distance dispersal may occur via ants, rodents or water in wet years (Scogin 1989). Etyemezian et al. (2010) reported a dispersal distance of 1-15 cm from the parent plant in the one location, Hidden Valley, NV, where they observed dispersal.

Observations of very isolated plants suggested that set seed might indicate self-compatibility, and the pollen-ovule ratio approaches that of many facultative outcrossing species (Scogin, 1989).

Because there is ample seed set, a large seed bank probably exists in the sandy substrate (Scogin 1989). However, seed bank studies are lacking. How long the seeds remain viable in the seed bank is unknown, as are climate conditions necessary for successful germination and establishment (The Nature Conservancy 2007).

This species dies back to the ground after spring and positive identification of occupied habitat is no longer possible for much of the year.

BIOLOGY: Several insects, including small carabid beetles, large flies, and vespid wasps, visit the showy flowers, and are the likely pollinators (Calscape, n.d). A large blister beetle (*Epicauta puncticaulis*) is a significant herbivore as they were observed devouring leaves (The Nature Conservancy 2007, from Scogin 1989).

Based on a study at the Pisgah site (Lavic Lake population) in California, individual life spans from 1991 to 2000 averaged 3.3 years and had a maximum of seven years. Older plants were important to overall fecundity as 16 % of the plants contributed 78 % of seed production. Herbivory appeared to be the primary cause of mortality in this population (The Nature Conservancy 2007).

Young cuttings of white-margined penstemon have been shown to produce adventitious roots in experiments at Rancho Santa Ana Botanic Garden (Scogin, 1989). This suggests that vegetative reproduction may occur in its natural habitat. However, attempts to propagate from cuttings at the garden failed, even though this technique works for other species of *Penstemon* (Scogin 1989). Genetic studies of clusters in the field could determine if each group was clonal.

Scogin (1989) reported failure to successfully transplant this species and attributed it to the loss of sand falling away from the taproot during disturbance. Propagation by cuttings that include portions of the taproot remains unstudied.

HABITAT: White-margined penstemon is a psammophile restricted to sandy habitats—mostly deep, loose to stabilized sand, sometimes on sand dunes or in sandy to gravelly washes. In Nevada, plants are found on loose deposits of aeolian sand or sandy alluvium, particularly in or near small dry drainages, wash bottoms, on valley floors, gentle foot-slopes, or alluvial terraces (Smith 2001). Nevada populations occur on the lee side of valleys and in the lower foothill slopes on the western slopes of mountains where there is a sand source upwind of the site. There is little or no profile development of soils, and soil crust is present only in a few minimally disturbed areas (The Nature Conservancy 2007). Etyemezian et al. (2010) found that the Nevada populations occurred where there was less than 20% shrub-cover, and where there was an accumulation of carbonates in the surface soil. In California, *Penstemon albomarginatus* is found in deep, stabilized, alluvial sands that hold its long tap root in place. It is also found in wind-blown sand at the head of canyons. In Arizona, it is found in sandy loam uplands and washes in alluvial plains, but gravelly areas alternating with and interspersed with the sandy places do not support this species (MacKay 2006, Scogin 1989).

NatureServe (2018) reports the Environmental Specificity for *P. albomarginatus* as very narrow, a specialist. It occurs in alluvial sands, in stabilized dunes, and washes with little scrub canopy in both the Mojave and Sonoran Deserts.

ELEVATION: 1,190 – 3,467 feet (363 to 1,057 m), range-wide (The Nature Conservancy 2007).

EXPOSURE: Marked preference for gentle slopes averaging about three degrees, but may be found on slopes up to 29 degrees. Warmer western exposures (northwest to southwest) are most common while cooler east, southeast, northeast, and north exposures are least common. Prevailing western winds likely deposit seeds on windward slopes and plants apparently are able to grow and persist on warm exposures since the sandy substrate holds adequate moisture during its growing months (The Nature Conservancy 2007) .

SUBSTRATE: *P. albomarginatus* is restricted to sandy habitats—mostly deep, loose to stabilized sand, sometimes on sand dunes or in sandy to gravelly washes. In Nevada, plants are found on loose deposits of aeolian sand or sandy alluvium, particularly in or near small dry drainages, wash bottoms, on valley floors, gentle foot-slopes, or alluvial terraces (Smith 2001). In California it is found in deep, stabilized, alluvial sands. In Arizona, it occurs in sandy loam uplands and sandy washes in a broad alluvial plain, but gravelly areas alternating with and interspersed with the sandy places do not support this species (Anderson 2001). The Nature Conservancy (2007) notes the species consistently occurs on mapped Quaternary alluvial deposits.

PLANT COMMUNITY: In Arizona, the white-margined penstemon occurs with Joshua tree (*Yucca brevifolia*) and mixed shrub association, dominated by creosotebush (*Larrea tridentata*) and white bursage (*Ambrosia dumosa*) with big galleta grass (*Pleuraphis rigida*). In Nevada and California, it occurs with simply the creosotebush and white bursage association, and Joshua trees are not present (Anderson 2001, Beatley 1976).

POPULATION TRENDS: There have been a number of surveys for *Penstemon albomarginatus* during the past 20 some years.

The location in California near Pisgah Crater probably constitutes a single extended population consisting of more than 450 plants spread out along a four mile long wash and sandy basin (Scogin, 1989). At Pisgah Siding near Twenty-nine Palms in California, there were six miles of occupied wash habitat along both sides of I-40 in the late 1980s. This is the Lavic Lake population. These populations were disturbed twice by military activity in the 1980s and 1990s. Sheldon (1994) notes a population of 4,420 plants. It is not clear from the publications either the methodology or the area that was included in these surveys. A second population near Cadiz Summit, Fenner Valley, is considered historic and has not been documented since 1941. In 1993, Bransfield and Rutherford found at least 200 plants along benches and terraces adjacent to the easternmost drainage in which plants were previously found (MacKay 1998).

The Las Vegas BLM conducted numerous surveys during the 1990s. Sheldon, in 1994, surveyed seven sites that included portions of all four populations in Clark County and

reported 8,775 plants on approximately 324 hectares. During other Clark County surveys, populations at Hidden Valley were estimated at 3,053 – 14,235 plants on about 1,155 acres in 1994. Of the data points collected in Hidden Valley, 85% were judged as heavily disturbed. Many fewer plants were found during surveys in 1996 and 1997. In 1996, estimates for the Jean Lake populations ranged from 2,381 – 13,456 over 2,188 acres. Only 18% of the data points were considered heavily disturbed, while 53% had no disturbance. Also in 1996, the Ivanpah Valley populations were estimated to range between 3,201 – 13,917, on 2,465 acres (the largest areal extent), and 89% of the data points exhibited no disturbance. The Roach Lake populations were surveyed in 1997, and ranged from 217 – 989 individuals, on 157 acres. Disturbance was reported as 58% light to moderate, and 24% as heavily disturbed. In Nye County, five sites had an estimated 6,200 plants and occupied about 133 acres (Blomquist et al 1995). During the 1997 surveys conducted by the BLM and Smith (2001), Rock Valley was the largest population in Nye County with an estimated 20,000 individuals on 236 acres. The North of Ash Meadows group had an estimated 13,200 plants in four occurrences on 190 acres, and the Specter Range group had about 9,000 plants in two populations occupying about 47 acres.

Smith (2001) estimated that all the populations in Nevada totaled 68,164+ plants on 6,437 acres (12 sites, 10 with 1 km separation, among 23 populations). Etyemenian et al. (2010) estimated 78,954 plants in Nye County, NV and 125,825 plants in Clark Co., NV.

In Arizona, 16 sites were documented in the Sacramento Valley and Dutch Flat areas east of Yucca in 1990. In 1998, 28 sites were found across about 75 square miles with a population estimate of 100,000 plants. This large area is not all suitable habitat (Anderson 2000). This is the largest population group of *Penstemon albomarginatus*.

Based on extant information and local expert input, The Nature Conservancy (2007) summarized their rankings for landscape context, condition, size and viability for all known populations. Overall, these ranking ranged from fair to good for all locations. Notably, population sizes were considered to be all good. The North of Ash Meadows, Rock Valley and Specter Range in Nevada sites were judged to be good for all four attributes. The Nature Conservancy (2007) global assessment also judged the species to be stable across its known distribution.

According to NatureServe (2018), the California and Arizona populations are considered critically imperiled (S1) at the state level, and the Nevada populations are considered imperiled (S2).

SPECIES PROTECTION AND CONSERVATION

ENDANGERED SPECIES ACT STATUS: None (USDI, FWS 1996)

[Category 2, USDI, FWS 1990]

STATE STATUS: Salvage Restricted (ARS, ANPL accessed 2019)

[Salvage Restricted (ARS, ANPL 1993, 1999)]

OTHER STATUS: Not FS Sensitive (USDA, FS Region 3, 1999)

[Forest Service Sensitive, USDA FS Region 3, 1990]

Bureau of Land Management Sensitive (USDI, BLM AZ 2000, 2005, 2008, 2010, 2017)

MANAGEMENT FACTORS:

The Nature Conservancy (2007) presents a list of nine key ecological attributes and their ranking for what constitutes the ideal condition for the white-margined penstemon:

- Aeolian deposition process = sufficient Aeolian sand deposition in all habitats
- Ecological integrity = virtually no vehicle tracks or animal trails
- Fire regime = high end of Class I
- Characteristic native plant community = no habitat altering exotic species
- Pollination= diverse matrix with target species alongside pollen producing species
- Soil structure and stability (degree of soil erosion or compaction) = both erosion and compaction essentially absent
- Minimum dynamic area: number and average size of habitat patches = few habitat patches with very large average sizes
- Minimum dynamic area: sufficient acreage for historic disturbances = Sufficient acreage for all sensitive species and severe disturbances
- Population size = > 50,000

Numerous threats have been identified. Some are more unique to a particular population, whereas others are more ubiquitous.

NatureServe (2018) identified **loss and/or degradation of habitat to land conversion** as the primary threat to *Penstemon albomarginatus*. In Arizona, the checkerboard pattern of federal, state and private land ownership was a major impediment to the management of the land to conserve the white-margined penstemon, even with the creation of the White-Margined Penstemon Reserve Area of Critical Environmental Concern (ACEC) by the BLM (Anderson 1999). Within the ACEC, there are still private lands that continue to be converted to residential areas. This close proximity to land development activities also promotes other threats that will be detailed below. Urban growth of Clark County, Nevada, the county that contains Las Vegas, is also resulting in land conversion. In addition to residential and commercial development that accompanies an expanding human population, there is also a demand for a new airport in the Ivanpah Valley near where *Penstemon albomarginatus* occurs (Etyemezian et al. 2010). Although this project was reported to be on hold in 2013, the Clark

County commissioners voted unanimously in September 2018 to prepare for an environmental impact study (Davidson 2018). This process will take at least two years. Both in Clark County NV and San Bernardino County CA, the white-margined penstemon is threatened by the development of solar farms, known as the Stateline Solar Farm Project (The Nature Conservancy 2007). **Activities associated with transmission line and pipeline right-of-ways can also have deleterious impacts** on this species, as has been noted in California (MacKay 2006). These routes can also provide access for ORVs.

Off-road vehicles (ORVs) have and continue to be detrimental to this species. An established plant may survive occasional damage by tires due to the ability to re-sprout from the taproot. However, churning motions from tires could uproot the taproot, and it is possible that frequent damage or crushing of above-ground parts could deplete root reserves. It is also likely that seedlings and young plants in loose sand could be completely destroyed by tires (Scogin 1989). In 1998, MacKay stated that the remote location of the California population and the scattered nature of the plants limited the amount of damage from OHVs at that time, and concluded that the white-margined penstemon would not likely be extirpated from this area by recreational human activities in the near future. However, with increasing population growth in urban areas, off-road enthusiasts are traveling farther to find recreational opportunities in less crowded areas, so management steps must be taken to limit access to white-margined penstemon habitat. Based on a monitoring study conducted by the BLM on the Jean Lake population in Nevada before and after a sanctioned OHV race in 1996, even one event can dramatically affected white-margined penstemon population sizes (The Nature Conservancy 2007).

The Mannix tank trail is a corridor for the purpose of tank maneuvering between Twentynine Palms and Fort Irwin military bases. It runs from Mannix to Hector, but does not overlap with the range of this species. However, military units have been observed **camping** in areas where this species occurs, outside of the military base boundary, and military-issue debris has been observed in the same area. **Trash dumping** has also been observed near other populations. There are currently some mining claims within the species' range, so the plant could have localized disruptions from future **mining activities** (MacKay 1998 and 2006).

Grazing probably does not impact this species much, since it is found growing next to stock tanks in Arizona. However, some other studies have mentioned the need to eliminate grazing from white-margined penstemon habitat, so perhaps this issue needs to be resolved.

Button (1991) notes that white-margined penstemon in Arizona readily colonizes areas within its habitat that were previously disturbed but where there is now limited vehicular use, such as pipeline routes.

The Nature Conservancy (2007) highlights the various threats for each population and presents a table summarizing each of the 13 threats identified. Some of the highlighted threats include the spread of exotic annuals that have altered the historic fire regimes;

encroaching residential development; grazing in Hidden Valley since at least the mid-1970s; ORH activity; whether the proposed Ivanpah Airport will impact the supply and movement of sand to the Jean Lake population; road development and utility corridor maintenance; the impact of military exercises, and camping and ORV use on the Lavic Lake population. In the summary table, 52% of the impacts identified rank high or very high, 6% rank medium, and 37% are not considered to adversely impact one or more of the populations. Overall, the threat impacts are ranked as very high.

PROTECTIVE MEASURES TAKEN:

The 1990 USDI BLM Kingman Resource Area Resource draft Management Plan and Environmental Impact Statement included the White-Margined Penstemon Reserve ACEC. As designated, the area within Dutch Flat, near Yucca, west of the Hualapai Mountains included about two-thirds of the known habitat in Arizona. The checkboard land ownership pattern (federal, state and private holdings) was identified as a complication to effective management, but it was suggested that land exchanges and some simple new measures to protect this habitat could ensure the continued survival of this species and preclude the need for listing under the ESA. Management prescriptions included: (1) the proposed designation of 17,493 acres of public (federal) land to the ACEC; (2) limit OHV use in riparian areas and develop Mining Plans of Operation and mineral leasing regulations designed to protect resources values; (3) acquire over 15,289 acres of private lands and 2,114 acres of state land; (4) do not allow development of recreational facilities or the removal of native plants except for salvage; (5) implement a livestock management plan consistent with the goals of the ACEC and evaluate all other land use to be consistent with the goals of the ACEC; and (6) develop a recovery plan for the white-margined penstemon (USDI, Kingman BLM, 1990).

The White-margined Penstemon Area of Critical Environmental Concern (ACEC) was designated by the BLM in 1993 (Anderson 2001). The area encompassed by this ACEC is 59 square miles.

By 1998, the BLM (with Arizona and Fish Department as a cooperating agency) submitted the final EIS and Amendment for the Proposed Hualapai Mountains Land Exchange (USDI, BLM, Kingman, 1998). The objective of this proposed action was to ensure the long-term survivability of the Dutch Flat white-margined penstemon population by blocking together public lands through the exchange which will consolidate prime habitat for more uniform management. As part of this exchange, some lands occupied by the white-margined penstemon were transferred to private ownership. However, under this proposed action, twice as many acres of high-quality habitat became public, and there was a net gain of 2,130 acres becoming public land within the ACEC. Overall, the tradeoff was a loss of quantity of land as compared to an increase in quality and manageability of habitat.

Anderson (2001) summarizes the methodology used to accomplish the land exchange, and its results. Without the land exchange, the inevitable impacts of the rural development would be dispersed over a wider area of the plant's habitat. Because of the land exchange, a large core

area of high-quality habitat was consolidated as public land within the southeastern part of the ACEC. Based on landscape ecology, this area is the largest continuous piece of high-quality habitat for the species. The BLM thought that the survivability of the white-margined penstemon would be improved by the increased manageability of the solid block of public land habitat for conservation of the species by easing the implementation of proactive measures such as fencing and off-road vehicle restrictions. Even though a large amount of low-quality white-margined penstemon habitat was lost in the exchange, the BLM was able to consolidate a core area of high-quality habitat to support the future survivability of the species.

Hidden Valley, Nevada, is contiguous with Sloan Canyon NCA, which offers adjacent protective status (The Nature Conservancy 2007).

SUGGESTED PROJECTS: Some of the recommendations cited below were made over 30 years ago. Accordingly, it is imperative that a determination is made as to whether each recommendation was implemented or not, and whether the intended results were achieved. This newly obtained information should become the basis for management actions going forward.

For the California populations, Rutherford (1988) discusses the need to establish management guidelines and consider management options for the species on BLM lands in California prompted by significant military and camping impacts to the Pisgah (Lavic Lake) population. Scogin (1989) indicates that there is a parking area off the Interstate 40 frontage road that is heavily used by recreationists and possibly military vehicles. This area has the highest density of white-margined penstemon, and he suggests that a barrier be erected there to prevent access. MacKay (1998) recommends active management of ORV use by recreationists and the military as the most important management need to insure continued survival of the white-margined penstemon in the Western Mohave Planning Area (WMPA).

MacKay (1998) also noted that mitigation by transplanting individuals may be difficult since they have not been transplanted successfully. More propagation studies are needed to determine if seedlings, cuttings, or transplants could be used effectively for mitigation efforts. She also thinks that monitoring of populations, including seed set, seedling counts, and flowering effort by established plants every year or two will help to indicate population health and fluctuation, and may help indicate if management strategies are successful.

Sheldon (1994) made five management recommendations for the Hidden Valley, Nevada, population, some of which have been acted on. They include: 1) fencing 470 acres to protect most of the population from cattle grazing; 2) limiting road travel to existing roads and trails and closing roads leading to North McCullough Wilderness Area to protect from ORV use; 3) building an exclosure to monitor impacts of cattle in the southwestern most area (built in 1998); 4) conducting searches at Jean and Roach dry lakes (done in 1996 and 1997); and, 5)

developing a conservation agreement between the CA, NV, and AZ BLM District offices to protect it over its entire range.

Sheldon (1994) also noted that the Hualapai Mountains land exchange helped to consolidate some of the checkerboard ownership pattern in the BLM ACEC in Arizona. However, the Arizona population remains fraught with management complications. Oliva et al. (2004) reviewed BLM management of existing ACECs in the four corners states and highlighted several problems with the White-margined Penstemon Reserve ACEC managed by BLM Kingman Field Office. The ACEC has 16,803 acres of inholdings owned by private and state landowners, and although the ACEC has a directive to acquire these additional inholdings, no funds for land acquisition have been requested by the BLM District. In the meantime, a 150,000 acre ranchette subdivision called Stagecoach, is being developed on private lands within the ACEC. Also, Oliva et al. (2004) report unregulated ORV use from Lake Havasu recreationists, and existence of numerous crisscrossing roads and survey markers throughout the ACEC. They conclude that the BLM appears ineffective in stopping the threat of rural development and sprawl in the area. Additionally, no site-specific management plan or monitoring plan exists for the ACEC, 13 years after designation even though white-margined beardtongue was to be monitored. The Nature Conservancy (2007) concluded that the Arizona population may be indefensible from rural development and sprawl even with partial ACEC management.

The Nature Conservancy (2007) provides a list of research and management needs for the white-margined penstemon. Their top priority ranking needs include: species range and distribution information; smaller scale soils and vegetation maps for predictive distribution mapping; population genetics; pollination ecology; current viability of populations under documented climate conditions; seed bank research; population viability analysis; geospatial-based threats analysis; effectiveness and status monitoring; effects of fire and invasive species interactions; effective restoration techniques; role of exotics in resource competition; and impacts of global climate change. Secondary priority ranking needs include: species extents and abundances; reproductive biology; and habitat patch connectivity requirements. Tertiary priorities are randomized surveys and a comprehensive conservation report.

LAND MANAGEMENT/OWNERSHIP: In Arizona: BLM - Kingman Field Office (57%); State Land Department (7%); Private (36%). Range-wide: BLM manages 92% of white-margined penstemon habitat.

SOURCES OF FURTHER INFORMATION

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MAJOR KNOWLEDGEABLE INDIVIDUALS:

Pamela J. MacKay, Department of Biology, Victor Valley College, Victorville, CA
Wendy Hodgson - Desert Botanical Garden, Phoenix, Arizona.

ADDITIONAL INFORMATION:

The species epithet, "*albomarginatus*" means white (=albo) margin (=marginatus), referring to the white margins of leaves and sepals,

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