

Interim Core Map Documentation for the Bakersfield Cactus

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Interim Core Map Developer: U.S. Environmental Protection Agency (EPA), Office of Pesticide Programs

Species Summary

The Bakersfield cactus (*Opuntia treleasei*/*Opuntia basilaris* var. *treleasei*, Entity ID 1082) is an endangered perennial terrestrial plant species. The U.S. Fish and Wildlife Service (FWS) has not designated a critical habitat for this species. It is restricted to a limited area in central Kern County, California, near Bakersfield, and is typically found in sandy to sandy-loam soils with some gravel, cobbles, or boulders on flood plains, ridges, bluffs, and rolling hills. The Bakersfield cactus cannot withstand prolonged inundation. Additional information on the species is provided in **Appendix 1**.

Description of Core Map

The core map for the Bakersfield Cactus is developed based on biological information. The outer boundary of this core map is defined by the FWS' species range within Kern County, California. EPA has further refined this area to include only regions with sandy to sandy-loam soil, classified as Group A soil, and to exclude cultivated areas.

Figure 1 illustrates the interim core map for the Bakersfield Cactus, which spans approximately 81,611 acres. **Table 1** provides the landcover categories within the core map area, which predominantly include cultivated crops, grassland/herbaceous, and scrub/shrub.

The core map developed for the Bakersfield Cactus is considered interim. It will be utilized to establish pesticide use limitation areas (PULAs) that encompass the Bakersfield Cactus. This core map incorporates information developed by FWS and made publicly accessible; however, it has not undergone formal review by the FWS. Future revisions may be made to this provisional map to incorporate feedback from species experts at the FWS. This interim core map has an "average" (3) best professional judgment classification to describe major uncertainties/limitations. It is based on known locations identified by the FWS, with EPA excluding certain areas based on the species' biological needs. This core map does not replace or revise any range or designated critical habitat developed by the FWS for this species.

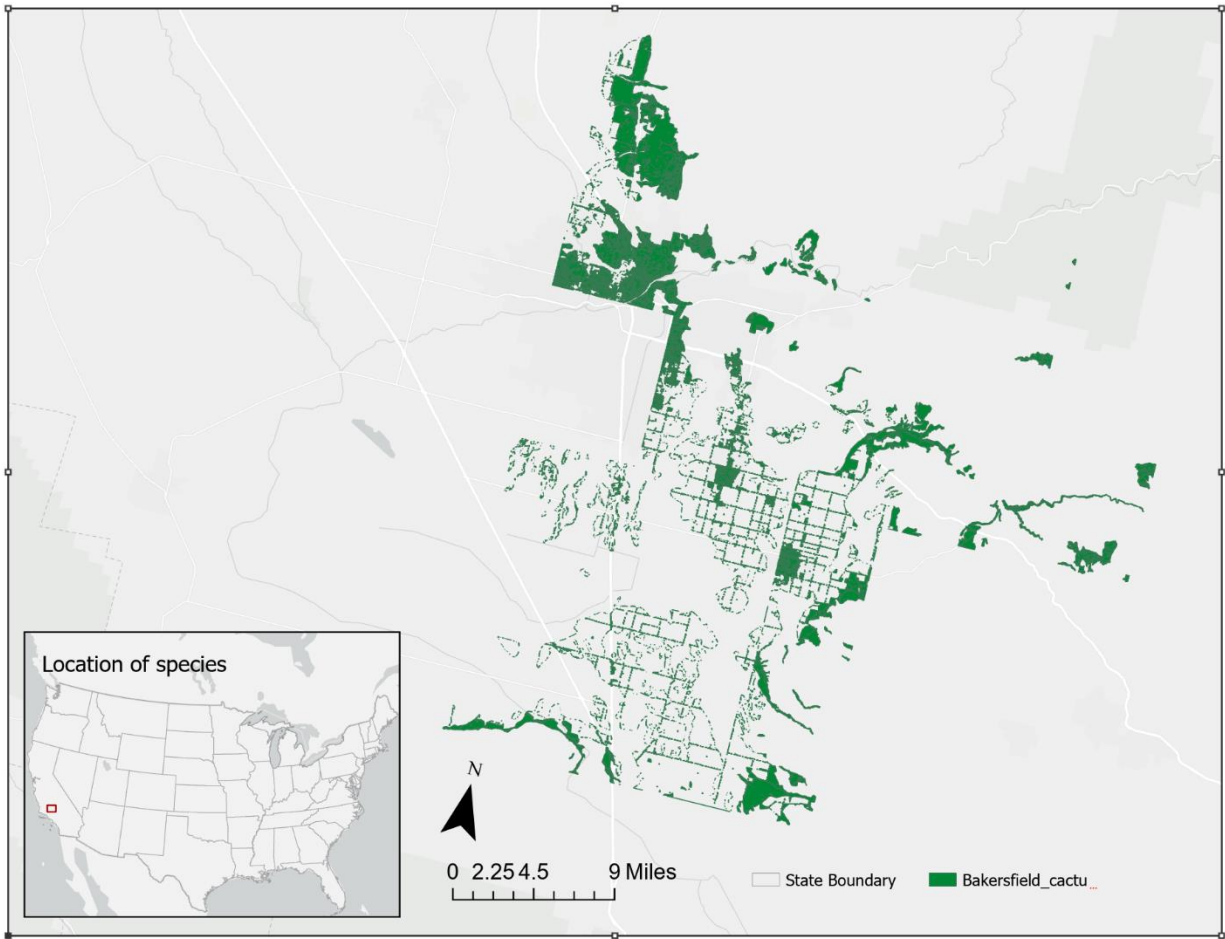


Figure 1. Interim core map for the Bakersfield Cactus.

Table 1. Percentage of Interim Core Map Represented by NLCD¹ Land Covers and Associated Example Pesticide Use Sites/Types.

Example pesticide use sites/types	NLCD Class/Value	% Area	Total area for landcover type
Forestry	Deciduous Forest (41)	0%	2%
Forestry	Evergreen Forest (42)	2%	2%
Forestry	Mixed Forest (43)	0%	2%
Agriculture	Pasture/Hay (81)	1%	1%
Agriculture	Cultivated Crops (82)	0%	1%
Mosquito adulticide, residential	Developed Open Space (21)	12%	43%
Mosquito adulticide, residential	Developed Low Intensity (22)	9%	43%
Mosquito adulticide, residential	Developed Medium Intensity (23)	17%	43%
Mosquito adulticide, residential	Developed High Intensity (24)	5%	43%
Invasive species control	Woody Wetlands (90)	0%	49%
Invasive species control	Emergent Herbaceous Wetlands (95)	0%	49%
Invasive species control	Open Water (11)	0%	49%
Invasive species control	Grassland/Herbaceous (71)	44%	49%
Invasive species control	Shrub/Scrub (52)	4%	49%
Invasive species control	Barren Land (31)	1%	49%
Total Acres	Interim Core Map Acres	~ 81,611 acres	

Evaluation of Known Location Information

There are four datasets containing known location information:

- Descriptions of locations provided by FWS;
- Occurrence locations in iNaturalist;
- Occurrence locations in NatureServe; and
- Occurrence locations in the Global Biodiversity Information Facility (GBIF).

EPA assessed known location data (Appendix 1) prior to selecting the type and developing the core map. Data from FWS identified the general population range where the species was discovered (refer to **Figure A1-1** in **Appendix 1**). Occurrences documented in iNaturalist, GBIF, and NatureServe did not support expanding the core map beyond the FWS species range map. **Appendix 1** contains further details on the available known location information.

¹ Dewitz, J., 2023, National Land Cover Database (NLCD) 2021 Products: U.S. Geological Survey data release, <https://www.usgs.gov/data/national-land-cover-database-nlcd-2021-products>

Approach Used to Create Core Map

The core map was developed following the “Process EPA Uses to Develop Core Maps for Draft Pesticide Use Limitation Areas for Species Listed by the U.S. Fish & Wildlife Service (FWS) and their Designated Critical Habitats”², referred to as “the process”. EPA developed the core map using the four steps outlined in the process document:

1. Compile available information for the species;
2. Identify the core map type;
3. Develop the core map for the species; and
4. Document the core map.

In step 1, EPA compiled available information on the Bakersfield cactus from FWS, as well as observational data from various publicly accessible sources, including iNaturalist, NatureServe, and GBIF. The compiled information for the Bakersfield Cactus is detailed in **Appendix 1**. Key information influencing the development of the core map included:

- The species range published by the FWS;
- The typical occurrence of this species in sandy to sandy-loam soils with some gravel, cobbles, or boulders on flood plains, ridges, bluffs, and rolling hills
- This species does not live in cultivated areas.

In step 2, EPA utilized the compiled information to determine the core map type, focusing on species range and habitat. EPA started with the FWS’s species range and refined it by removing cultivated areas and retaining only areas with sandy to sandy-loam soil, which is the species’ preferred habitat. The entire species range was not used for the core map, as it includes areas where the species does not occur.

In step 3, EPA employed the best available data sources to create the core map, as discussed in the process document. For this core map, EPA used FWS’s species range as the outer boundary. To identify the sandy/sandy-loam areas essential for the species, EPA utilized the USDA SSURGO data. **Appendix 2** provides further details on the GIS analysis and data used in generating the core map.

Discussion of Approaches and Data that were Considered but not Included in Core Map

EPA contemplated using the FWS’s species range as the core map but determined that the range included areas with soil types unsuitable for the species’ growth. Critical habitat was not considered because FWS has not designated any critical habitat for this species, meaning there is no critical habitat depicted by FWS for this species.

EPA also examined data repositories such as iNaturalist, which depend on contributions from individuals with varying levels of expertise. However, due to uncertainties and scale/precision of these observations and for this species “the observer may have misidentified that plant due to highly variable variety morphology or due to limited experience” - the EPA decided not to utilize these observation records to create the core map.

² Dated 2024, available online at: <https://www.epa.gov/endangered-species/process-epa-uses-develop-core-maps-pesticide-use-limitation-areas>

Appendix 1. Information Compiled for the Bakersfield Cactus During Step 1

1. Recent FWS documents/links and other data sources

- Five Year Review (2025) (https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/22881.pdf)
- Five Year Review (2020) (https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/2995.pdf)
- Five Year Review (2011) (https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/1826.pdf)
- Recovery Plan (1998) (https://ecos.fws.gov/docs/recovery_plan/980930a.pdf)
- Biological opinion (2007) (https://ecos.fws.gov/docs/plan_documents/bobs/bobs_840.pdf)

2. Background information

- **Status:** Federally listed as endangered in 1990
- **Resiliency, redundancy, and representation** (the 3Rs)
 - Not discussed explicitly in FWS documents. But the species' recovery priority number is 3C, which means high degree of threat, high recovery potential.
- **Habitat**
 - Clumps typically appear on sandy to sandy-loam soils with some gravel, cobbles, or boulders on flood plains, ridges, bluffs, and rolling hills. (Five-year review 2025)
- **Pollinator/reproduction**
 - Flowers appear March through April (Five-year review, 2025).
 - May require pollinators to produce seeds (Service 2011, p. 14).
 - Potential pollinators include *Diadasia rinconis* (a native miner bee), *Diadasia australis ssp. californica* (a miner bee), and *Anthophora fulvicauda* (a digger bee).
- **Taxonomy**
 - Terrestrial Plant, low-growing perennial succulent. It grows in sandy to sandy-loam soils with some gravel, cobbles, or boulders on flood plains, ridges, bluffs, and rolling hills.
 - Blooming period is from April to May.
 - The taxonomy of the Bakersfield cactus has not been universally accepted. It is generally considered a variety of *Opuntia basilaris* (Service 1993, p.49). However, due to a lack of consensus among experts at the time of listing, it was listed as a species (Service 1998, p.2936). Although the Bakersfield cactus is usually distinguished from other varieties of *O. basilaris*, its morphology is highly variable and may not reliably differentiate it from other *O. basilaris* varieties. (Five-year review, 2025)
- **Relevant Pesticide Use Sites**
 - The Bakersfield cactus may need cross-pollination by bees, including *Diadasia rinconis*, *Diadasia australis ssp. californica*, and *Anthophora fulvicauda*, to produce seeds. Therefore, pesticides impacting these pollinators could threaten the species.

EPA has published final biological evaluations assessing the effects of labeled uses of three neonicotinoid pesticides on listed species.

- **Recovery Criteria/Objectives**

- Delisting criteria have not been evaluated because the downlisting criteria for the Bakersfield cactus have not been met.
- The recovery goal is to maintain self-sustaining populations in protected areas that reflect the historical geographic and topographic range of the taxon, spanning a variety of suitable natural communities.
- Protecting habitat is essential to prevent the species from becoming extinct or experiencing an irreversible decline.

- **Recovery Actions**

- Unoccupied habitat within metapopulations should be protected to facilitate the movement of pollinators and seed dispersers.
- Efforts should be made to avoid fragmenting the few large metapopulations into more than two blocks of contiguous, protected natural land each.
- In areas that are already fragmented, land should be protected in blocks of at least 16 hectares, ideally in blocks of 65 hectares.
- A buffer zone of at least 150 meters (500 feet) should be established beyond the population margins to mitigate external influences and facilitate population expansion.
- In case where development would destroy entire populations, as many clumps as possible should be transplanted to protected areas, with regular monitoring of these transplants.

- **Threats**

- Habitat loss and fragmentation due to agricultural, urban development, oil, gas, and other mining exploration.
- Wildfire, off-road vehicle use, proposed flood control basins, telecommunication and electrical line construction, livestock grazing, a hydroelectric project, road widening, illegal dumping, nonnative grasses, and inadequacy of existing regulatory mechanisms.
- Loss of genetic diversity, flooding, and air pollution, pollinator loss, elevated nitrogen deposition, and dust.
- Invasion of nonnative grasses, extreme weather events.

3. Description of Species Range

Figure A1-1 depicts the FWS range for the Bakersfield cactus. The range was last updated on May 26, 2015. The total acreage of the range is around 584,713 acres.



Figure A1-1. FWS range for the Bakersfield cactus. The total acreage of the range is around 584,713 acres.

4. Critical Habitat

- FWS has not designated a critical habitat for this species (<https://ecos.fws.gov/ecp/species/7799>).

5. Known Locations

- Restricted to Kern County, California, and typically occurs in sandy to sandy-loam soils with some gravel, cobbles, or boulders on flood.
- Occurrences Included in Public Databases
 - Source 1: iNaturalist <https://www.inaturalist.org/observations>
 - Source 2: GBIF <https://www.gbif.org/>
 - Source 3: NatureServe.

EPA queried data from iNaturalist, GBIF, and NatureServe. iNaturalist (available [here](#)) recorded 234 research-grade observations for this species (See **Figure A1-2**). Occurrences in NatureServe were consistent with other occurrence data (linked [here](#), see **Figure A1-2**). GBIF (available [here](#)) listed 190 occurrences and human observations (from 2005 to August 2025), all of which are also included in iNaturalist or NatureServe. Records indicate that the

Bakersfield cactus was observed further east into the Tehachapi Mountains and south into Los Padres National Forest, as well as beyond Kern County. However, the validity of these observations is uncertain, as the observer may have misidentified the plant due to highly variable morphological characteristics or limited experience. As a result, FWS considered the range of the Bakersfield cactus to be the same as historically described until further genetic and morphological studies confirmed a range expansion.

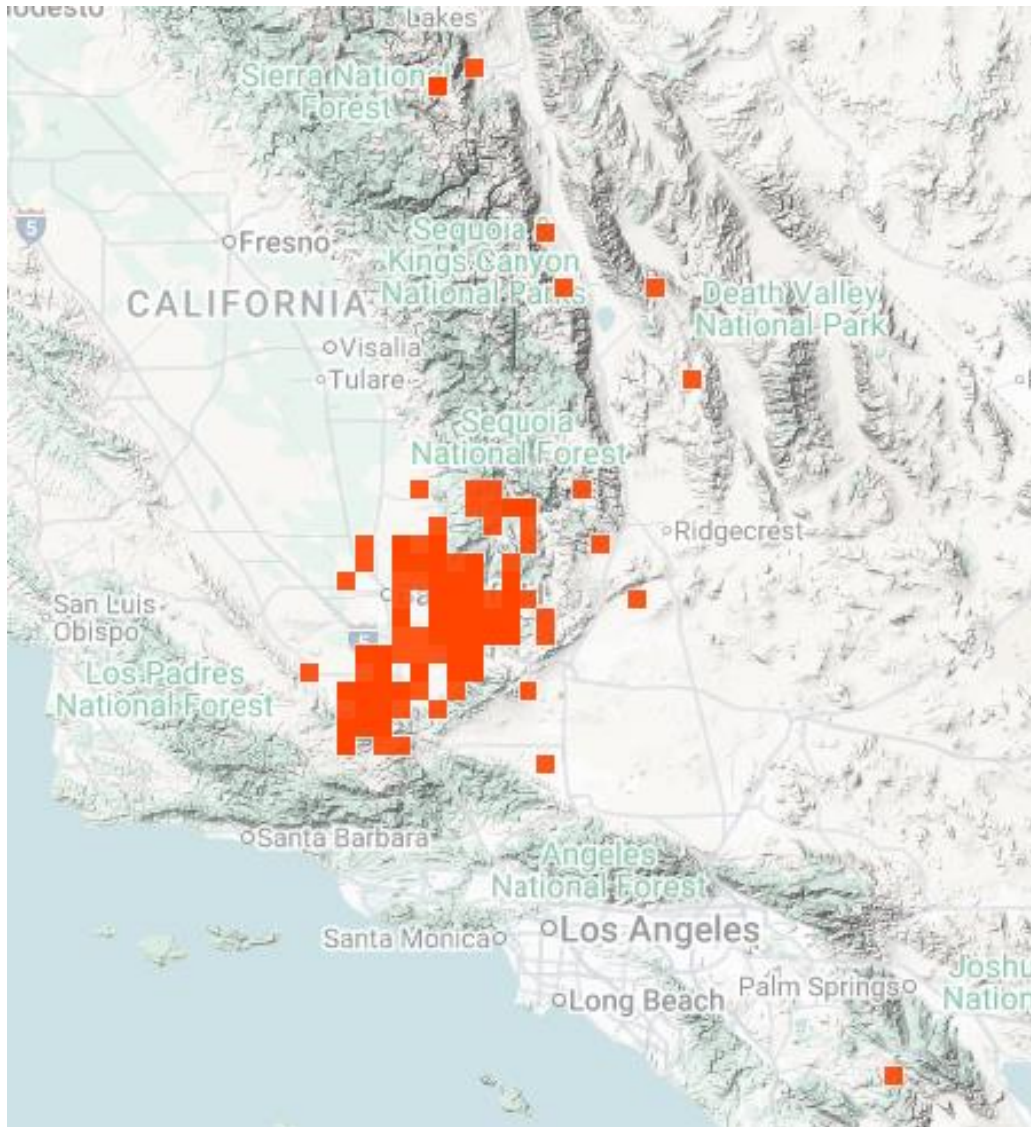


Figure A1-2 Screenshot of observations of the Bakersfield cactus in iNaturalist.

Appendix 2. GIS Data Review and Method to Develop Core Map (Step 3)

EPA developed the interim core map by refining the species range to focus on areas where sandy and sandy-loam soil occur within that range. Data from GBIF, iNaturalist, and NatureServe were considered and visually compared to the range but were not used to refine the interim core map, as the validity of these observations is uncertain.

1. Dataset References and Software

- Software used: ArcGIS Pro 3.5
- FWS Species Range – last updated on May 26, 2015

2. Datasets Used in Core Map Development

- USA SSURGO – Soil Hydrologic Group:
<https://www.arcgis.com/home/item.html?id=be2124509b064754875b8f0d6176cc4c>
- FWS Species Range: <https://ecos.fws.gov/ecp/species/7799>
- USA NLCD Land Cover:
<https://www.arcgis.com/home/item.html?id=3ccf118ed80748909eb85c6d262b426f>

3. Core Map Development

a) Determining the outer extent of the core map

The outer extent of the core map was determined using the FWS species range, which can be readily downloaded from ECOS. As detailed in Appendix 1, FWS have not designated a critical habitat for this species.

b) Refining species range based on suitable habitat

According to FWS documentation, the Bakersfield cactus typically occurs in sandy to sandy-loam soils. To identify suitable areas, the USA SSURGO – Soil Hydrologic Group layer was utilized to locate areas with Group A soil (i.e., sandy/sandy loam soil). A new layer containing only Group A soil was created. The FWS range map was refined by intersecting it with this new Group A soil layer, thereby eliminating areas within the range boundary that do not contain Group A soil. Additionally, since the Bakersfield cactus cannot grow on cultivated lands, areas classified as Cultivated Crops (i.e., gridcode is 82) in the NLCD layer were also excluded from the FWS range file.

The following steps were conducted to create the core map.

1. Extracting Group A soil layer:

- Imported the USA SSURGO soil hydrologic group raster layer into ArcGIS Pro.
- Clipped the SSURGO raster to the extent of the FWS range layer.
- Converted the SSURGO raster clip into a polygon using “ClassName” as the field of interest in the geoprocessing tool.
- Open the soil hydrologic group polygon layer and applied a “Select By Attributes” query with the expression “ClassName is equal to Group A”. Exported the selected areas to a new polygon layer that includes only sandy soil regions. According to the SSURGO data source, “Group A soils consist of deep, well-drained sands or gravelly sands with high infiltration and low runoffs rates.”

2. Extracting Cultivated Crops layer:

- Imported the USA NLCD raster layer into ArcGIS Pro.
- Clipped the NLCD raster to the extent of the FWS range layer.

- Converted the NLCD raster clip into a polygon layer
- Open the NLCD polygon layer and applied a “Select By Attributes” query with the expression “gridcode is not equal to 82” to exclude the cultivated crops areas from the NLCD layer.

3. Creating final core map

Overlaid the FWS range layer with the sandy soil layer and refined NLCD layer using the “Intersect” function to refine the range into a core map that exclusively contains Group A soil and non-cultivated lands.