

# CONSERVATION OF ENDANGERED BAKERSFIELD CACTUS (*OPUNTIA BASILARIS* VAR. *TRELEASEI*) THROUGH POPULATION ESTABLISHMENT AND EXPANSION, AND OUTREACH



PREPARED FOR: CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

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## EXECUTIVE SUMMARY

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Bakersfield cactus (*Opuntia basilaris* var. *treleasei*) is endemic to the southeastern corner of the San Joaquin Valley. Many sites with cactus have been converted to agricultural and urban uses, and remaining populations are fragmented and generally occur on small parcels. Populations of Bakersfield cactus continue to be lost, and habitat conditions are being degraded for some remaining populations. Consequently, the species is listed as federally and state endangered. Currently, only about 33 populations of Bakersfield cactus are known to be extant. Of these, 22 were small and consisted of fewer than 100 plants. Two strategies to reduce extinction risk and increase the long-term security of a species are to increase the size of existing populations and establish additional populations, particularly on conserved lands where the threat of habitat destruction is significantly reduced. The establishment of new populations of Bakersfield cactus through natural processes is unlikely because the dispersal potential of this species is low. Thus, anthropogenically-assisted movement of Bakersfield cactus is necessary to establish new populations.

Our goal was to expand the number and size of Bakersfield cactus populations. Specific objectives were to (1) expand existing populations of Bakersfield cactus and establish new populations in appropriate habitat via propagation and translocation, and (2) conduct outreach efforts to increase public awareness of Bakersfield cactus including current threats and on-going conservation efforts.

The expansion of existing populations and the establishment of new populations were achieved by collecting Bakersfield cactus pads from source populations, propagating the pads into small plants, and then planting these in suitable sites. A total of 403 pads were collected from 7 populations and propagated in a facility at the Wind Wolves Preserve. Of the small plants propagated, 197 were used to expand 5 existing populations. The remaining 206 plants were used to establish 5 new populations. All of the expanded and new populations were on permanently protected lands. These populations will be monitored to assess success. Additionally, efforts were facilitated at the Wind Wolves Preserve to restore a population damaged by a wildfire and to establish 4 new populations.

Several outreach efforts for Bakersfield cactus were conducted. These included efforts at the Wind Wolves Preserve and the Panorama Vista Preserve to develop interpretive programs for Bakersfield cactus. Additionally, an article on Bakersfield cactus conservation was published in the popular magazine *Outdoor California*, and another article is being prepared for submission to the journal *Fremontia*. Finally, public presentations on Bakersfield cactus and conservation efforts were delivered by ESRP staff, and additional presentations will be given as opportunities arise.

Recommendations resulting from this project are to (1) identify additional opportunities to expand existing or establish new Bakersfield cactus populations on protected lands, (2) conduct additional outreach and educational efforts, and (3) conduct a viability analysis to determine the size and number of populations necessary to ensure long-term viability of the Bakersfield cactus metapopulation.

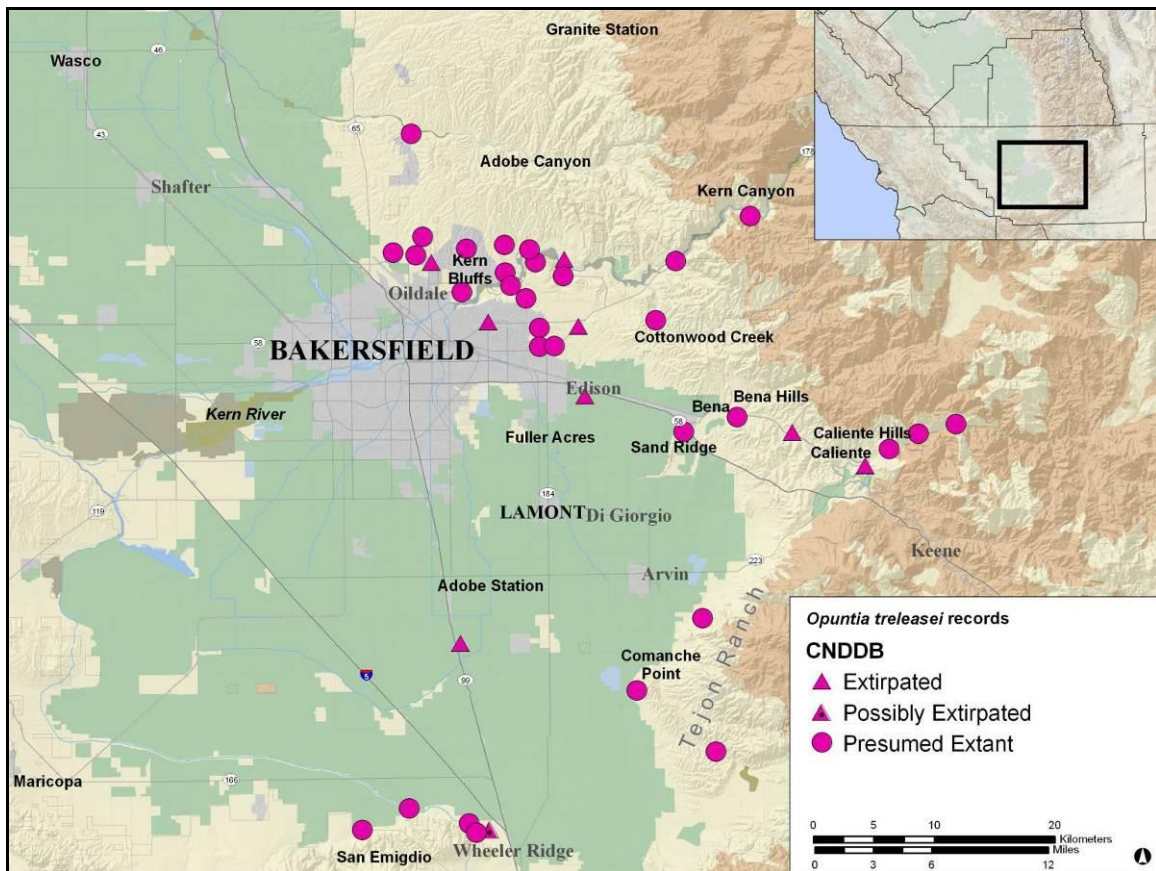
## **ACKNOWLEDGMENTS**

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## INTRODUCTION

Bakersfield cactus (*Opuntia basilaris* var. *treleasei*) is endemic to the southeastern corner of the San Joaquin Valley (Fig. 1) in central California (U.S. Fish and Wildlife Service 1998). The species historically occurred from just north of Bakersfield down to the Wheeler Ridge area at the southern end of the valley. Cactus populations may have been more or less continuous within this area, but many sites with Bakersfield cactus have been converted to agricultural and urban uses. Remaining populations are highly fragmented, and loss of habitat and populations is on-going. Consequently, Bakersfield cactus was listed as a federal and California endangered species in 1990 (U.S. Fish and Wildlife Service 1998).



**Figure 1. CNDDDB occurrence records for Bakersfield cactus in the San Joaquin Valley, California.**

Based on surveys conducted during 2010-2011 (Cypher et al. 2011b, 2014a), 27 natural populations of Bakersfield cactus were confirmed extant, and 6 translocated populations were identified. Of these populations, 22 were small and consisted of fewer than 100 plants. Also, the habitat is anthropogenically degraded in many populations. Only 4 entire populations and portions of 8 others are on permanently conserved lands. Many of the remaining populations are subject to continuing threats including urban and agricultural developments, incompatible land uses, competition from non-native plants,

and fires (Cypher et al. 2014a, U.S. Fish and Wildlife Service 2011). These factors collectively increase the vulnerability of the Bakersfield cactus metapopulation to extinction.

Two strategies to reduce extinction risk and increase the long-term security of a species are to increase the size of existing populations and establish additional populations (Henle et al. 2004), particularly on conserved lands where the threat of habitat destruction is significantly reduced. Bakersfield cactus has been established at a number of sites through translocation (Cypher et al. 2011b, 2014a); some of these efforts were opportunistic and others were experimental (Cypher et al. 2011a, 2014b). Furthermore, Bakersfield cactus cladodes (i.e., pads) are easily propagated into small plants that can be used to establish new populations (Dabulamanzi 2014). Such propagation increases the probability of successful plant establishment and reduces effects on source populations because pads can be collected instead of entire plants (Cypher et al. 2014a). Collecting and propagating cuttings also was used to establish new populations of endangered Knowlton's cactus (*Pediocactus knowltonii*) in New Mexico (Cully 1996).

The establishment of new populations of Bakersfield cactus through natural processes is unlikely because the dispersal potential of this species is low. Bakersfield cactus infrequently produces seed through sexual reproduction and predation rates on seeds by insects and rodents can be high (E. Cypher and B. Cypher, pers. obs). Dispersal also occurs when pads are naturally shed and then are transported by gravity or water to new locations (U.S. Fish and Wildlife Service 1998). However, profound habitat fragmentation and a lack of corridors have virtually eliminated any opportunities for such dispersal. Thus, anthropogenically-assisted movement of Bakersfield cactus is necessary to establish new populations.

Our goal was to expand the number and size of Bakersfield cactus populations to increase metapopulation viability and reduce extinction probability. Specific objectives were to (1) expand existing populations of Bakersfield cactus and establish new populations in appropriate habitat via propagation and translocation, and (2) conduct outreach efforts to increase public awareness of Bakersfield cactus including current threats and on-going conservation efforts.

## **IDENTIFYING EXPANSION POPULATIONS, NEW POPULATION SITES, AND SOURCE POPULATIONS**

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An initial step for this project was to identify Bakersfield cactus populations that might be expanded, sites where new populations might be established, and populations that could serve as sources of plants for the new populations. Expanding or establishing populations was only considered for locations on lands that were permanently conserved and where the potential for disturbances was estimated to be relatively low. Candidate populations for expansion were identified based on recommendations provided in Cypher et al. (2011b). Populations were considered good candidates for expansion if they were on protected lands, the populations were relatively small (<200 plants), and if suitable but unoccupied habitat was present. Five populations were identified for expansion (Fig. 2).

- ***California Living Museum:*** This population occurs on the grounds of a small zoo. The original population consisted of 2 large plants located in an area enclosed within the loop of a reduced-scale “Children’s Railroad”. These plants were originally salvaged from sites undergoing urban development and moved to this location. Additional open space was available within this area.
- ***California Department of Fish and Wildlife’s Bakersfield Cactus Ecological Reserve - Airport Unit:*** This population (California Natural Diversity Database [CNDDDB] Element Occurrence - 2) occurs on preserve lands owned and managed by the California Department of Fish and Wildlife (CDFW). The original population consisted of 100-150 plants that occurred in about 25% of the preserve. Considerable suitable habitat is present on this preserve.
- ***Tejon Ranch - Little Sycamore Canyon:*** This population (CNDDDB Element Occurrence - 38) occurs on conservation lands owned by Tejon Ranch and managed jointly by the Ranch and the Tejon Ranch Conservancy. The original population consisted of approximately 10 plants. Considerable suitable habitat is present in the vicinity of these plants.
- ***Bena Landfill Conservation Area - West:*** This population occurs on conservation lands surrounding a landfill. The lands are owned by Kern County and managed by the Kern County Waste Management Department. The original population consisted of approximately 20 plants that were translocated to this location in 2011 in an experimental effort to establish a new population. Considerable suitable habitat is present in the vicinity of these plants.
- ***California Department of Fish and Wildlife’s Bakersfield Cactus Ecological Reserve - Hart Park Unit:*** This population (CNDDDB Element Occurrence - 15) was not originally selected for expansion because the cactus population is relatively large (250-500 plants) and the area is subject to disturbance from illegal off-highway vehicle (OHV) use. However, in 2013, CDFW staff found that a number of pads had been broken off of plants by OHVs at the nearby Brown Unit of the Bakersfield Cactus Ecological Reserve. These were collected and the site was included in this project. Plants propagated from the pads were planted in areas less likely to be disturbed.

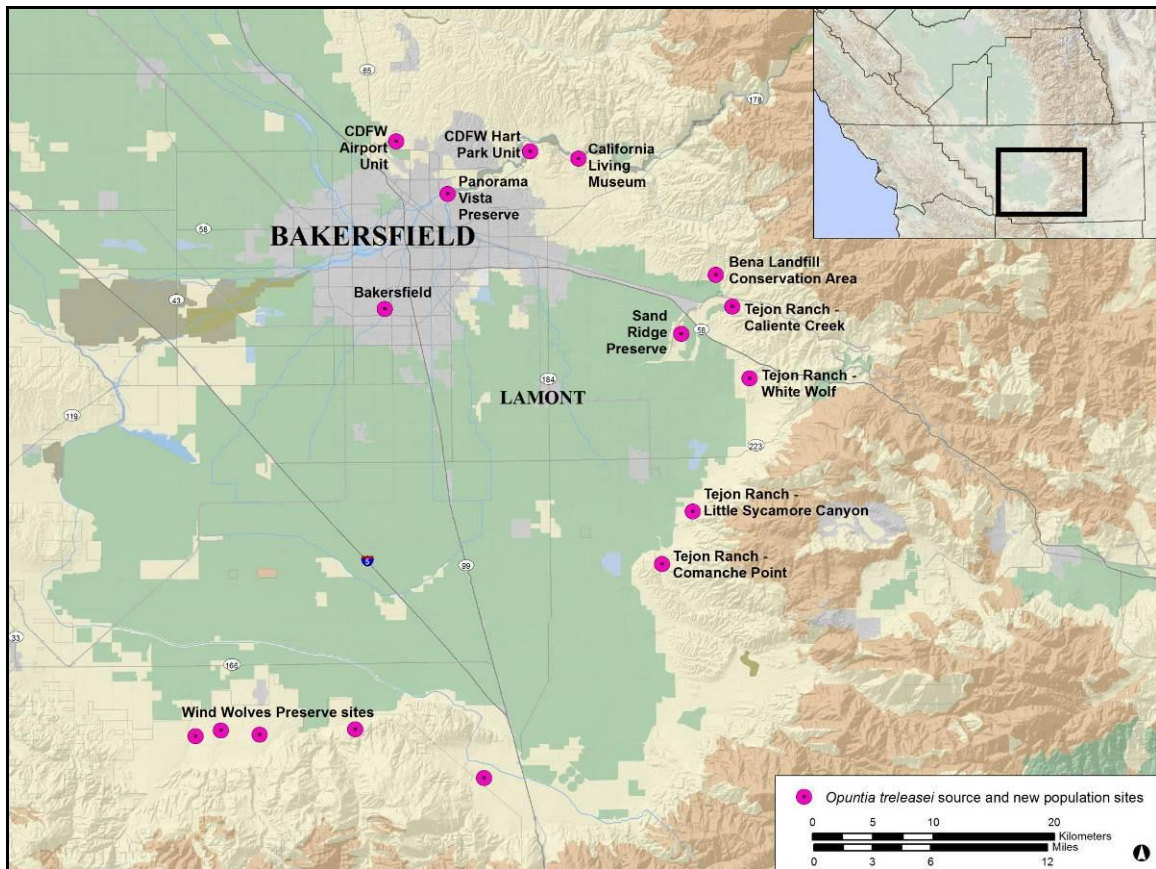
Five locations were identified for the establishment of new populations (Fig. 2).

- ***Panorama Vista Preserve:*** This Preserve encompasses over 900 acres, approximately half of which is suitable for Bakersfield cactus. An existing population of 150-200 cactus plants occurs on about 1-2 acres on the southern edge of the property. A single plant occurs at a site in the northern part of the property. Considerable suitable unoccupied habitat is present. The Preserve is owned and managed by the Kern River Corridor Endowment and Holding Company, a non-profit conservation organization.
- ***Bena Landfill Conservation Area - East (2 sites):*** Several hundred acres of suitable habitat occur in the eastern portion of the Bena Landfill Conservation Area. No Bakersfield cactus plants occur in this area although several large populations occur on adjacent lands just outside and down-slope from the landfill



boundary. Two sites separated by about 0.75 mi were selected for new cactus populations.

- **Tejon Ranch - White Wolf Area (2 sites):** Several thousand acres of suitable habitat occur in this area, which comprises conserved lands on Tejon Ranch. This area is located up-slope from cactus populations located 2.5 miles north and 3.5 miles west. Two sites separated by about 1.1 mi were selected for new cactus populations.



**Figure 2. Source, expanded, and new populations of Bakersfield cactus in the San Joaquin Valley, California.**

Source populations were identified for each expanded or new population. The results of a range-wide population genetics study conducted on Bakersfield cactus (Smith 2013) were consulted before-hand to identify any genetic issues that warranted consideration in translocating this species. The conclusions of this study essentially were that genetic partitioning within the Bakersfield cactus metapopulation was insufficient to warrant restrictions on translocations, although the author recommended that a best management practice was to keep source and recipient populations in as close proximity as possible. For 3 of the expanded populations, pads were collected from existing plants at those locations. Thus, the source and recipient populations were the same. For the remaining 2 expanded populations and all of the new populations, pads were collected from 3 large populations (Fig. 2).



- ***Tejon Ranch - Comanche Point:*** This population (CNDDDB Element Occurrence - 21) consists of at least 200 plants and served as the source population for the expansion of the Tejon Ranch - Little Sycamore Canyon population located 3 mi to the northeast.
- ***Tejon Ranch - Caliente Creek:*** This population (CNDDDB Element Occurrence - 25) consists of 300-400 plants and served as the source population for the 2 Tejon Ranch - White Wolf Area sites located 3 mi and 4 mi, respectively, to the south. It also served as the source population for one of the Bena Landfill Conservation Area – East sites located 0.8 mi to the north.
- ***Sand Ridge Preserve:*** This population (CNDDDB Element Occurrence - 3) consists of approximately 10,000 plants and served as the source population for the Bena Landfill Conservation Area - West site located 3.2 mi to the northeast and also for one of the Bena Landfill Conservation Area – East sites located 4.2 mi to the northeast.

## **PAD COLLECTION AND PROPAGATION**

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Bakersfield cactus pads were collected from source populations during September and October in 2013. Terminal pads were collected by excision from the pad below using a sharp knife to produce a clean cut and minimize damage to the collected and remaining pads. Pads from each source site were collected into a large plastic bin. All pads were stored in a cool dry space for 9-16 days to allow the cut end to callus over. This helps to protect the pads from soil-borne diseases or parasites (Showers 2005).

Based on previous efforts (e.g., Cypher et al. 2011a, 2014b), translocating plants was more successful than translocating pads. Plants have an existing root system and are able to immediately take up water and nutrients upon planting. Pads need to expend resources to develop a root system, and this initial expenditure may be sufficiently stressful to cause mortality. Thus, our strategy was to propagate pads into small plants with a root system. Pads were planted in “cactus mix” soil in small (4 x 4 x 6 in) plastic containers. Popsicle sticks were used to label each container with a number and the source population. The containers were placed on shelves in a small green-house and were watered at 1-2 week intervals. Pads were planted in October 2013 and allowed to grow for approximately 13 months. All planting and propagation was conducted at a small propagation facility (Fig. 3) located at the Wind Wolves Preserve located about 25 mi south of Bakersfield.

During propagation, approximately 5% of pads did not survive. It is unclear why some pads do not survive while others do survive. However, some mortality was not unexpected. For plants that did survive, many produced additional pads and all appeared to have developed a root system (Fig. 4).

## CACTUS PLANTING

At all population expansion and establishment sites, propagated Bakersfield cactus plants were planted in groups of 5 to 9 plants. Plants were spaced at least 10 ft apart, and distances between groups varied from about 10-200 ft. Plant and group spacing was intended to generally approximate spacing in natural populations.



Figure 3. Green-house propagation facility at the Wind Wolves Preserve, California.



Figure 4. Root system on 1-year old propagated Bakersfield cactus pad.

At each planting location, an area approximately 2 x 2 ft was cleared of all vegetation to reduce competition, particularly from non-native grasses. Within this cleared area, a small hole (~6 x 6 x 6 in) was excavated with a shovel or pickax. Cactus plants were removed from containers by gently dumping out the plant and soil onto a plastic place mat. The place mat was then rolled into a tube and inverted, and the plant and soil were allowed to slide roots-first down into the hole (Fig. 5). This planting method protected the plant from handling damage and protected planting crews from cactus spines. Excavated soil was filled in around the plant and the soil was tamped down. Each plant was encircled with a small berm 1-3 in tall to retain water (Fig. 6). Each plant was then watered until the soil around the plant was thoroughly wet and water pooled within the berm. For plants at sites grazed by cattle, 2 pieces of U-shaped rebar were inserted over the plants to help protect them from being trampled by cattle (Fig. 7). UTM coordinates were collected for the center point of each group of plants.



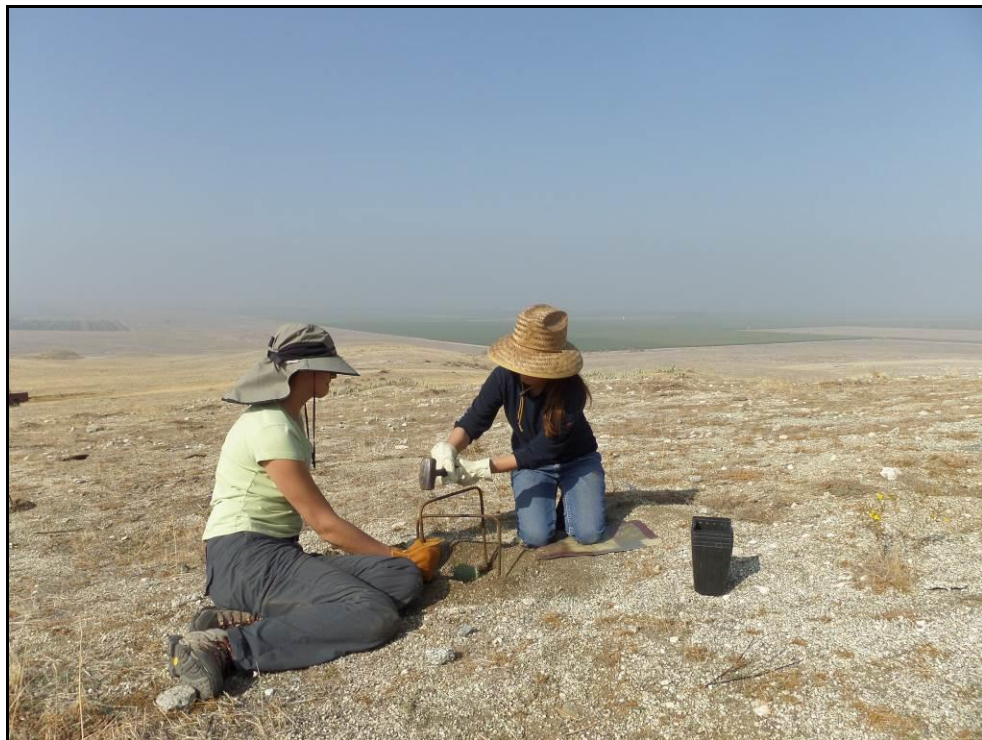
**Figure 5. Planting a propagated Bakersfield cactus pad.**

A total of 403 Bakersfield cacti were planted during this project to expand 5 existing populations and to establish 5 new populations (Table 1). Additional details and images for each site where Bakersfield cacti were planted are provided in the Appendix. Although the project officially ends in early 2015, CSUS/ESRP staff will periodically visit the expanded and new populations to assess project success. Survival, growth, and reproduction by propagated plants will all be indicators of success.





**Figure 6. Planted Bakersfield cactus pad.**



**Figure 7. Installing cattle guards around a newly planted Bakersfield cactus pad.**

**Table 1. Source and recipient populations for expansion and establishment of Bakersfield cactus populations.**

Source population	Recipient population	Expanded or new population	Number of cacti planted	Date of planting
CDFW – Airport Unit	CDFW – Airport Unit	Expanded	52	4 Nov 2014
California Living Museum	California Living Museum	Expanded	26	4 Nov 2014
Panorama Vista Preserve	Panorama Vista Preserve	New	52	6 Nov 2014
CDFW – Hart Park Unit	CDFW – Hart Park Unit	Expanded	15	6 Nov 2014
Tejon Ranch – Comanche Point	Tejon Ranch – Little Sycamore Canyon	Expanded	53	10 Nov 2014
Tejon Ranch – Caliente Creek	Tejon Ranch – White Wolf North	New	26	10 Nov 2014
Tejon Ranch – Caliente Creek	Tejon Ranch – White Wolf South	New	26	10 Nov 2014
Tejon Ranch – Caliente Creek	Bena Landfill Conservation Area – Southeast	New	51	11 Nov 2014
Sand Ridge Preserve	Bena Landfill Conservation Area – Northeast	New	51	11 Nov 2014
Sand Ridge Preserve	Bena Landfill Conservation Area – West	Expanded	51	11 Nov 2014

## **WIND WOLVES PRESERVE PROJECT**

In a collaborative effort, assistance was provided to staff of The Wildlands Conservancy (TWC) that is engaged in Bakersfield cactus conservation efforts on the Wind Wolves Preserve. One of the largest remaining populations of Bakersfield cactus occurs on the Preserve (Cypher et al. 2011b). In September 2011, a lightning-caused wildfire swept through this population killing approximately 11% of plants and severely damaging approximately 53% (Dabulamanzi 2013). Efforts were initiated to collect pads from remaining plants and propagate them into small plants. Some of these plants were placed back into the burned population to increase the number of individuals and assist with the recovery of that population. Other plants were placed at 4 new sites to establish new populations, which both increased the overall number of populations and provided a potential hedge against future catastrophic events, such as wildfires.

In 2013-14, 790 propagated cacti were planted in the 5 sites. Another 840 pads were collected for propagation, and these cacti will be planted during late 2014-early 2015. Collections, propagation, and planting will continue for another 4 years. All populations are being monitored each year to assess plant survival and project success (Dabulamanzi 2013).

CSUS/ESRP staff has provided advice, assistance, and support during this project. We provided guidance on the collection and propagation of cactus pads, including techniques and appropriate materials. CSUS/ESRP staff also assisted TWC staff in the field with the selection of appropriate sites for the establishment of new populations. CSUS/ESRP staff

also assisted with some planting efforts. Finally, assistance was provided on outreach efforts at the Wind Wolves Preserve (see *Outreach Efforts* below).

## **OUTREACH EFFORTS**

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Outreach efforts for Bakersfield cactus and other listed species in the San Joaquin Valley are sorely lacking. Such efforts are important for increasing public awareness and eliciting local support for conservation efforts. Several outreach efforts were conducted or initiated during the course of this project, as detailed below.

### ***1. WIND WOLVES PRESERVE***

CSUS/ESRP staff assisted with implementing outreach efforts for Bakersfield cactus at the Wind Wolves Preserve. Specifically, several cactus plants from the Preserve's propagation program were planted along 2 interpretive trails on the Preserve. Cacti were planted near the beginning of the San Emigdio Canyon trail and along the Wildflower Loop trail. Interpretive signage also was installed. CSUS/ESRP staff assisted with the selection of the planting sites and provided information for the signage. Visitation to the Preserve numbers in the thousands annually, many of which are school children brought to the Preserve for nature education classes.

### ***2. PANORAMA VISTA PRESERVE***

CSUS/ESRP staff also assisted with implementing outreach efforts for Bakersfield cactus at the Panorama Vista Preserve. Interpretive signage was developed and installed along a hiking trail on the Preserve (Fig. 8). The information presented described the ecological value of Bakersfield cactus, reasons for endangerment, and on-going conservation efforts. In the future, cactus plants will be planted next to one of the hiking trails on the Preserve so that the public will be able to view some plants at close range. Visitation to the Preserve numbers in the thousands annually, many of which are school children brought to the Preserve for nature education classes.

### ***3. OUTDOOR CALIFORNIA ARTICLE***

CSUS/ESRP and CDFW staff were interviewed for an article on Bakersfield cactus conservation that was published in *Outdoor California* (Horg 2014). The article included several color photographs and described the range and ecology of the species, reasons for endangerment, and current threats and conservation efforts. *Outdoor California* is intended for the general public and readership numbers in the thousands.



**Disappearing Habitat**  
 Bakersfield cactus historically grow from just north of the city of Bakersfield down to the Wheeler Ridge area at the southern end of the San Joaquin Valley. Cactus distribution may have been more or less continuous within this area. However many sites with Bakersfield Cactus have been converted to agricultural and urban uses. Many of the remaining populations are small and very few of these populations are adequately protected. This plant now only occurs in approximately 30 locations. Protection of remaining populations is crucial.

**Protected by Law**  
 In 1990, Bakersfield cactus was listed as "Endangered" by both the Federal government and the State of California. Conservation of remaining populations is essential to prevent the extinction of this plant. On the Panorama Vista Preserve the plants and their habitat are being protected from development.

**Saving the Species**  
 Efforts are underway to establish additional populations on the Preserve in partnership with the Stanislaus State University Endangered Species Program. Cactus pads have been carefully collected and grown in a greenhouse to produce small plants. These new plants are being placed in suitable areas and will be cared for and monitored. Hopefully, several new cactus populations will be established at the Panorama Vista Preserve which will help increase the total number of cactus populations and reduce the threat of extinction.

**BAKERSFIELD CACTUS** An Endangered Beauty

Bakersfield Cactus (*Opuntia basilaris* var. *treleasei*) is a type of small "beaver tail" cactus. It has flattened pads with spines, and produces large, bright pink flowers in the spring. It grows to a height of about 1 to 1 ½ feet tall. It is found only in the southeastern corner of the San Joaquin Valley. Two populations occur at the Panorama Vista Preserve.

*“The hilly country is completely bleak, without any vegetation except a beautiful species of cactus whose magnificent red blossoms grace this sad sandy desert in a strange manner.”*

Charles Preuss, cartographer with the Fremont Expedition, 1844

Figure 8. Interpretive sign for Bakersfield cactus at the Panorama Vista Preserve.

**4. FREMONTIA ARTICLE**

An article on Bakersfield cactus conservation efforts, and particularly the population expansion and establishment project, is being prepared for submission to *Fremontia*. *Fremontia* is a semi-technical journal published by the California Native Plant Society. Each issue is sent out to the Society’s nearly 10,000 members along with numerous libraries. Issues also are available for downloading from the Society’s website.

**5. PUBLIC PRESENTATIONS**

In 2013 and 2014, ESRP staff participated in events at the Panorama Vista Preserve in which school children were brought to the Preserve for an environmental education program. ESRP staff operated a station that provided information on local endangered species including Bakersfield cactus. ESRP staff also participated in the 2014 Wind Wolves Nature Festival and gave a presentation on endangered species, which included a large segment on Bakersfield cactus conservation efforts. Furthermore, we are preparing a focused presentation on Bakersfield cactus and conservation efforts, and will seek opportunities to deliver it to local public organizations, classes, and any other groups that are interested.

## **6. BAKERSFIELD CALIFORNIAN ARTICLE**

On 27 February 2014, Ellen Cypher and Erin Tennant met with a reporter and photographer from the *Bakersfield Californian* at the CDFW Bakersfield Cactus Preserve – Hart Park Unit. They discussed issues related to trespass OHV use of the Unit and the damage inflicted on the cactus populations there. A nice article was published in the newspaper the next day (<http://www.bakersfieldcalifornian.com/local/x406539027/A-struggle-to-preserve-Recreation-destroying-cactus-habitat>).

## **RECOMMENDATIONS**

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Based on the results of this project, the following recommendations are offered for Bakersfield cactus conservation.

### **1. EXPAND OR ESTABLISH ADDITIONAL POPULATIONS ON PROTECTED LANDS**

The long-term viability and security of a species increases and the probability of extinction decreases as the number and size of populations increases. Given the continuing habitat and population loss for Bakersfield cactus, additional opportunities to expand existing populations and to establish new populations should be aggressively sought. In particular, these activities should be focused on permanently protected lands to reduce the probability that conservation efforts will be negated by habitat or population destruction. Similarly, efforts should be made to permanently conserve lands with Bakersfield cactus populations or at least with suitable habitat. This will concomitantly increase opportunities for additional population expansion and establishment.

### **2. CONDUCT ADDITIONAL OUTREACH AND EDUCATION PROGRAMS**

Outreach and education programs for listed species in the San Joaquin Valley have been minimal. Such programs could help increase public support for conservation efforts, provide information on conservation measures to landowners, and encourage contributions of resources for conservation efforts.

### **3. CONDUCT A POPULATION VIABILITY ANALYSIS**

A population viability analysis should be conducted for Bakersfield cactus to determine the optimal number of individual populations necessary to sustain a metapopulation with long-term viability. Such an analysis would help determine the necessity and criticality for expanding and establishing additional populations. A population viability analysis also might help identify the optimum or at least the minimum size necessary to maintain viability for individual populations.

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APPENDIX

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Bakersfield cactus population expansion and establishment efforts are summarized below by site. These summaries were provided to landowners upon completion of the efforts. All coordinates are given in WGS84.

## **Bakersfield Cactus Establishment – California Living Museum**

On September 25, 2013, the California State University, Stanislaus – Endangered Species Recovery Program collected 26 Bakersfield cactus (*Opuntia basilaris* var. *treleasei*) pads from the California Living Museum (CALM) population. The pads were propagated at Wind Wolves Preserve for approximately one year and were transplanted into a new area at CALM on November 4, 2014 (Figures 1 and 2). Cacti were planted in groups in an attempt to mimic natural placement. The number of plants and the coordinates of the center cactus in each group were recorded (Table 1; Figure 3). Staff from McCormick Biological generously assisted with the planting.



**Figure 1. Transplanted Bakersfield cactus at CALM.**





Figure 2. CALM Bakersfield cactus planting crew.

Table 1. Group number, number of cactus, and group coordinates for Bakersfield cactus planted at CALM in November 2014.

Group	Number of plants	Group coordinates
1	5	N35.43410 W-118.88421
2	5	N35.43413 W-118.88422
3	5	N35.43418 W-118.88424
4	5	N35.43422 W-118.88429
5	6	N35.43427 W-118.88440





Figure 3. Placement of Bakersfield cactus groups at CALM.

## **Bakersfield Cactus Establishment – Airport and Hart Park Unit**

On September 25, 2013, the California State University, Stanislaus – Endangered Species Recovery Program collected 52 Bakersfield cactus (*Opuntia basilaris* var. *treleasei*) pads from the Airport Unit owned by the Department of Fish and Wildlife. An additional 15 disturbed pads were salvaged on November 15, 2013 by Department staff from the Brown parcel, also owned by the Department. The pads were propagated at Wind Wolves Preserve for approximately one year and were transplanted into existing population areas on Department owned lands on November 4, 2014 (Figures 1 and 2). The purpose of the plantings was to expand these existing populations and make them more robust. The 52 cactus pads that were collected from the Airport Unit were returned to augment that population and the 15 pads salvaged from the Brown parcel were transplanted into the existing population on the Hart Park Unit, as per Department recommendations. Cacti were planted in groups in an attempt to mimic natural placement. The number of plants and the coordinates of the center cactus in each group were recorded (Table 1; Figures 3 and 4). Staff from McCormick Biological generously assisted with the planting.



**Figure 1. Transplanted Bakersfield cactus at Airport Unit.**





Figure 2. Airport Unit cactus planting.

Table 1. Site, group number, number of cactus, and group coordinates for Bakersfield cactus planted on Department lands in November 2014.

Site	Group	Number of plants	Group coordinates
Airport Unit	1	7	N35.45350 W-119.05353
	2	9	N35.45345 W-119.05320
	3	9	N35.45343 W-119.05274
	4	9	N35.45346 W-119.05224
	5	9	N35.45373 W-119.05242
	6	9	N35.45400 W-119.05314
Hart Park Unit	1	5	N35.44330 W-118.92600
	2	5	N35.44340 W-118.92519
	3	5	N35.44331 W-118.92505





Figure 3. Placement of Bakersfield cactus groups at the Airport Unit.



Figure 4. Placement of Bakersfield cactus groups at the Hart Park Unit.

## **Bakersfield Cactus Establishment – Panorama Vista Preserve**

On September 26, 2013, the California State University, Stanislaus – Endangered Species Recovery Program collected 52 Bakersfield cactus (*Opuntia basilaris* var. *treleasei*) pads from the Panorama Vista Preserve population. The pads were propagated at Wind Wolves Preserve for approximately one year and were transplanted into a new area within the Panorama Vista Preserve on November 6, 2014 (Figures 1 and 2). Cacti were planted in groups in an attempt to mimic natural placement. The number of plants and the coordinates of the center cactus in each group were recorded (Table 1). Staff from McCormick Biological generously assisted with the planting.



**Figure 1. Transplanted Bakersfield cactus at Panorama Vista Preserve.**



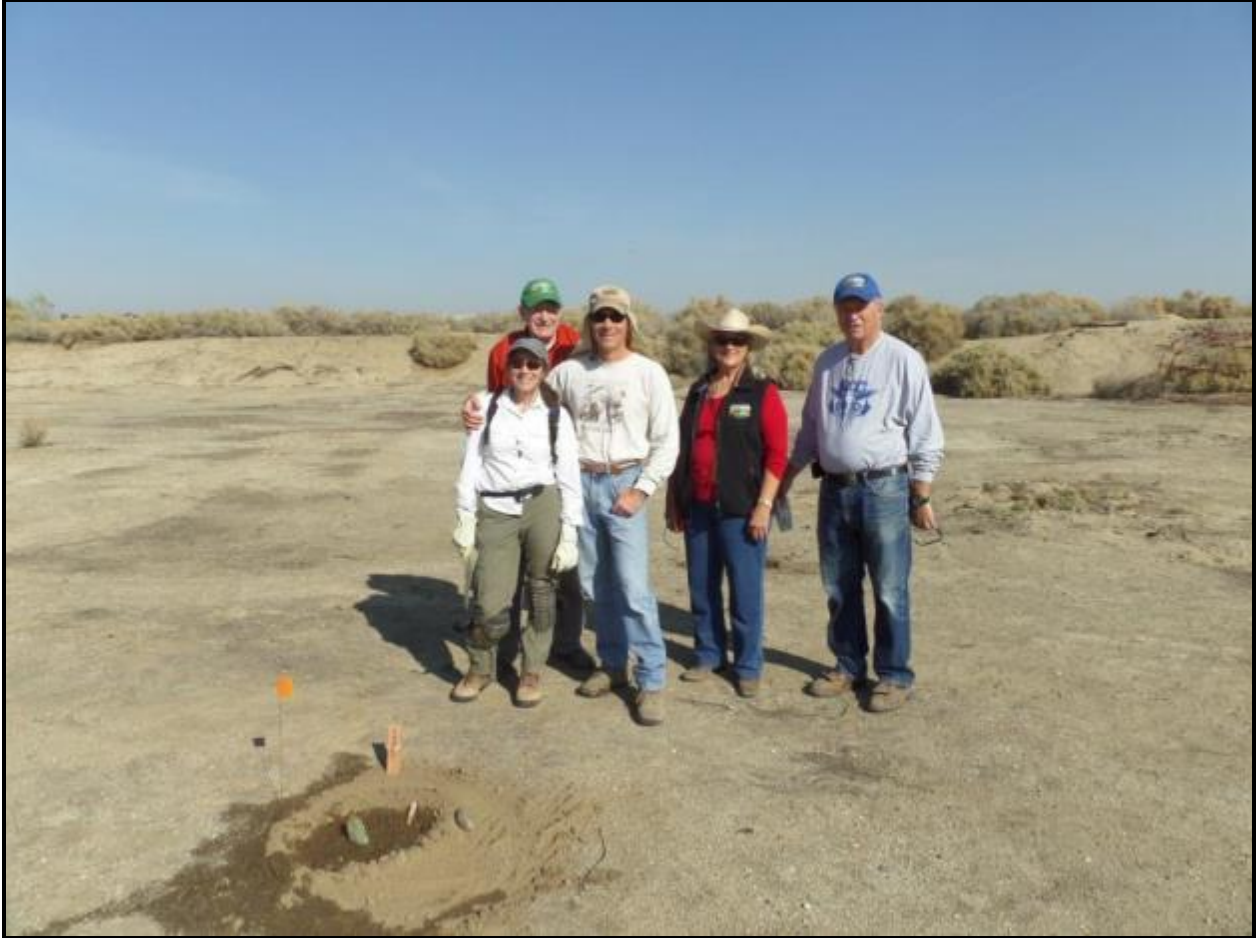


Figure 2. Panorama Vista Preserve cactus planting crew.

Table 1. Group number, number of cactus, and group coordinates for Bakersfield cactus planted at Panorama Vista Preserve in November 2014.

Group	Number of plants	Group coordinates
1	9	N35.41572 W-118.99339
2	9	N35.41571 W-118.99317
3	9	N35.41571 W-118.99287
4	7	N35.41562 W-118.99303
5	9	N35.41547 W-118.99316
6	9	N35.41548 W-118.99280

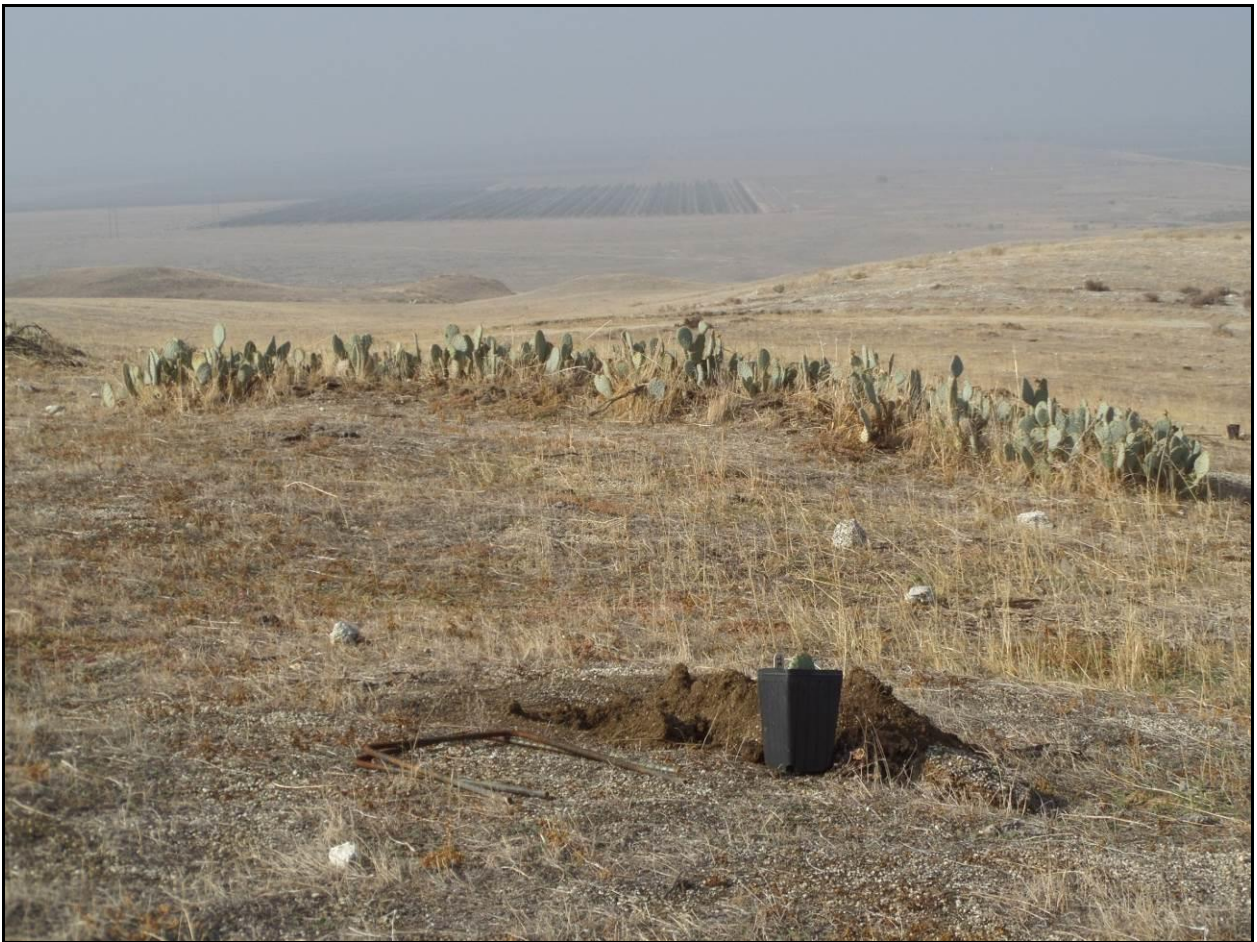




Figure 3. Location of Bakersfield cactus groups planted at the Panorama Vista Preserve.

## **Bakersfield Cactus Establishment – Tejon Ranch**

On October 1, 2013, the California State University, Stanislaus – Endangered Species Recovery Program collected 103 Bakersfield cactus (*Opuntia basilaris* var. *treleasei*) pads from Caliente Creek and 53 from Comanche Creek on Tejon Ranch. The pads were propagated at Wind Wolves Preserve for approximately one year and were transplanted into an existing population and new areas on Tejon Ranch on November 10, 2014 (Figures 1 and 2). Of the pads collected at Caliente Creek, 52 were used to establish new populations in the White Wolf area and the pads collected from Comanche Creek were transplanted into the existing population at Little Sycamore Canyon (Figure 3). Cacti were planted in groups in an attempt to mimic natural placement. The number of plants and the coordinates of the center cactus in each group were recorded (Table 1; Figures 4, 5, and 6). Staff from McCormick Biological generously assisted with the planting.



**Figure 1. Bakersfield cactus planting near the existing population at Little Sycamore Canyon.**





Figure 2. Tejon Ranch Bakersfield cactus planting crew.

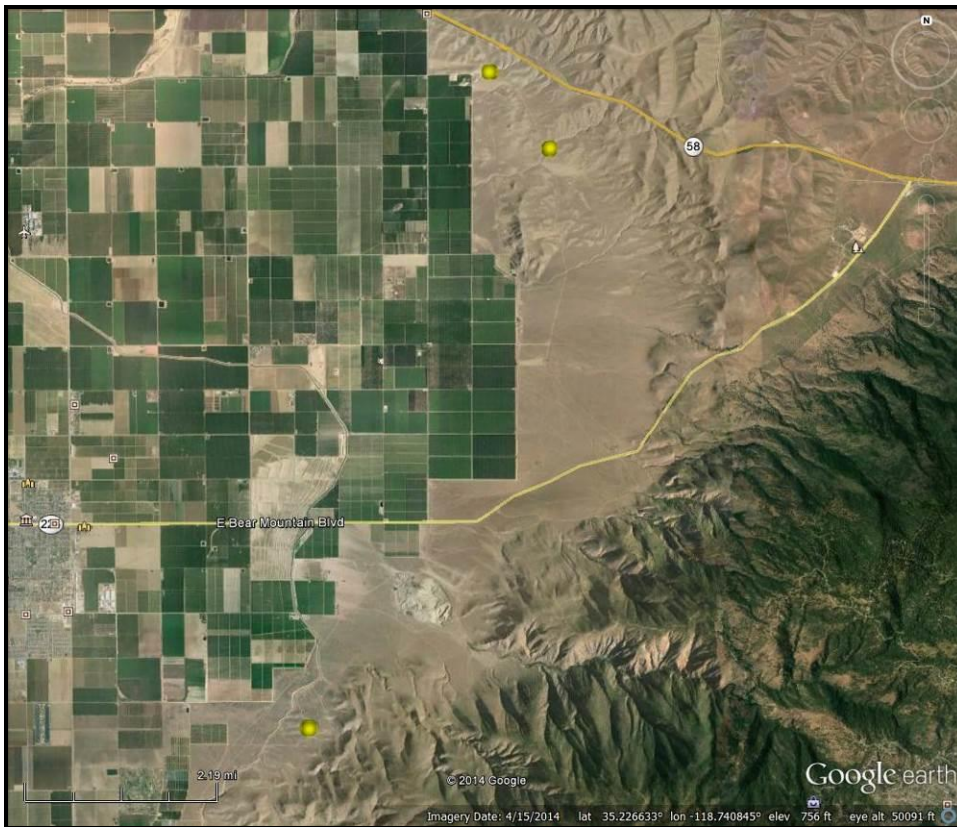


Figure 3. Locations of Bakersfield cactus transplants on Tejon Ranch.

**Table 1. Site, group number, number of cactus, and group coordinates for Bakersfield cactus planted on Tejon Ranch in November 2014.**

Site	Group	Number of plants	Group coordinates
White Wolf North	1	6	N35.28267 W-118.74014
	2	5	N35.28261 W-118.74036
	3	5	N35.28259 W-118.74029
	4	5	N35.28251 W-118.74011
	5	5	N35.28256 W-118.73989
White Wolf South	1	5	N35.27022 W-118.72824
	2	5	N35.27015 W-118.72850
	3	5	N35.27006 W-118.72834
	4	6	N35.27000 W-118.72852
	5	5	N35.26994 W-118.72843
Little Sycamore Canyon	1	8	N35.17636 W-118.77646
	2	9	N35.17630 W-118.77615
	3	9	N35.17618 W-118.77603
	4	9	N35.17598 W-118.77614
	5	9	N35.17591 W-118.77633
	6	9	N35.17603 W-118.77662



**Figure 4. Bakersfield cactus groups in the northern White Wolf area of Tejon Ranch.**





Figure 5. Bakersfield cactus groups in the southern White Wolf area of Tejon Ranch.



Figure 6. Bakersfield cactus groups in the Little Sycamore Canyon area of Tejon Ranch



## **Bakersfield Cactus Establishment – Bena Landfill**

In October of 2013, the California State University, Stanislaus – Endangered Species Recovery Program collected 102 Bakersfield cactus (*Opuntia basilaris* var. *treleasei*) pads from Sand Ridge, owned by the Center for Natural Lands Management, and 103 from Caliente Creek on Tejon Ranch. The pads were propagated at Wind Wolves Preserve for approximately one year and were transplanted into existing populations and new areas on conservation lands at the Bena Landfill on November 11, 2014 (Figures 1 and 2). Of the 102 pads collected at Sand Ridge, 51 were transplanted into the existing population on the west side of the landfill and 51 were planted on the east side to establish a new population of cactus (Figure 3). A second population was established on the east side of the landfill using 51 pads collected from Caliente Creek. Cacti were planted in groups in an attempt to mimic natural placement. The number of plants and the coordinates of the center cactus in each group were recorded (Table 1; Figures 4 and 5). Staff from McCormick Biological generously assisted with the planting.



**Figure 1. Bakersfield cactus planting at Bena Landfill.**





**Figure 2. Bena Landfill cactus planting crew.**



**Figure 3. Placement of Bakersfield cactus groups at the Bena Landfill.**

**Table 1. Site, group number, number of cactus, and group coordinates for Bakersfield cactus planted at Bena Landfill in November 2014.**

Site	Group	Number of plants	Group coordinates
Bena West	1	9	N35.34697 W-118.77030
	2	9	N35.34674 W-118.77025
	3	6	N35.34678 W-118.76989
	4	9	N35.34643 W-118.77001
	5	9	N35.34633 W-118.77039
	6	9	N35.34612 W-118.77047
Bena East	1	30	N35.34541 W-118.74260
	2	21	N35.34504 W-118.74263
	3	25	N35.33526 W-118.74538
	4	26	N35.33505 W-118.74529





Figure 4. Placement of Bakersfield cactus groups on the west side of Bena Landfill.



Figure 5. Placement of Bakersfield cactus groups on the east side of Bena Landfill.