

The White-Margined Penstemon (*Penstemon albomarginatus* Jones), a Rare Mohave Desert Species, and the Hualapai Mountains Land Exchange in Mohave County, Arizona

JOHN L. ANDERSON

U.S. Bureau of Land Management, Phoenix, Arizona

Abstract: The white-margined penstemon (*Penstemon albomarginatus* Jones) is a rare Mohave Desert species with an unusual tripartite distribution with disjunct localities in Arizona, California, and Nevada. The Arizona population is the largest single population occurring with a range of 15 miles by 5 miles in Dutch Flat near Yucca, Arizona in Mohave County. The land ownership pattern in Dutch Flat was a checkerboard of public and private land, a legacy of railroad lands. Although the Bureau of Land Management (BLM) designated the white-margined penstemon Area of Critical Environmental Concern (ACEC) in 1993 for conservation of this Arizona BLM sensitive species, the checkerboard pattern of public and private lands within the ACEC made its conservation management difficult. Rural development was increasing impacts to the Dutch Flat area as the private land was being sold off in 40 acre parcels. The Hualapai Mountains Land Exchange between the Santa Fe Pacific Railroad and the BLM provided a tool for consolidating a portion of the ACEC into a solid block of public land, thereby increasing its manageability for the conservation and survivability of the white-margined penstemon.

A real estate artifact of the westward U.S. expansion in the nineteenth century is the large areas of checkerboard land ownership patterns between public and private land. To encourage pioneer settlement, the federal government gave railroad companies every other section (the odd-numbered sections) along railroad routes they constructed. Because of the resultant checkerboard land ownership pattern, there are no large areas of contiguous ownership; consequently, these areas are both hard to manage for natural resource values on public land (either federal or state) and hard to develop for private land owners. Throughout the West, the Bureau of Land Management (BLM) has entered into various land exchanges with private land owners to consolidate federal land ownership to facilitate natural land resource management and protection of special habitats and species (Los Angeles Times 2000). In Mohave County, Arizona, one such checkerboard example is the Dutch Flat and Hualapai Mountains area east of Interstate 40 and approximately 20 miles south of Kingman (Figure 1). Here, the private land was originally owned by the Atchison, Topeka, and Santa Fe Railroad (Figure 2).

In 1997 the BLM and the Santa Fe Pacific Railroad, through its representative, Ironhorse Investors (the proponent), began the Hualapai Mountains Land Exchange (Figure 3) involving approximately 70,000 acres of selected lands (pub-

lic lands selected by the proponent) and 70,000 acres of offered lands (private lands offered to the BLM by the proponent). The area covered by the Hualapai Mountains Land Exchange contained occupied habitat of a rare Mohave Desert plant (BLM 1995), *Penstemon albomarginatus* Jones, the white-margined penstemon (Figure 4), a member of the Figwort family (Scrophulariaceae). An analysis of the impacts of the Hualapai Mountains Land Exchange on the white-margined penstemon and its habitat was conducted to determine whether the effects of the exchange to the plant would be positive or negative (BLM 1998).

Penstemon albomarginatus was described by Marcus Jones (1908), who said it was "a most conspicuous and remarkable plant." It is indeed a distinctive species that has never been confused with any other species of *Penstemon*. A member of subgenus *Penstemon*, which is characterized by glabrous anthers that dehisce the full length and are usually widely spreading, *Penstemon albomarginatus* is a low growing plant 15–35 cm tall with several herbaceous stems arising from a buried root crown. It has a glabrous inflorescence of medium-sized, lavender-pink, campanulate flowers, 13–17 mm long, with a glabrous staminode and yellow hairs in the throat. The most distinguishing morphological character of the white-margined penstemon is the scarious white margins of the leaves, which are lanceolate to oblanceolate,

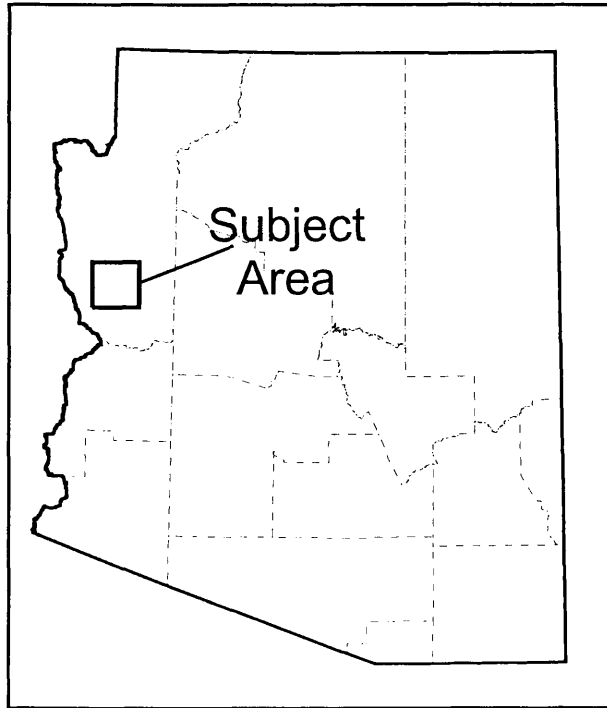


Figure 1. Subject area location within Arizona.

usually entire, and shiny glabrous with a bluish green color.

In his type description, Jones (1908) cited specimens from Good Springs Station, Nevada, in 1905, and Yucca, Arizona, where he had first collected it more than 20 years earlier on May 19, 1884 (in the area of the Hualapai Mountains Land Exchange). Ironically, his 1884 trip to the Yucca area was probably made possible by the completion that year of the Santa Fe Railroad to Needles, California (Lenz 1986). Jones (cited in Lenz 1986) wrote that "The whole spring flora was collected at Yucca and the desert was a perfect garden in all directions, never was as good for 20 years afterwards." The white-margined penstemon is one of the few *Penstemon* species that grows exclusively at low elevations in the Mohave Desert (Kearney and Peebles 1960, Munz 1974); others are *Penstemon bicolor* (T. S. Brand.) Clokey & Keck ssp. *roseus* Clokey and Keck and *Penstemon subulatus* A. Nels. As an adaptation to the arid conditions of Mohave Desert valleys, the white-margined penstemon is an "ephemeral" perennial whose stems die back to the ground after the spring growing season and during the hot, dry Mohave Desert summer and the cold Mohave Desert winter. Occasionally, the plant will green up in late summer if there is mon-

soon activity. For much of the year it is not visible above ground.

As a rare plant, *Penstemon albomarginata* has an unusual tripartite distribution pattern in the Mohave Desert (Scogin 1989). It occurs in three widely disjunct localities between three states—Arizona, Nevada, and California. The Arizona locality in Dutch Flat near Yucca is the single largest occurrence, extending in a band approximately 15 miles long and 5 miles wide along the western base of the Hualapai Mountains and Dutch Flat between Rock Creek on the northwest to Cow Creek on the southeast, although the entire area does not contain the appropriate soil habitat (Figure 5). Nevada has the widest scattered colonies (approximately 15 colonies) in two metapopulations over a hundred miles apart, one at Jean-Goodsprings 30 miles southwest of Las Vegas and one at Amargosa Valley 80 miles northwest of Las Vegas. California has the smallest occurrence, one 4 mile long population of scattered colonies 30 miles east of Barstow at Sleeping Beauty Mountain (MacKay 1999).

At all three widely separated localities, the white-margined penstemon grows on a similar habitat—sandy soils—but these sandy soils are of different origins. In California and Nevada the plants occupy stabilized sandy soils derived from colluvial sand deposits (personal observation), whereas in Arizona the plants occupy sandy loam uplands on alluvial fan terraces, and a smaller number of plants also occupy sandy wash bottoms. There is also a difference in associated vegetation of the white-margined penstemon between Arizona and the other two states. In Arizona the white-margined penstemon occurs with Joshua tree (*Yucca brevifolia* Engelm.) and mixed shrub association (Brown 1982), primarily creosotebush (*Larrea tridentata* (DC) Coville) and white bursage (*Ambrosia dumosa* (Gray) Payne) with big galleta grass (*Pleuraphis rigida* Thurb.), whereas in Nevada and California it occurs with simply the creosotebush and white bursage association (Brown 1982), and Joshua trees are not present (personal observation). In degraded habitats rayless goldenhead (*Acamptopappus sphaerocephalus* (Gray) Gray) and burro bush (*Hymenoclea salsola* T & G) increase as associated species. There is seemingly much potential sandy soil habitat for the white-margined penstemon between the existing sites that does not contain the plant. The reasons for its disjunct distribution pattern, whether biological or physical, are unknown but this pattern probably indicates that the *Penstemon albomarginatus* is a relict species.

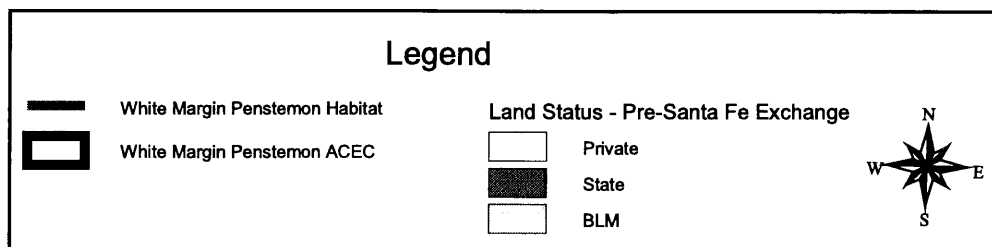
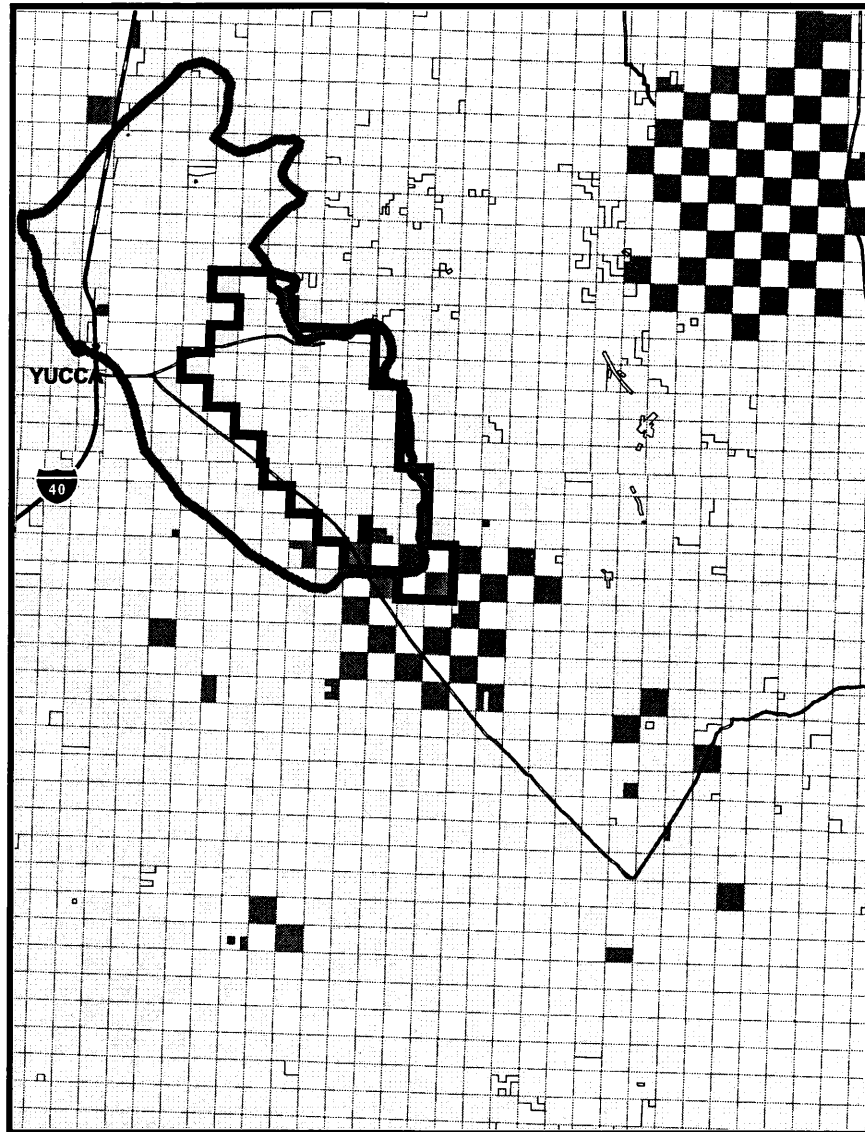


Figure 2. Checkerboard land status pattern in Hualapai Mountains–Dutch Flat area.

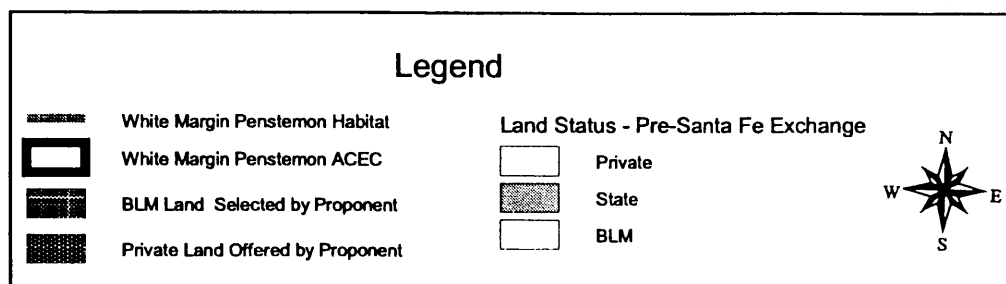
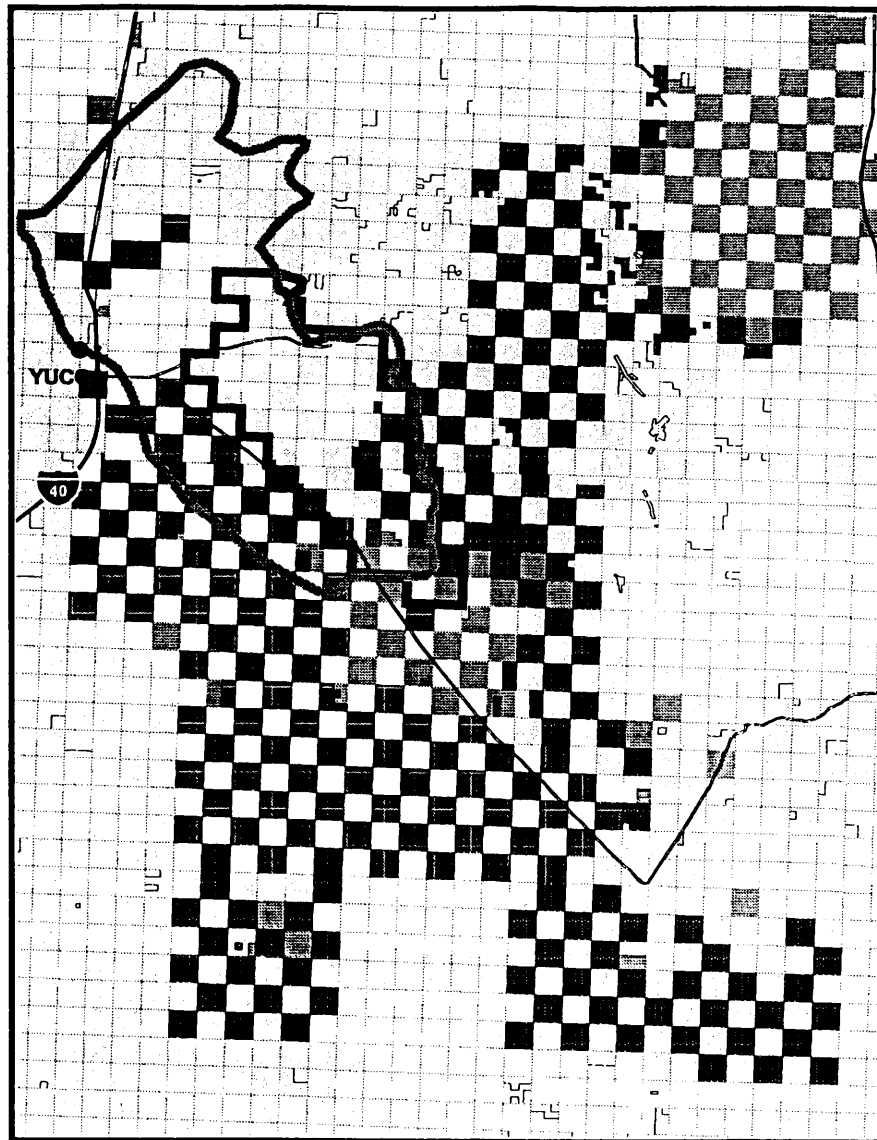


Figure 3. Selected and offered lands of the Hualapai Mountains Land Exchange.



Figure 4. *Penstemon albomarginatus* Jones.

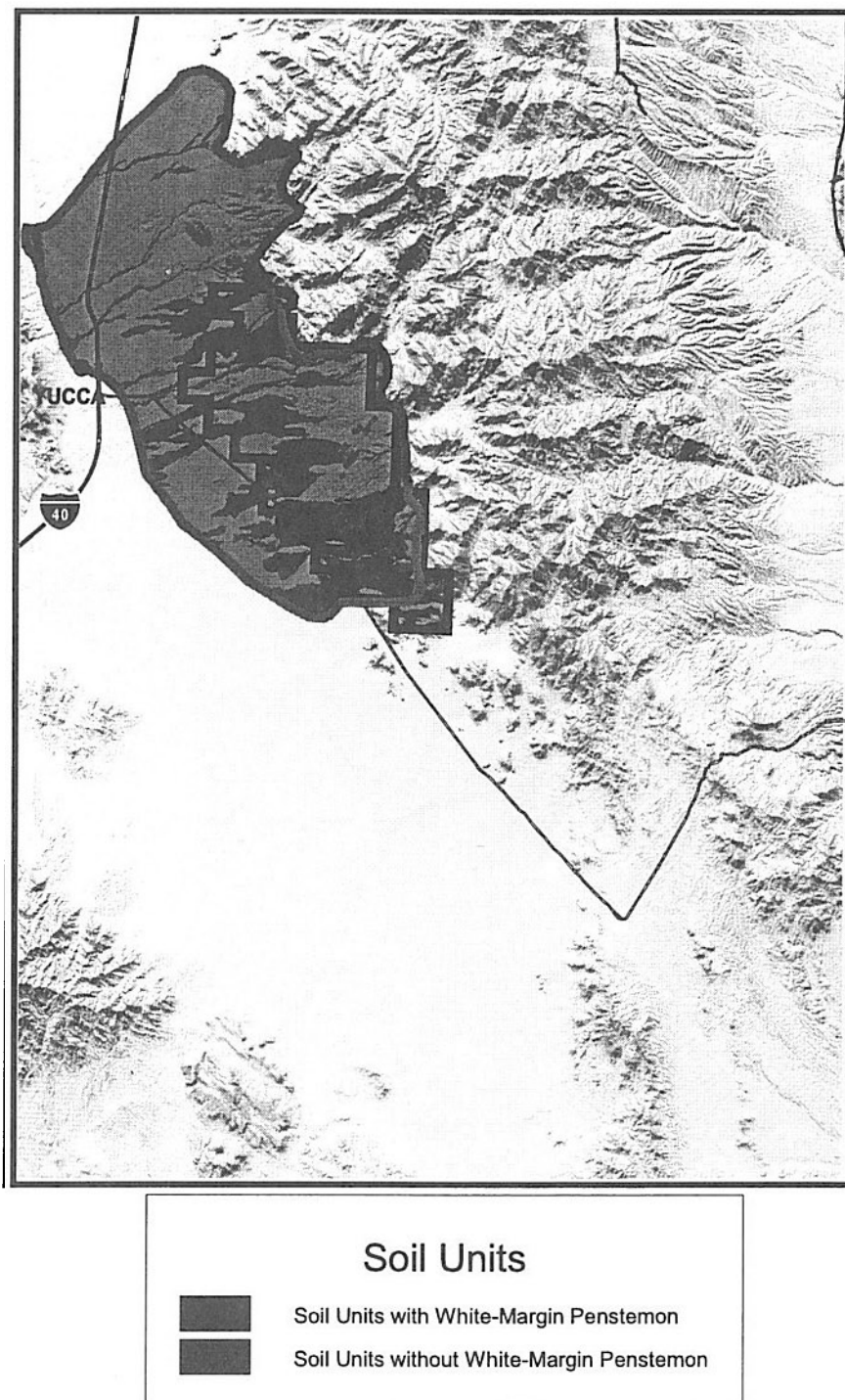


Figure 5. Soil units with white-margined penstemon present.

Penstemon albomarginatus is a BLM sensitive species; it was a Category 2 candidate species under the old U.S. Fish and Wildlife Service ranking. The Kingman Resource Area Resource Management Plan (BLM 1995) designated Dutch Flat as the white-margined penstemon ACEC to protect the best-quality habitat of the species. However, the ACEC contained a checkerboard land ownership pattern of roughly equal amounts of public land, 17,489 acres, and private land, 16,038 acres, making management of the white-margined penstemon difficult. The management prescriptions for the ACEC in the Kingman Resource Area Resource Management Plan (BLM 1995) called for acquisition of the private land within the ACEC.

Methods

The parameters of the effects (and their analysis) of the Hualapai Mountains Land Exchange on the white-margined penstemon were largely set by the mutually agreed upon locations of the "selected" and "offered" lands proposed in the exchange. Selected lands are the federal public lands that a private entity, in this case Ironhorse Investors (the proponent), wants to acquire, and offered lands are the private lands that the proponent is offering to the BLM in exchange for the selected public lands. The approximate boundary of the white-margined penstemon in the Dutch Flat-Yucca area had been mapped previously by the BLM. Sections adjacent to the previously mapped white-margined boundary were inventoried to further confirm the accuracy of that boundary. A qualitative method of inventory was chosen over a quantitative method because of the large amount of acreage involved. In this way every selected and offered section of the Hualapai Mountains Land Exchange within this area was visually inspected on the ground by BLM personnel trained in identification of the white-margined penstemon, except for the sections eliminated with the stratification system described below.

The sections were ranked qualitatively into high, medium, or low quality habitat based on the occurrence of the white-margined penstemon as abundant, infrequent, or rare respectively (Oosting 1956). Soil differences exist within the overall habitat boundary and not all of this area is suitable soil habitat. Abundance of white-margined penstemon within a given section was a function of the amount of appropriate soil type present. The soils of the exchange area had been previously mapped into soil mapping units as part of the Mohave County soil survey (Natural Resources

Conservation Service 1996). Based on field observations, the Kingman Field Office BLM soil scientist, Paul Hobbs, and the author defined which soils were habitat, soil mapping units 50, 54, 54B, and 150B, and which soils were not habitat, soil mapping units 52, 73, and 76. These soil mapping units are also given ecological site names in the NRCS report, which are used here. The primary ecological site supporting the white-margined penstemon is the sandy loam upland in the 6–12 precipitation zone; fewer plants grow on clay loam uplands (the surface texture of this unit is still a sandy loam) and along sandy (wash) bottoms. These sandy loam upland units are interspersed with coarse sandy loam (limy) and limy uplands ecological sites that do not support the white-margined penstemon. These ecological sites were sorted into two groups, habitat and non-habitat. This stratification of habitat and non-habitat by ecological sites reduced the amount of on-the-ground inventory that needed to be done. Selected and offered sections containing only non-habitat ecological sites were not inventoried. Also, sections on the west side of the exchange containing sandy loam uplands, but in the 3–6 precipitation zone, were not inventoried after initial surveys showed them to be too dry for white-margin penstemon habitat.

After the on-the-ground inventory was completed, the habitat acreage totals for the selected and offered land were modified by two factors, habitat quality and manageability. First, the habitat acreage totals were multiplied by numerical habitat importance values of 1.0 for high-quality habitat, 0.75 for medium-quality habitat, and 0.25 for low-quality habitat. The low-quality habitat was given a much lower rating because the plants on this habitat were very widely scattered. Second, these modified acreage totals were further multiplied by a land ownership pattern ranking factor. Using as a manageability criteria the concept that blocked-up units of public and private ownership were more or less favorable respectively for the long-term survivability of the white-margined penstemon, the different ownership patterns were given correspondingly reduced manageability ratings of 1.0 for blocked public land ownership pattern (no reduction) and 0.2 for blocked private ownership pattern after the land exchange (the preferred alternative); intermediate reduced ratings used for the existing situation (no action alternative) were 0.6 for checkerboard public ownership pattern and 0.4 for checkerboard private ownership pattern. Multiplying the modified habi-

tat value acreage figures by the reduced manageability ratings gave the final habitat unit figures that could be used to compare the effects of the land exchange on the white-margined penstemon to the existing land ownership pattern situation. The totals were also compared separately between habitat quality units and within the ACEC.

Results

The analysis of the total habitat units for the land exchange and the existing situation produced mixed results (Table 1). The actual acreage total of the selected lands (public lands becoming private land) is much higher than that of the offered lands (private lands becoming public lands), 3,575 acres compared to 1,040 acres, but after the acreage figures are multiplied by the habitat value ratings and management value ratings, there were only 14 percent more habitat units with the existing checkerboard ownership pattern, 1,683 habitat units, than with the blocked ownership pattern after the land exchange, 1,449 habitat units. In comparing actual differences between habitat quality ratings, the offered lands contained 980 acres of high-quality habitat and 60 acres of medium-quality habitat, and the selected lands contained 480 acres of high-quality habitat, 1,735 acres of medium-quality habitat, and 1,360 acres of low-quality habitat. Because the amount of high-quality habitat gained in the offered lands is nearly twice as much as that lost to the selected lands, 980 acres compared to 480 acres, the public land habitat gained in quality of acreage versus quantity of acreage.

Within the ACEC approximately 4,000 acres of offered private land (all or portions of eight sections) became public land after the land exchange and approximately 1,800 acres of selected public land (all of three sections on the western edge of the ACEC) became private land (exact acreages

depend on cadastral surveys). The entire ACEC contains all or portions of 57 sections, but not all of the acquired public lands contained habitat for the white-margined penstemon and not all of the selected public lands that became private lands after the land exchange contained habitat either. There were 980 acres of high-quality habitat and 60 acres of medium-quality habitat in the acquired public land (all of the offered lands with white-margin penstemon habitat were within the ACEC), and there were 815 acres of medium-quality habitat and 320 acres of low-quality habitat in the selected public lands that became private. Thus, the ACEC gained greatly in the overall amount of public acreage within the ACEC as well as the amount of high-quality habitat in public ownership (T16-1/2 N, R16 W, S19, 29, and 33), although slightly more acreage of white-margined penstemon habitat within the ACEC became private land. Nearly 20 percent of the sections within the ACEC were affected by the land exchange. Sixteen sections of public land in the southeastern part of the ACEC are now contiguous by at least two sides with another section of public land, forming a large core area of manageable public land. Before the land exchange, only one section of public land within the ACEC was contiguous on two sides with more than one other public section, and in four instances, two public sections shared one mutual side.

Discussion

The proponent owned the checkerboard private lands in the southern half of the ACEC and their plans were to develop this land by selling it in 40 acre tracts. Individual land owners could then further subdivide their land into smaller tracts for sale. Therefore, the Dutch Flat area and the habitat of the white-margined penstemon would be subject to rural development whether

Table 1. White-margined penstemon habitat units for the proposed action (preferred) alternative and the no-action alternative based on habitat value and management value ratings.

Habitat value	High (1.00)	Medium (0.75)	Low (0.25)	Management value	Total
Public acres (blocked)	980	60	0	1.00	424
Private acres (blocked)	480	1735	1360	0.20	1025
Total habitat units					1449
Public acres (checkerboard)	480	1735	1360	0.60	1273
Private acres (checkerboard)	980	60	0	0.40	410
Total habitat units					1683

the Hualapai Mountains Land Exchange took place or not. With the large increase in population of the Sun Belt, impacts to the white-margined penstemon and its habitat would happen anyway. Without the land exchange, the inevitable impacts of the rural development would be dispersed over a wider area of the plant's habitat; with the land exchange a large core area of high-quality habitat would be consolidated as public land within the southeastern part of the ACEC (Figure 6). Based on landscape ecology, this area is the largest continuous piece of high-quality habitat. It contains a broad fan terrace below a broad mountain face. Farther north the fan terrace below the mountains is dissected by three large washes, Bar I-L, Happy Jack, and Mackenzie Washes, coming out of the Hualapai Mountains, that have eroded the fan terrace and left only smaller strips of uneroded fan terrace for white-margined penstemon habitat. 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. With the existing checkerboard land ownership pattern, BLM management would be primarily reactive to actions derived from the interspersed private land.

The environmental tradeoff from the land exchange is the conversion of the western edge of the white-margin penstemon habitat in Dutch Flat to private land. Basically, the Alamo Road which runs down the center of Dutch Flat has become the dividing line between the consolidated public land to the east and the consolidated private land to the west. However, the elevation in Dutch Flat descends from the east to the west down the fan terrace from the Hualapai Mountains, and the western edge of the white-margined habitat that became private land contains the lower elevation, lower precipitation, lower quality habitat. Even though a much larger amount of habitat acreage became private (3,575 acres) than public (1,040 acres), most of this newly private acreage is the lower quality habitat. With the conversion factors applied, the comparative habitat unit values are similar between the preferred alternative (1,025 federal, 424 private, and 1,449 total) and the no-action alternative (1,273 federal, 410 private, and 1,683 total; Table 1). In addition, even with the inevitable rural development taking place in Dutch Flat, much of the private land will still remain in a natural condition. This situation

already exists at the north edge of Dutch Flat near Cactus Mountain, where the author has observed white-margined penstemon plants growing on private land in between the widely scattered dwellings and associated paraphernalia.

The generosity of the proponent allowed the BLM to acquire an additional 320 acres of high-quality habitat as a donation. Although this half section was not part of the offered lands, previous BLM surveys for the white-margined penstemon had found it to be high-quality habitat. The author approached the proponent about the possibility of a land donation and they were agreeable to the idea. Because of its location, this half section, T16-1/2 N, R16 W, S31 E1/2, was very important in the conservation of the white-margined penstemon. It borders the core area of high-quality habitat within the ACEC, is contiguous on two sides with other public land sections, and extends the core area further westward (Figure 6).

Another benefit of this analysis of the effects of the Hualapai Mountains Land Exchange on the white-margined penstemon is with its use as a baseline for the analysis of cumulative effects from future land exchanges. The BLM is currently processing the Cane Springs Land Exchange involving primarily another area of checkerboard lands east of the Hualapai Mountains. However, one of the selected sections is in Dutch Flat, T17 N, R17 W, Section 4 at the north end of Dutch Flat near Cactus Mountain (Figure 6). There are no offered sections of white-margined penstemon habitat in the Cane Springs Land Exchange. Using the same habitat quality and management criteria, this section was found to have 480 acres of low-quality habitat, which corresponds to 120 habitat quality units. Applying the ranking factors for manageability criteria, this section would have 72 habitat units under the existing situation of checkerboard federal ownership and 24 habitat units under the proposed land exchange action of blocked private, a difference of 48 more habitat units under the existing situation. The cumulative effect combined with the Hualapai Mountains Land Exchange will then be 1,473 habitat units with both exchanges and 1,755 habitat units under the existing situations, for an additional 2 percent loss in habitat units (but low-quality habitat) for the white-margined penstemon with the Cane Springs Land Exchange.

In summary, the white-margined penstemon would fare better if Dutch Flat was still the "perfect garden" that Marcus Jones saw in 1884. With the inevitable rural development presently

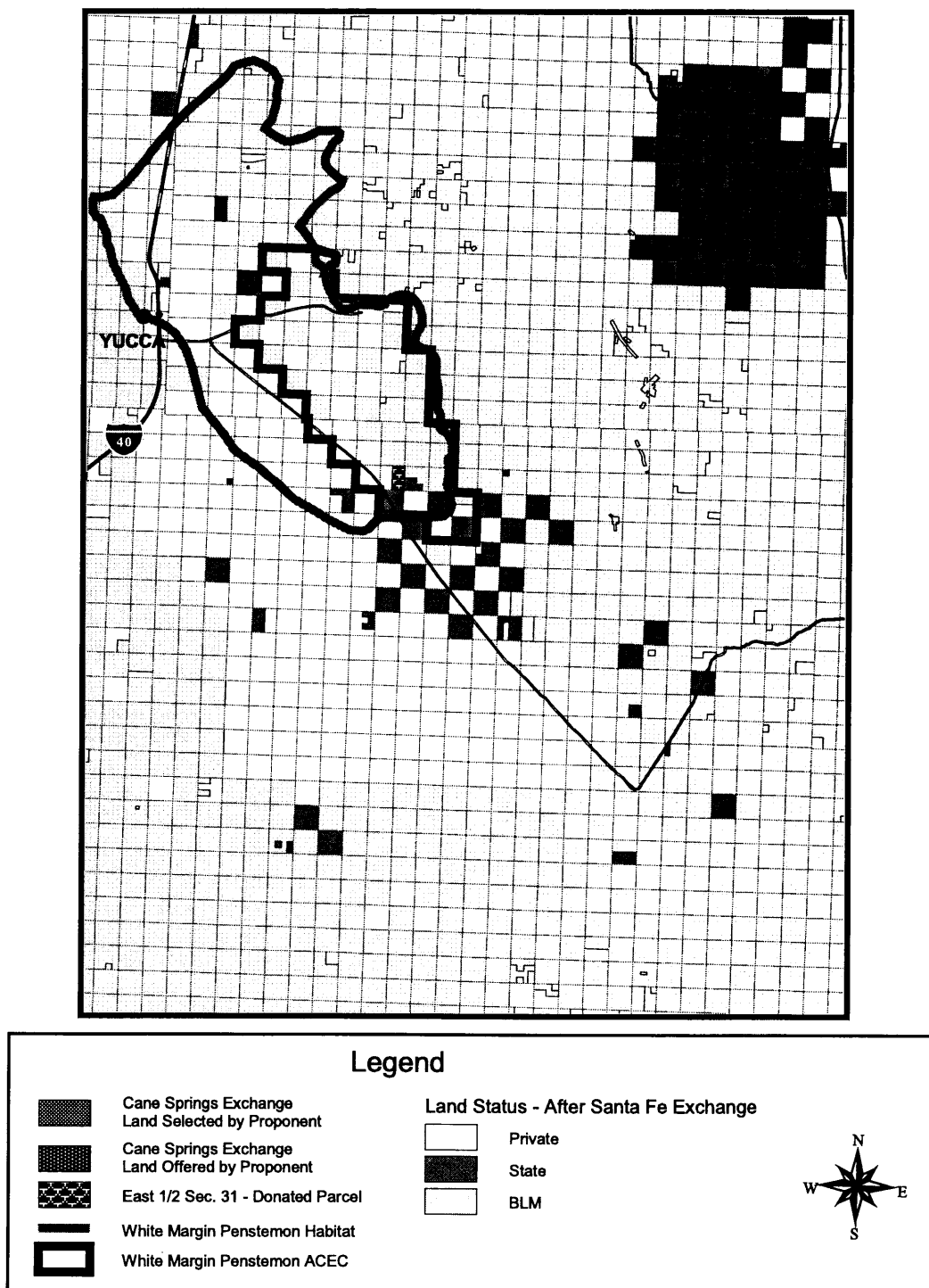


Figure 6. Blocked land ownership pattern after the Hualapai Mountains Land Exchange.

occurring, the land use situation in the Dutch Flat area was already causing impacts to the white-margined penstemon. The Hualapai Mountains Land Exchange provided the BLM with its best tool for implementing one of the white-margined penstemon ACEC management prescriptions of acquiring the private land within the ACEC for proactive management. 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. White-margined penstemon will also be able to continue to exist amongst the rural development scenario on the private land habitat.

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