

Bakersfield Cactus (*Opuntia basilaris* var. *treleasei*)

Legal Status

State: Endangered, S2.1¹

California Rare Plant

Rank: 1B.1²

Federal: Endangered, U.S. Forest Service Sensitive

Critical Habitat: N/A

Recovery Planning: Recovery Plan for Upland Species of the San Joaquin Valley, California (USFWS 1998)

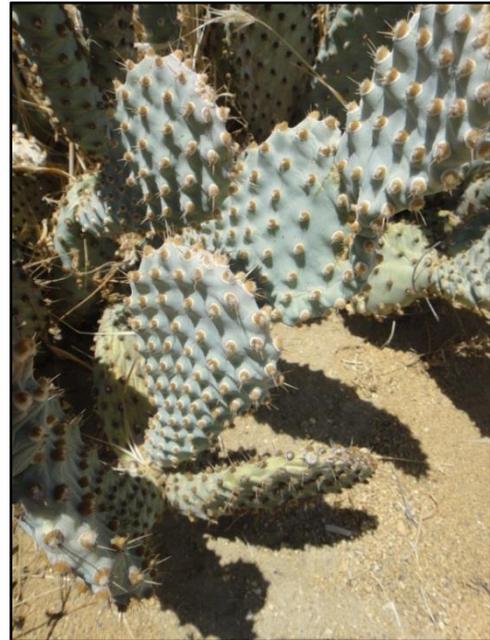


Photo courtesy of Neal Kramer.

Taxonomy

Bakersfield cactus (*Opuntia basilaris* var. *treleasei*) is a perennial stem succulent in the cactus family (Cactaceae) (Jepson Flora Project 2011; CNPS 2011). Bakersfield cactus was originally published as *Opuntia treleasei* by J.M. Coulter in 1896 (IPNI 2011). Bakersfield cactus was listed as *Opuntia treleasei* in the Federal Register notice announcing the endangered status of the species (55 FR 29361–29370). Bakersfield cactus has been consistently treated as a variety of *Opuntia basilaris* in every major California flora, including Munz and Keck (1959), Munz (1974), Hickman (1993), FNA(1993), and Baldwin et al. (2012), is to treat Bakersfield cactus as a variety of *O. basilaris*. since the publication of Jepson's 1936 *A Flora of California*.

Bakersfield cactus is low growing with stem segments approximately 9 to 20 centimeters (3.5 to 7.9 inches) long (USFWS 2011; Jepson Flora Project 2011). A full physical description of the species can be found in the Jepson eFlora (Jepson Flora Project 2011).

¹ **S2:** Imperiled; **X.1:** Very threatened.

² **1B:** Rare, threatened, or endangered in California and elsewhere; **X.1:** Seriously threatened in California.

Distribution

General

Bakersfield cactus occurs in the Tehachapi Mountain area and the southeastern San Joaquin Valley in Kern County, California (Figure SP-P02; Jepson Flora Project 2011). The historical distribution of Bakersfield cactus was likely more or less continuous east of Bakersfield, from Granite Station south to Comanche Point, east to Caliente, and west to Oildale (USFWS 1998, 2011). However, it is currently restricted to a limited area of central Kern County near Bakersfield in the southern San Joaquin Valley (USFWS 2011), and in the vicinity of Oak Creek and Mojave (Kentner, pers. comm. 2012). Approximately one-third of the historical population has been extirpated (USFWS 1998). The California Natural Diversity Database (CNDDDB) includes 46 occurrences, of which 6 are in the Plan Area at 9 different localities (CDFW 2013a). However, there are a large number of records from the Plan area that were submitted to CNDDDB in 2011, but have not been made publically available yet (Kentner, pers. comm. 2012; CDFW 2013a).

Following the recent discovery of the plants near Oak Creek, surveys for Bakersfield cactus were conducted on several thousand acres of proposed wind energy developments in the adjacent foothills of the eastern Tehachapi Mountains and the creosote brush and Joshua Tree woodlands of the desert areas to the east (Kentner, pers. comm. 2012).

Most of the individuals of the cactus population in this area are unambiguously identified as *Opuntia basilaris* var. *basilaris*, or beavertail cactus. However, the population is highly polymorphic and about a third of the individual plants display a varying number of morphological features that are characteristic of Bakersfield cactus (Kentner, pers. comm. 2012).

In 2010 and 2011, botanical surveys for proposed wind energy developments in the Tehachapi pass/Oak Creek area detected thousands of individual plants that were identified as Bakersfield cactus. The identification criteria were based on the recommendations of CDFG (Cypher 2011) which state that any plant with any one of several diagnostic characteristics of Bakersfield cactus should be considered to be the listed variety. Based on their

identification recommendations, CDFG has been requiring Incidental Take Permits and mitigation for the take of large numbers cactus in the vicinity of Oak Creek and Mojave within the Plan area (Kentner, pers. comm. 2012).

Point data for 1,244 individuals identified as Bakersfield cactus were submitted to CNDDDB in the summer of 2011, and surveys have been ongoing since then. However, the CDFG identification criteria are controversial, and many of the identified plants appear to be intermediate between the varieties (Kentner, pers. comm. 2012).

Distribution and Occurrences within the Plan Area

Historical

Of the nine localities documented in the CNDDDB within the Plan Area, one is considered historical with plants that have not been observed since 1934. This locality is mapped approximately 1 mile south of Fram (CDFW 2013a; Figure SP-P02). The historical locality in the Plan Area is east of the recent occurrences described below.

Recent

The eight recent localities of Bakersfield cactus reported in the Plan Area by the CNDDDB occur at Oak Creek Pass in the Tehachapi Mountains, and near West Antelope Station and east of Bean Canyon at the foothills of the Tehachapi Mountains (Figure SP-P02; CDFW 2013a). Three of these localities are located on private land; ownership of the others is unknown (CDFW 2013a). Most of these localities are all very new, found in 2009 and 2010, and extend the variety's known range southeast since they occur south of Comanche Point and east of Caliente, which were considered the range limits in 1987 according to the 5-Year Review (USFWS 2011).

Natural History

Habitat Requirements

Bakersfield cactus grows primarily in chenopod scrub, but is also found in valley and foothill grassland; and occasionally in cismontane woodland, including blue oak woodland and riparian woodland (CNPS

2011; USFWS 2011; CDFW 2013a; Jepson Flora Project 2011). Some associated species include California filago (*Filago californica*), yellow pincushion (*Chaenactis glabriuscula*), and red brome (*Bromus madritensis* ssp. *rubens*), as well as other non-native annual grasses (USFWS 2011).

Bakersfield cactus occurs on floodplains, ridges, bluffs and low rolling hills, and flats (USFWS 2011; CDFW 2013a). Soils are sandy or gravelly with little silt and clay, are low in organic matter, and may contain cobbles or boulders (CNPS 2011; USFWS 2011); they are granitic and well-drained (CDFW 2013a). Bakersfield cactus ranges from 90 meters (295 feet) (CNPS 2011; CDFW 2013a) to 5,000 feet (Kentner, pers. comm. 2012). Table 1 lists primary habitat associations and parameters for Bakersfield cactus.

Table 1. Habitat Associations for Bakersfield Cactus

Land Cover Type	Habitat Designation	Habitat Parameters	Supporting Information
Saltbush scrub, grassland, blue oak woodland, and riparian woodland	Primary	Coarse well-drained sandy or gravelly soils, from 90 to 1,140 meters (295 to 5,000 feet) elevation	CNPS 2011; CDFW 2013a; USFWS 2011

Reproduction

Bakersfield cactus blooms from April to May (CNPS 2011).

The pollination biology of Bakersfield cactus is only relevant for the portion of the population that is genetically capable of reproduction by seed. However, that proportion remains unknown (Kentner, pers. comm. 2012). Bakersfield cactus exhibit several features that are characteristic of bee pollination: flowers are large and showy with a watermelon-like odor; it has a long flowering period; and produces large amounts of nutritious pollen from numerous stamens (Jepson Flora Project 2011; Grant and Grant 1979). Flowers of beavertail prickly-pear (*Opuntia basilaris* var. *basilaris*) are commonly visited by

beetles and bees, but are pollinated mainly by bees (Grant and Grant 1979). The native solitary bee, *Diadasia australis* ssp. *california*, is a potential pollinator of Bakersfield cactus (USFWS 2011). This bee is known to occur in Kern County and specializes in collecting pollen from prickly-pear species. *Diadasia* bees in general are oligolectic (exhibit a narrow, specialized preference for pollen sources), with some specializing on cactus species. The little cactus bee (*Diadasia rinconis*) has been recorded as a visitor to Bakersfield cactus (Grant and Grant 1979).

Chromosome counts indicate that at least some Bakersfield cactus are triploid (2 of the 3 plants that have been examined were triploid ($2n = 3X = 33$); Pinkava et al. 1977, 1992). Triploid plants are typically at least partially sterile and may have a greatly reduced capacity for sexual reproduction either via pollen or by seed. Triploid populations therefore often rely predominantly on vegetative reproduction—the production of new plants from sources other than seed. Fallen pads can take root. Cactus pads may be dispersed by flood waters. Seed dispersal agents are unknown (USFWS 2011), but the fruits and vegetative parts of *Opuntia* species in general, such as the spiny pad, are closely linked with seed dispersal and vegetative dissemination by animals (Reyes-Agüero et al. 2006). Bakersfield cactus does not survive prolonged inundation (USFWS 2011).

Morphological evidence indicates that gene flow (*i.e.* hybridization) between *O. b. basilaris* and *O. b. treleasei* may be occurring in the populations near Oak Creek. The issue of the ploidy of Bakersfield cactus is highly relevant to the question of hybridization between the varieties. Both the proportion of triploid vs. diploid individuals in Bakersfield cactus populations and the frequency with which triploid individuals produce euploid gametes that would be compatible with the gametes of diploid individuals, including *O. b. basilaris*, is currently unknown (Pinkava et al. 1977, 1992).

Ecological Relationships

Competition with non-native grasses for water is likely the cause of the decline in the number of cactus pads and low rates of reproduction observed in recent population studies at Sand Ridge Preserve (USFWS 2011).

A study conducted from 2002 to 2005 at Sand Ridge Preserve analyzed the effects of grass clipping and Fusilade II (a grass-specific herbicide) treatments on Bakersfield cactus survival, flower production, and recruitment. Bakersfield cactus declined on the control plots, and the rates of both vegetative and sexual reproduction were low, likely due to a reduction in soil moisture storage by non-native annual grasses in years with below average precipitation. In contrast to the control plots, the number of cactus pads in the clipped plots and herbicide-treated plots increased (USFWS 2011). A decline in pollinators may be partly responsible for the low levels and infrequency of seed set observed (USFWS 2011).

Predation of Bakersfield cactus is unknown, though it is not considered to a threat to this species (USFWS 2011). In Mexico, the seed and fruits of other *Opuntia* species are consumed primarily by rodents, but also by harvester ants, birds, and other mammals (González-Espinosa and Quintana-Ascencio 1986).

Population Status and Trends

Global: G5T2, variety is Imperiled (NatureServe 2011, Conservation Status last reviewed 1990)

State: S2.1, Imperiled (CDFW 2013b)

Once likely more or less continuous east of Bakersfield, the current range of Bakersfield cactus consists of scattered fragments of these once larger populations (USFWS 2011).

Though the total population of Bakersfield cactus was not estimated historically, densely spaced clumps of cactus once covered an estimated area of 2 square miles from the Caliente Creek floodplain onto Sand Ridge (USFWS 2011). When known sites were inventoried in 1989, fewer than 20,000 clumps of Bakersfield cactus were estimated to remain. Only four areas had populations of 1,000 clumps or more: Comanche Point, Kern Bluff, Sand Ridge, and the area north of Wheeler Ridge (USFWS 2011). A status survey in 2010 and 2011 was conducted to determine the current state of the historical occurrences of Bakersfield cactus throughout its range (USFWS 2011; Cypher et al. 2011a). Based on these surveys which focused on existing CNDDB occurrences, 25 occurrences are confirmed extant, 11

are believed to be extirpated, the status of 3 could not be determined, 2 previously unreported populations were documented, and 6 undocumented translocated populations were identified. Therefore, there is a minimum of 33 extant occurrences (Cypher et al. 2011a).

Threats and Environmental Stressors

Agricultural land conversion, oil development, sand mining, urbanization, off-road vehicle use, proposed flood control basins, telecommunication and electrical lines construction, and possibly wildfires were considered threats to Bakersfield cactus habitat at the time of its listing in 1990 (USFWS 2011). Currently, the loss and modification of habitat from agricultural conversion, wind energy development, and urban, especially residential, development remain the largest threats to Bakersfield cactus (USFWS 2011; Kentner, pers. comm. 2012). Threats today also include oil development, off-road vehicle use, sand mining, and competition from non-native grasses. In addition, climate change, air pollution (including elevated nitrogen deposition), loss of pollinators, flooding, and loss of genetic diversity have been identified as potential new threats (USFWS 2011). However, loss of genetic diversity is not relevant to the unknown proportion of the population that is triploid and undergoing clonal reproduction (Kentner, pers. comm. 2012).

Conservation and Management Activities

A recently-completed survey has provided updated information on the status of known occurrences, confirming at least 33 current occurrences (Cypher et al. 2011a).

In 1990, The Nature Conservancy doubled the size of the Sand Ridge Preserve to 270 acres by acquiring a remnant of the Caliente Creek wash at the eastern base of the ridge. In 1997, the preserve was transferred to the Center for Natural Lands Management (USFWS 2011; CNLM 2011).

Since 1993, with implementation of the Metropolitan Bakersfield Habitat Conservation Plan, several colonies of Bakersfield cactus have been acquired. The Implementation Trust for the Metropolitan Bakersfield Habitat Conservation Plan has protected parts of

occurrences within the Kern Bluffs and Sand Ridge recovery sites (USFWS 2011). Negotiations over the proposed Department of Water Resources (DWR) Habitat Conservation Plan (HCP) for the California Aqueduct right-of-way are currently stalled with no target date for HCP completion (Grunewald 2011).

The approximately 100,000-acre Wind Wolves Preserve at the very southern end of the San Joaquin Valley is owned and run by the Wildlands Conservancy. There are approximately 50 acres of presumed occupied Bakersfield cactus habitat on the Wind Wolves Preserve within the Wheeler Ridge recovery site (USFWS 2011).

Tejon Ranch Corporation negotiated with national conservation groups on a preservation agreement, executed on June 17, 2008, in which Tejon Ranch Corporation committed to placing aside 178,000 acres through a combination of dedicated and designated project open spaces and allowing the conservation organizations to purchase up to an additional 62,000 acres at State-appraised cost. The conservation easement established through the agreement would result in the permanent conservation of almost 90% of the Ranch (USFWS 2011).

The California Native Plant Society (CNPS) transplanted Bakersfield cactus clumps from sites proposed for development to Sand Ridge Preserve and the California Living Museum in Bakersfield. In addition, a few of the cactus clumps growing on the East Hills Mall site in Bakersfield were removed prior to mall construction, then replanted in a display bed after construction. No monitoring of transplanted individuals has occurred at any of the sites to determine survival rates or reproductive success (USFWS 1998). Hundreds if not thousands of Bakersfield cactus plants have been relocated during the construction of wind energy developments near Oak Creek and Mojave. Relocations there are ongoing (Kentner, pers. comm. 2012).

Data Characterization

Distribution of Bakersfield cactus is not well known. It likely occurs in additional locations that have not been documented considering there is a lot of potential habitat that has not been surveyed, primarily because this habitat occurs on private land (Cypher et al.

2011). The recent expansion on the range to include the eastern Tehachapi Mountains from recent occurrences found on wind energy development project sites in Oak Creek and Mojave has not become publically available through the CNDDDB at this time (Kentner, pers. comm. 2012).

Although inferences can be made from other *Opuntia* species, the reproductive biology of Bakersfield cactus has not been studied directly (USFWS 2011).

Management and Monitoring Considerations

The USFWS 5-year review identified the following five highest priority actions to be implemented over the next 5 years to achieve progress toward recovery (USFWS 2011):

1. Protect populations within Bakersfield City limits in the Kern Bluff area and south of Highway 178
2. Work with willing landowners to establish a conservation easement or fee title to the property at the mouth of Kern Canyon
3. Complete the draft Department of Water Resources Habitat Conservation Plan
4. Conduct census of known populations and monitor the reproductive status of known populations
5. Determine suitable management methods for reducing non-native annual grasses and increasing native perennials, including Bakersfield cactus, and communicate the benefits of such management to rangeland landowners.

Cypher et al. (2011b) translocated Bakersfield cactus pads and clumps from the Center for Natural Land Management's Sand Ridge Preserve to Kern County's Bena Landfill Conservation Area as part of a trail population establishment. Ten clumps and 25 shed pads were translocated in fall 2009. Cypher et al. (2011b) concludes that translocation may constitute an effective strategy for establishing new populations of Bakersfield cactus, but suggests continued monitoring of the success of the Bena Landfill population.

Species Modeled Habitat Distribution

This section provides the results of habitat modeling for Bakersfield cactus, using available spatial information and occurrence information, as appropriate. For this reason, the term “modeled suitable habitat” is used in this section to distinguish modeled habitat from the habitat information provided in Habitat Requirements, which may include additional habitat and/or microhabitat factors that are important for species occupation, but for which information is not available for habitat modeling.

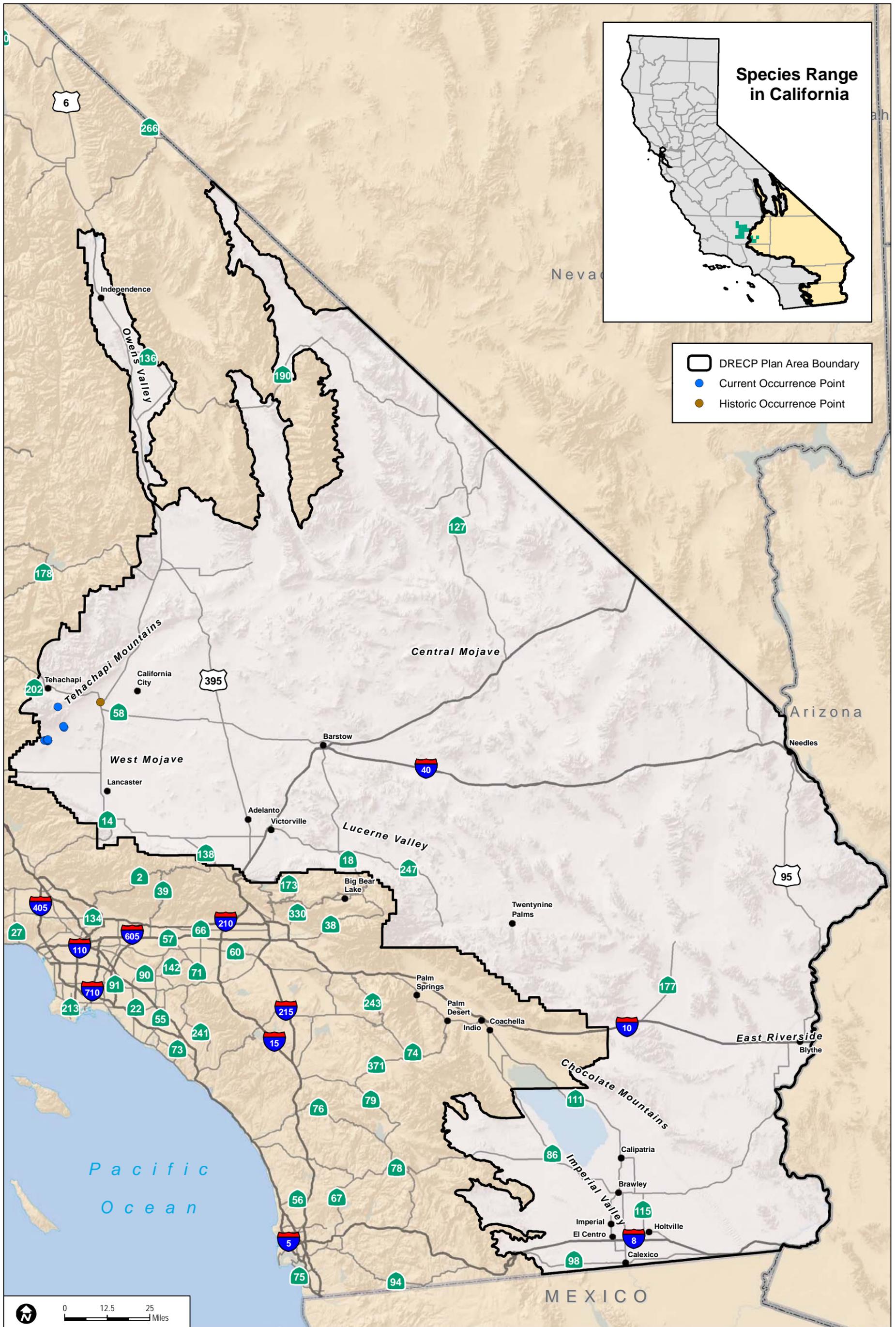
There are approximately 3,421 acres of modeled suitable habitat for Bakersfield cactus in the Plan Area. Appendix C includes a figure showing the modeled suitable habitat in the Plan Area.

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Sources: ESRI (2014); DRECP Species Occurrence Database (2013), CWHR (2008)

FIGURE SP-P02
Bakersfield Cactus Occurrences in the Plan Area