

Interim Core Map Documentation for Solano Grass

Version 1

Review Completed: April 2026

Core Map Developer: Compliance Services International (CSI) on behalf of BASF Corporation

Species Summary

The Solano grass (*Tuctoria mucronata*; Entity ID 859) is a dicotyledonous endangered plant located in California. The U.S. Fish and Wildlife Service (FWS) has assigned designated critical habitat for Solano grass. This species inhabits vernal pools in four distinct locations. Additional habitat information is provided in **Appendix 1**.

Review Notes

The developers created this core map using EPA's process available at: <https://www.epa.gov/endangered-species/process-epa-uses-develop-core-maps-pesticide-use-limitation-areas>. The EPA reviewed the draft map and documentation and evaluated if: (1) the map and documentation are consistent with EPA's process; (2) areas included or excluded from the core map are consistent with the biology, habitat, and/or recovery needs of the species; (3) data sources are documented and appropriate; and (4) the Geographic Information System (GIS) data and mapping process are consistent with the stated intention of the developer. EPA agrees that this map is a reasonable depiction of core areas for this species given the available data and was consistent with EPA's mapping process. This documentation was not prepared by EPA, and EPA may have edited this documentation for clarity or other purposes. Some views in this documentation may not necessarily be the views of EPA or its staff.

The core map developed for this species can be used to develop pesticide use limitation areas (PULAs). This core map incorporates information developed by FWS and made available to the public. This map has not yet been reviewed by FWS species experts and may be revised in the future to incorporate FWS review and additional information as it becomes available for this species.

This core map does not replace or revise any range or designated critical habitat developed by FWS.

Description of Core Map

The core map for the Solano grass is biological information type based on the designated critical habitat supplemented by three other sites known to contain extant populations of the species. The species' 5-Year Review (FWS 2024) includes a catalog of locations of extant populations, and textual descriptions of habitats where the species is known to occur. Known location information from the iNaturalist database and NatureServe provided support for the use of these sites as the core map extent.

The four sites of extant populations were judged to be sufficiently representative of where the species could occur, so no habitat-based refinement was done in the development of this core map. However, a refinement of area was applied to exclude areas of cultivated lands greater than 25 contiguous acres, based on the species not expected to be found in agricultural fields.

The core map developed in this document for the Solano grass spans 1,825 acres (Figure 1). A summary of acreage by National Landcover Database (NLCD 2021) land use type is provided in Table 1.

Based on EPA’s “best professional judgment classification” system, CSI has graded this core map as “limited” (2) because relatively few assumptions were made to develop the core map, and the use of national or state-level Geographical Information System (GIS) datasets was relatively straightforward. The species’ primary habitat—vernal pools—is adequately represented by the site locations themselves that were found in the documentation from FWS and various other datasets described in **Appendix 2**. More information about the best professional judgment classification system and its definitions can be found in the core map process document (EPA 2024).



Figure 1. Interim core map for the Solano grass (*Tuctoria mucronata*; Entity ID 859). The core map spans 1,825 acres, while the range is 72,560 acres.

Table 1. Acres by National Land cover Database (NLCD 2021) class within the core map of Solano grass. Total core map area (based on NLCD pixel count): 1,823 acres¹.

Example pesticide use sites/types	NLCD Class/Value	% Area
Forestry	Deciduous Forest (41)	0%
Forestry	Evergreen Forest (42)	0%
Forestry	Mixed Forest (43)	0%
Agriculture	Pasture/Hay (81)	0%
Agriculture	Cultivated Crops (82)	3%
Mosquito adulticide, residential	Developed Open Space (21)	1%
Mosquito adulticide, residential	Developed Low Intensity (22)	1%
Mosquito adulticide, residential	Developed Medium Intensity (23)	0%
Mosquito adulticide, residential	Developed High Intensity (24)	0%
Invasive species control	Woody Wetlands (90)	0%
Invasive species control	Emergent Herbaceous Wetlands (95)	8%
Invasive species control	Open Water (11)	0%
Invasive species control	Grassland/Herbaceous (71)	84%
Invasive species control	Shrub/Scrub (52)	3%
Invasive species control	Barren Land (31)	0%
Total Acres	Interim Core Map Acres	~ 1823

Evaluation of Known Location Information

There were four evaluated datasets with known location information:

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

Compliance Services International evaluated these four datasets before developing the core map. Overall, there were five usable research-grade observations found in iNaturalist.² The GBIF dataset comprised 26 georeferenced observations, five of which were considered usable based on the criteria described below. Neither dataset was comprehensive enough or precise enough to serve as the basis of the core map.

¹ This acreage is slightly different from the core map acreage (1,825) due to the pixelation of NLCD land cover. The core map is not developed from raster data.

² According to iNaturalist, an observation is designated as “research grade” if it 1) is verifiable with date, coordinates, photos/sounds, and not captive; 2) achieves community agreement defined as “more than 2/3 of identifiers needs to agree on the species level ID or lower;” and 3) “must pass a data quality assessment, which includes checks for accurate date and location, evidence of a wild organism, and clear evidence of the organism itself”

(<https://help.inaturalist.org/en/support/solutions/articles/151000169936-what-is-the-data-quality-assessment-and-how-do-observations-qualify-to-become-research-grade->).

FWS location information included all four extant population sites, which all occur in identifiable areas; this provided a refinement.

NatureServe public element occurrence (EO) data were also evaluated and provided supporting information.

Approach Used to Create Core Map

The core map was developed using EPA’s process for developing core maps for species listed by FWS and their designated critical habitat (referred to as “the process”). This core map was developed by CSI using the four steps described in the process document:

1. Compile available information for a species
2. Identify core map type from among the following defined types: critical habitat, range, and biological information. From EPA, summaries of each core map type are provided below (EPA 2024)
3. Develop the core map for the species
4. Document the core map

For step 1, CSI compiled available information for the Solano grass from FWS, as well as observation information available from various publicly available sources including iNaturalist, GBIF, and NatureServe. The information compiled for the Solano grass is included in **Appendix 1**. Influential information that impacted the development of the core map includes a description of the species habitat from the Recovery Plan:

- ‘*Tuctoria mucronata* has been found only in the Northern Claypan type of vernal pool (Sawyer and Keeler-Wolf 1995) within annual grassland (California Natural Diversity Data Base 2005). Pools where *T. mucronata* occurs tend to be milky from suspended sediments (Holland 1987). The pools that are occupied in Solano County are more properly described as alkaline playas or intermittent lakes, due to their large surface area (Crampton 1959, U.S. Fish and Wildlife Service 1985a), whereas those at the Yolo County site are “relatively small” (C. Witham in litt. 2000a). Soils underlying known *T. mucronata* sites are saline-alkaline clay or silty clay in the Pescadero series (Crampton 1959, California Natural Diversity Data Base 2003). Known occurrences are at elevations of about 5 to 11 meters (15 to 35 feet) (California Natural Diversity Data Base 2005)’ (FWS 2005).

For step 2, CSI used the compiled information including the species range, known locations, and habitat location information to determine the core map type. Compliance Services International (CSI) compared the known location data to the range and found that known locations from FWS (extant populations identifiable in NHD and other external sources) were usable as a refinement of range in determining the core map extent. Other known location data from GBIF, iNaturalist, and NatureServe were used for comparison purposes and were not used to develop the core map.

Review of the available data suggested that the core map was refined enough that it need not exclude landcover types inconsistent with Solano grass habitat. However, the core map shape had contiguous cultivated areas > 25 acres (EPA 2024) removed to develop the core map because this species’ habitat is not consistent with cultivated areas.

For step 3, CSI used best-available data sources to generate the core map. Data sources are discussed in EPA's core map process document. For this interim core map, CSI followed EPA's decision framework to arrive at a core map type of critical habitat. Designated critical habitat was selected as a core map type because Solano grass does have critical habitat and it is relevant to the continued existence of the species. Critical habitat locations were supplemented with locations of three additional populations that were found since the critical habitat rule was designated. The additional sites containing extant populations are included in the core map. **Appendix 2** provides more details on the GIS analysis and data used to generate the core map.

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

Data and approaches not already described in this document were not further explored for the development of this core map.

Appendix 1. Information compiled for Solano grass

1. Recent FWS documents

- 5-Year Review (2009): https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/1341.pdf
- 5-Year Review (2024): https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/18987.pdf
- Recovery Plan (2005): https://ecos.fws.gov/docs/recovery_plan/Vernal%20Pool%20Ecosystem%20Final%20Recovery%20Plan.pdf
- Critical Habitat (2006): <https://www.govinfo.gov/content/pkg/FR-2006-02-10/pdf/06-1080.pdf#page=1>

2. Background information

- Status: Federally listed as endangered in 1978.
- Resiliency, redundancy, and representation (the 3Rs) were not evaluated for this species
- Habitat, Life History, and Ecology
 - '*Tuctoria mucronata* has been found only in the Northern Claypan type of vernal pool (Sawyer and Keeler-Wolf 1995) within annual grassland (California Natural Diversity Data Base 2005). Pools where *T. mucronata* occurs tend to be milky from suspended sediments (Holland 1987). The pools that are occupied in Solano County are more properly described as alkaline playas or intermittent lakes, due to their large surface area (Crampton 1959, U.S. Fish and Wildlife Service 1985a), whereas those at the Yolo County site are "relatively small" (C. Witham in litt. 2000a). Soils underlying known *T. mucronata* sites are saline-alkaline clay or silty clay in the Pescadero series (Crampton 1959, California Natural Diversity Data Base 2003). Known occurrences are at elevations of about 5 to 11 meters (15 to 35 feet) (California Natural Diversity Data Base 2005)' (FWS 2005).
 - 'The germination period for *Tuctoria mucronata* seeds is not known, but is presumed to be in May or June (U.S. Fish and Wildlife Service 1985a). *Tuctoria* seedlings do not produce floating juvenile leaves (Griggs 1980). This species typically flowers in June and sets seed during July (Holland 1987)' (FWS 2005).
 - 'Solano grass is wind-pollinated and blooms from June to July. Its seeds can remain dormant for an undetermined length of time (but at least 3 to 4 years) and germinate underwater after they have been immersed for prolonged periods' (FWS 2024).
- Taxonomy
 - 'Solano grass is in the Orcuttieae tribe of the grass family Poaceae (Reeder 1965). Solano grass was originally described under the name *Orcuttia mucronata*, based on specimens collected "12 miles due south of Dixon, Solano County" (Crampton 1959:108). Reeder (1982) transferred this species to a new genus, *Tuctoria*, resulting in the currently accepted name *Tuctoria mucronata*. Other common names are Crampton's Orcutt grass (Griggs 1977b), mucronate orcuttia (Smith *et al.* 1980), and Crampton's *tuctoria* (Skinner and Pavlik 1994)' (FWS 2005).
- Relevant Potential Pesticide Use Sites
 - 'The Environmental Protection Agency (Agency) recently released final biological evaluations assessing the effects of labeled uses of three neonicotinoid pesticides on listed species (Agency 2022a, entire; Agency 2022b, entire; Agency 2022c, entire). The three

pesticides (clothianidin, imidacloprid, and thiamethoxam) are registered for use on a variety of agricultural crops; there are also some non-agricultural applications. The three pesticides target insect species by acting on their neurotransmitters to cause excessive nervous stimulation, paralysis, and death. The overall importance of pollinating insects for Solano grass is poorly understood. Grasses within the Orcuttieae tribe are thought to primarily be wind pollinated; however, some insect pollination may occur, including by native bees (Halictidae spp.), which have been observed gathering pollen from other species in the Orcuttieae tribe including Sacramento Orcutt grass (*Orcuttia viscida*) and hairy Orcutt grass (*Orcuttia pilosa*; Griggs 1974, as cited in Stone *et al.* 1988, p. 16). The Agency's final biological evaluations determined that all three pesticides are highly toxic to invertebrate pollinators including bees, have the potential to result in bee brood and colony reductions, and if affected bee colonies decline near Solano grass, there is a potential for the three pesticides to indirectly adversely affect the species (Agency 2022a, pp. 4, Appendix 4- 1; Agency 2022b, pp. 2, Appendix 4-1; Agency 2022c, pp. 3, Appendix 4-1). The Agency anticipates releasing amended proposed interim decisions and a national consultation with the Agency is currently pending' (FWS 2024).

- Relevant Recovery Criteria and Actions
 - Criteria for downlisting/delisting (FWS 2024)
 - 1A. 95% of suitable vernal pool habitat for the species within each of the two prioritized core areas (Davis Communication Annex and Jepson Prairie) is protected.
 - 1B. 100% of the species occurrences distributed across the species geographic range and genetic range are protected. Protection of extreme edges of populations protects the genetic differences that occur there.
 - 1C. Reintroductions must be carried out and meet success criteria established in the recovery plan.
 - 1D. Additional occurrences identified through future site assessments, GIS and other analyses, and status surveys that are determined essential to recovery goals are permanently protected.
 - 1E. Habitat protection results in protection of hydrology essential to vernal pool ecosystem function, and monitoring indicated that hydrology that contributes to population viability has been maintained through at least one multi-year period that includes above average, average, and below average local rainfall, a multi-year drought, and a minimum of 5 years of post-drought monitoring.
 - 2A. Habitat management and monitoring plans that facilitate maintenance of vernal pool ecosystem function and population viability have been developed and implemented for all habitat protected.
 - 2B. Mechanisms are in place to provide management in perpetuity and long-term monitoring.
 - 2C. Monitoring indicates that ecosystem function has been maintained in the areas protected for at least one multi-year period that includes above average, average, and below average local rainfall, a multi-year drought, and a minimum of 5 years of post-drought monitoring.
 - 2D. Seeds have been collected from all populations and are stored at two seed banking facilities.
 - 3A. Status surveys, 5-year status reviews, and population monitoring show populations within each vernal pool region where the species occur are viable (e.g., evidence of reproduction and recruitment) and have been maintained (stable or increasing) for at least

- one multi-year period that includes above average, average, and below average local rainfall, a multi-year drought, and minimum of 5 years of post-drought monitoring.
- 3B. Status surveys, status reviews, and habitat monitoring show that threats identified during and since the listing process have been ameliorated or eliminated. Site specific threats identified through standardized assessment and habitat management planning also must be ameliorated or eliminated.
 - 4A. Research actions necessary for recovery and conservation of Solano grass have been identified. Additionally, research actions on species biology and ecology, habitat management and restoration, and methods to eliminate or ameliorate threats have been completed and incorporated into habitat protection, habitat management and monitoring, and species monitoring plans, and refinement of recovery criteria and actions.
 - 4B. Research on genetic structure has been completed and results incorporated into habitat protection plans to ensure that within and among population genetic variation is protected.
 - 4C. Research necessary to determine appropriate parameters to measure population viability for Solano grass have been completed.
 - 5A. Recovery implementation team is established and functioning to oversee rangewide recovery efforts.
 - 5B. Vernal pool regional working groups are established and functioning to oversee regional recovery efforts.
 - 5C. Participation plans for each vernal pool region have been completed and implemented.
 - 5D. Vernal pool region working groups have developed and implemented outreach and incentive programs that develop partnerships contributing to achieving recovery criteria.
- Recommendations for Future Actions (FWS 2024)
 1. **Develop and implement standardized population trend survey protocols to complete population status surveys.** Annual population monitoring of all known extant locations. Incomplete and infrequent monitoring of this species makes population status and trends difficult to assess. An effort should be made to conduct regular status surveys for Solano grass (and other listed vernal pool plants, like Witham’s 2013 survey) to make assessment of population trends possible. Without a better understanding of the population dynamics of the species, we do not know the extent to which protected lands provide self-sustaining populations of this species within each vernal pool region. Furthermore, monitoring of annual trends needs to assess short- and long-term fluctuations of individual localities which would assist in anticipating demographic changes in response to climate change over time.
 2. **Conduct coordinated research on the impact certain threats and their management have on the Solano grass:** 1. Assess the long-term effects from urbanization and agricultural-related alterations to vernal pool sub-watersheds on the hydrology of vernal pools. Efforts should lead to determinations of appropriate hydrology (or upland) buffers. Stone et al. (1988, pp. 4–5) also recommended research focused on assessing the range of inundation conditions necessary to maintain Solano grass. 2. Identify and understand the anticipated risks from climate change, specifically the effects of drought on the long-term viability of Solano grass. 3. Determine if and how pesticides may threaten Solano grass population viability. Evaluate if fungicides inhibit germination of Solano grass, as is

the case for other species in the Orcuttieae tribe (Keeley 1988, p. 1088). Additional research is warranted on how pesticides impact sensitive vernal pool plants in conjunction with other stressors. Specifically, identify whether there is a need for agricultural buffer zones and to evaluate the overall tolerances of vernal pools to pesticides (Johnson 2006, p. 5).

3. **Conduct a Species Status Assessment:** The Yolo Habitat Conservation Plan is in the process of protecting the Yolo Grasslands Regional Park and Davis Air Force Communication Facility sites in perpetuity (A. Stewart, Senior Fish and Wildlife Biologist, in litt. 2024). Once in place all occurrences will be permanently protected in perpetuity. For the next 5-year status review of the species, the Service should conduct a Species Status Assessment (SSA). If the species is found to continue to exist within its historical range and all or most occurrences are protected in perpetuity, the SSA will help assess the species status and whether downlisting is appropriate.
4. **Initiate a collaborative seed banking program with botanical gardens to collect and preserve Solano grass seeds from across its range.** Seed banking actions should ensure adequate collection from each occurrence to preserve the genetic diversity. No seeds have been collected for a seed bank since 2001.
5. **Design and implement transplantation and population augmentation experiments.** Augmenting existing occurrences may benefit them by increasing plant individuals and genetic diversity. Developing success criteria based off existing literatures and the results of future population augmentations will help guide effective conservation efforts.
6. **Develop regional and/or state-level working groups for vernal pool species.** Initiating regional working groups will develop the partnerships needed to oversee regional recovery efforts for vernal pool species, including Solano grass.

3. Range

Historical Distribution—Prior to 1985, *Tuctoria mucronata* was known only from Olcott Lake in Solano County, which is believed to be the type locality (Crampton 1959, California Natural Diversity Data Base 2003) (Figure II-20). Another occurrence was discovered in 1985 about 4 kilometers (2.5 miles) southwest of Olcott Lake (California Natural Diversity Data Base 2005). A third occurrence, comprising the largest population now known, was discovered in 1993 on a Department of Defense communications facility in Yolo County (California Natural Diversity Data Base 2005). All three sites are in the Solano-Colusa Vernal Pool Region (Keeler-Wolf *et al.* 1998).

Current Distribution— *Tuctoria mucronata* may have been extirpated from Olcott Lake; the species has not been found there since 1993, when only four individual plants were observed (California Natural Diversity Data Base 2003). Twenty-six plants were found in 2004 and 3 plants were found in 2005 at the other Solano County site (C. Witham *in litt.* 2005). The Yolo County population is extant' (FWS 2005). See Figure 2 for a map of the current range.



Range of the Solano Grass (August 2025)

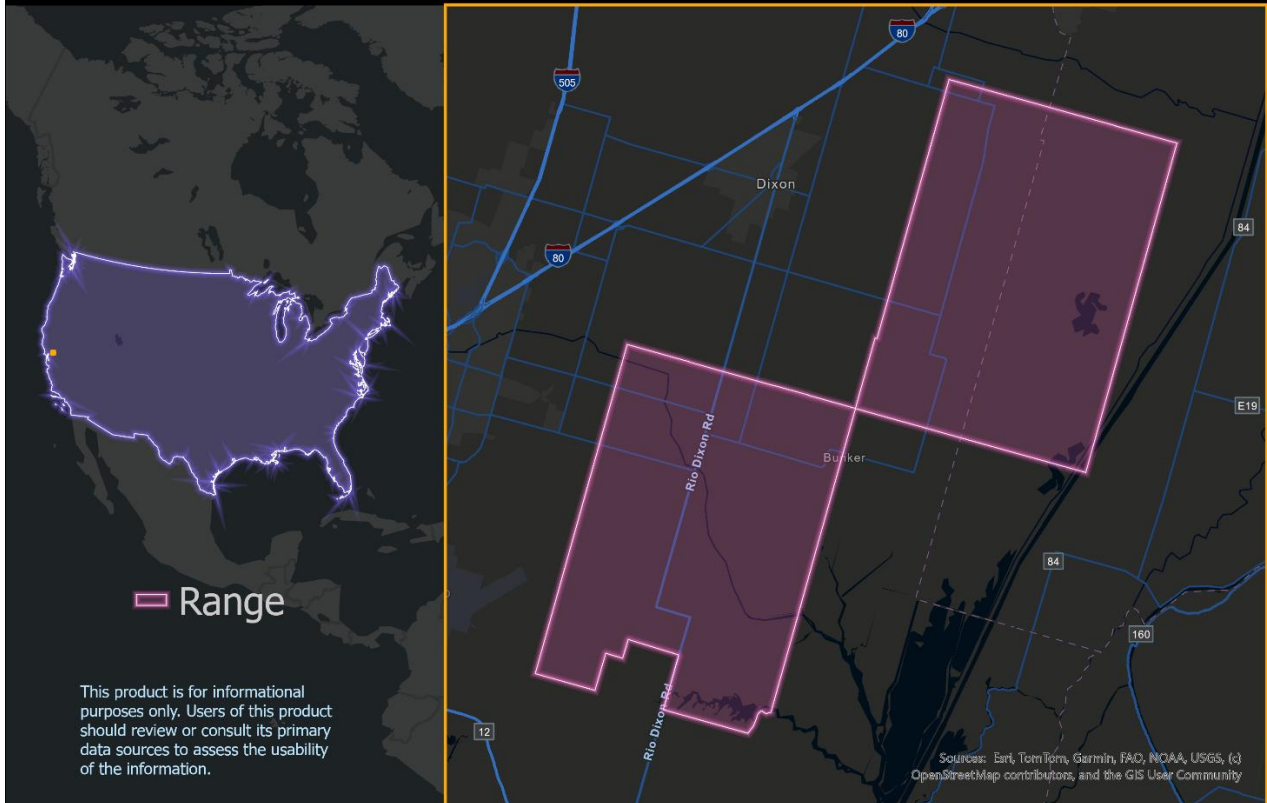


Figure 2. Range of the Solano grass (FWS 2025).

4. Description of Critical Habitat

- Critical habitat designated in 2006 (Figure 3).
- Designated habitat includes approximately 440 ac (178 ha) in Yolo County, California.
- The primary constituent elements of critical habitat for Solano grass are the habitat components that provide:
 1. Topographic features characterized by isolated mound and intermound complex within a matrix of surrounding uplands that result in continuously, or intermittently, flowing surface water in the depressional features including swales connecting the pools described in paragraph (2)(ii) of this section, providing for dispersal and promoting hydroperiods of adequate length in the pools; and
 2. Depressional features including isolated vernal pools with underlying restrictive soil layers that become inundated during winter rains and that continuously hold water or whose soils are saturated for a period long enough to promote germination, flowering, and seed production of predominantly annual native wetland species and typically exclude both native and non-native upland plant species in all but the driest years. As these features are inundated on a seasonal basis, they do not promote the development of obligate wetland vegetation

habitats typical of permanently flooded emergent wetlands.

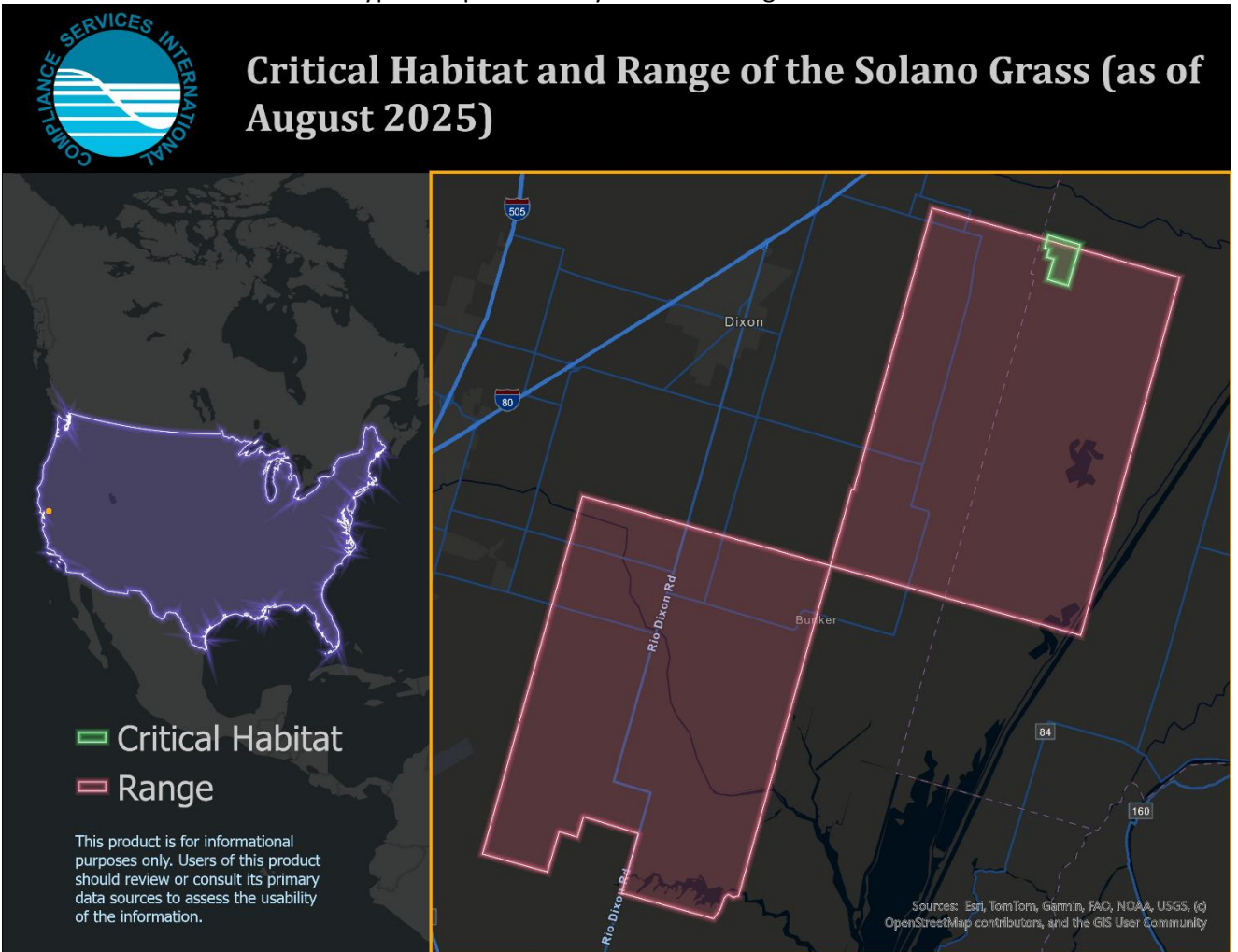


Figure 3. Critical habitat and range of the Solano grass (FWS 2025).

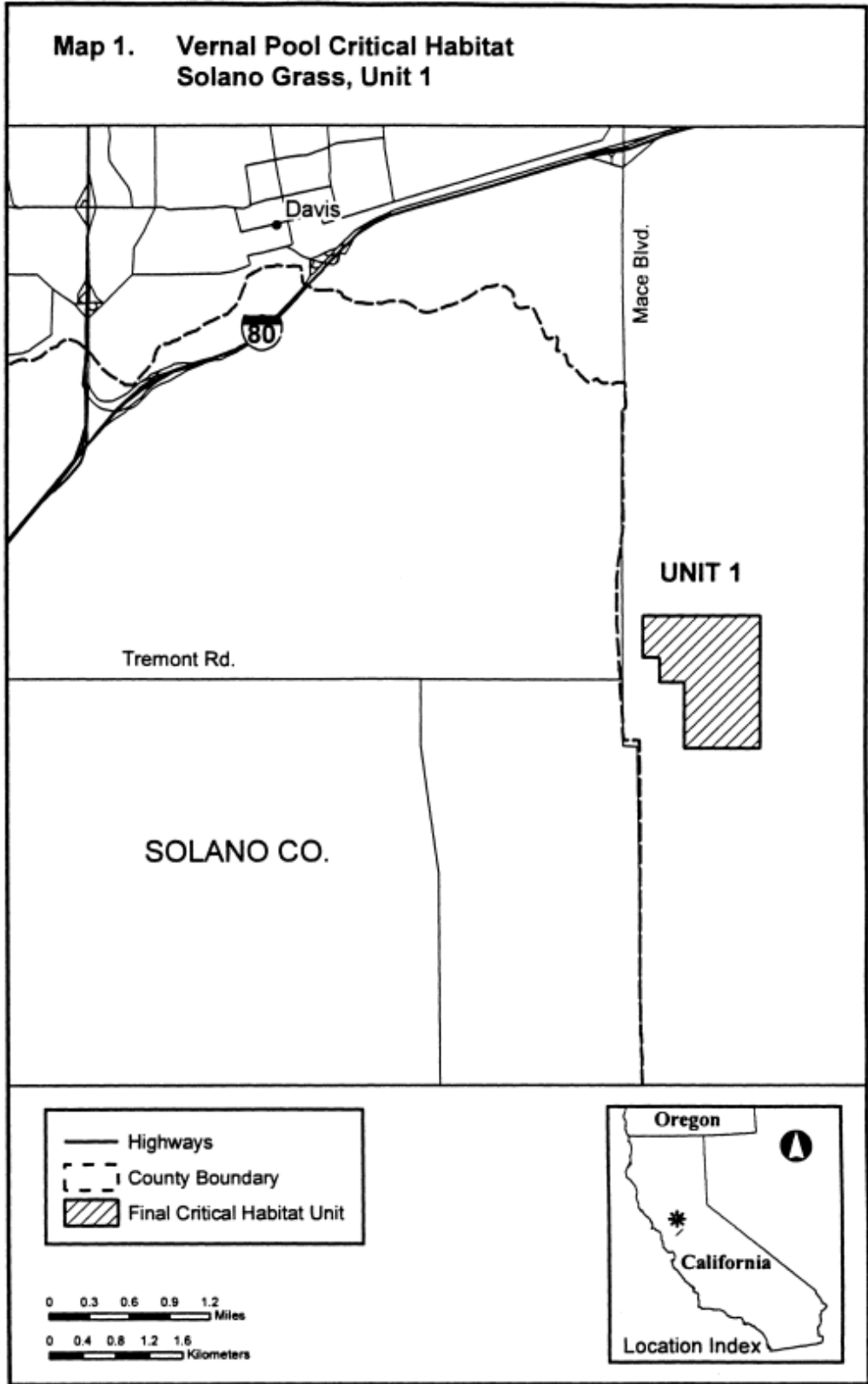


Figure 4. Critical habitat of the Solano grass. Copied from the critical habitat listing document (FWS 2006).

5. Known Locations

- ‘At time of listing in 1978, Solano grass was only known to be present at Olcott Lake (occurrence #1) within the Solano Land Trust’s Jepson Prairie Preserve (Service 1979, p. 44811). This site was considered possibly extirpated at the time of the 2009 5-year review and two new occurrences were identified: Hamilton Ranch (occurrence #2; private land recently purchased by new owners) and the Davis Air Force Communication Facility (occurrence #3; now overseen by the Yolo County Parks Department; Service 2009, p. 14). Since the 2009 5-year review, Solano grass has been transplanted into restored vernal pools in Yolo Grasslands Regional Park, creating a fourth occurrence, and has also been reintroduced at Olcott Lake (occurrence #1), resulting in four occurrences that are all currently extant. These four occurrences span two core areas (Table 1; Diversity Database 2024)’ (FWS 2024).

Table 2. Summary of Solano grass occurrences, including both current status and status as described in the 2009 5-Year Review. Copied from Table 1 of the most recent 5-Year Review (FWS 2024).

Element Occurrence	Element Name	2009 Status	2024 Status	Year Last Documented	Occurrence Type	Core Area	County
1	Jepson Prairie (Olcott Lake)	Possibly Extirpated	Presumed Extant	2023 (J. Westbrook pers. Comm. 2024)	Natural/Native occurrence (reseeded)	Jepson Prairie	Solano
2	Hamilton Ranch (Alex Cook Ranch or Cook Ranch)	Presumed Extant	Presumed Extant	2010	Natural/Native occurrence	Jepson Prairie	Solano
3	Davis Air Force Communication Facility	Presumed Extant	Presumed Extant	2011	Natural/Native occurrence	Davis Communication Annex	Yolo
4	Yolo Grasslands Regional Park	N/A	Presumed Extant	2011	Transplant	Davis Communication Annex	Yolo

- GBIF: <https://www.gbif.org/species/2704087>
 - GBIF includes 72 occurrence records; 26 of which are georeferenced. Five observations had usable coordinate data based on these criteria:
 - U.S. only (excludes Mexico)
 - Latitude and longitude precision were both 3+ decimal places.
 - Coordinate uncertainty values no greater than 30 km.
 - Relative recency (2010-present)
 - Must include date information.
 - No “preserved specimen” observations; only “human observation.”
 - The five usable coordinates were mapped against the species range to evaluate their utility in representing species extent. It was observed that all the usable GBIF coordinates are originally sourced from iNaturalist, which also had five records. Therefore, the GBIF dataset was not used for core map development.

- iNaturalist: https://www.inaturalist.org/observations?taxon_id=60314
 - iNaturalist includes five observations which are research-grade with usable coordinate data based on these criteria:
 - U.S. only (excludes Canada)
 - Latitude and longitude precision were both 3+ decimal places.
 - Relative recency (2010-present)
 - Observation description did not include the text “intentionally incorrect.”
 - Public positional accuracy (PPA) value no greater than 30 km³
This did not result in the exclusion of any records.
 - The observations intersect the range when accounting for the PPA uncertainty value.
 - The iNaturalist data are neither comprehensive nor precise enough to be used in core map development. However, the observations do represent areas where the species still has extant populations.

- NatureServe Explorer: <https://explorer.natureserve.org/>
 - Available public occurrence information from NatureServe Explorer aligns with the information from iNaturalist and GBIF.
 - EOs were generally consistent with other known observation datasets.

³ For “obscured” observations, public positional accuracy (PPA) represents the diagonal of a 0.2 x 0.2 arc cell. See the iNaturalist geoprivacy page for more details on this and related terms [What is geoprivacy? What does it mean for an observation to be obscured? : iNaturalist Help](#).

Appendix 2. GIS Data Review and Method to Develop Core Map

The core map for this species is based on critical habitat, expanded to include other extant population locations identified in the most recent 5-Year Review document from FWS. These sites were found using a combination of Google maps, Bay Nature Magazine, and EcoAtlas.org; one shape was extracted from the U.S. Geological Survey National Hydrography Dataset (NHD Plus v. 2). Additionally, the core map was further refined to exclude areas of contiguous cultivated land > 25 acres according to a spatial layer developed by EPA.

1. References and Software

- Software used: ArcGIS Pro version 3.5.2.
- FWS 5-Year Review (2024): https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/18987.pdf.
- FWS Species Range and Critical Habitat: <https://ecos.fws.gov/ecp/species/8302>.
- Bay Nature Magazine: <https://baynature.org/article/vernal-splendor/>
- National Hydrography Dataset (Version 2.1): https://nhdplus.com/NHDPlus/NHDPlusV2_tools.php.
- EcoAtlas.org: <https://www.ecoatlas.org/regions/adminregion/swrcb/projects/9905>
- Yolo County Easements and Public Lands: <https://experience.arcgis.com/experience/da47e45427aa46ebb7aed636aec8f650>

2. Datasets Used in Core Map Development

2.1. Range and Critical Habitat

The range for this species was last updated by FWS on March 21, 2018. Its critical habitat was published February 10, 2006. Shapefiles including species range and critical habitat for all listed species were downloaded from the FWS ECOS website on August 7, 2025, and the species profile for this species was checked on September 1, 2025, for any updates. The shapefiles were converted to feature classes stored in a file geodatabase and reprojected to WKID #102008 (“North America Albers Equal Area Conic”).

1. Using an ArcGIS Web Map the species was queried based on the ECOS listed “Entity ID” of 859 and exported as a feature class to a temporary file geodatabase as a standalone Entity ID-specific layer.
2. The area of the range was calculated automatically by loading it into the software (ArcGIS Pro version 3.2) and reading its area from the attribute table (“Shape_Area”), then converting its units (square meters) into acres with a conversion factor of 0.000247105.

This shapefile was added to an ArcGIS Pro map and compared against the known observation datasets. The range was used for comparison purposes only and did not otherwise contribute to core map extent of Solano grass. There is some core map area extending beyond the range and critical habitat in the vicinity of the Alex Cook Range observation. The critical habitat shape was found to be one of the four extant population sites listed in Table 2 (“Davis Air Force Communication Facility”) and was therefore included in the development of the core map unaltered (though subject to the same removal of cultivated areas described elsewhere).

2.2. Yolo County Easements and Public Lands

While observing and processing the critical habitat shape corresponding to Davis Air Force Communications Facility described above, it was observed that the Yolo Grasslands Regional Park is adjacent to this facility. The park was searched for in the U.S. Geological Survey Protected Areas Database of the United States (PAD-US, v.

4.1) but not found. However, the shape of the property’s perimeter was identifiable on the Yolo County Easements and Public Lands website (<https://experience.arcgis.com/experience/da47e45427aa46ebb7aed636aec8f650>). Its shape was not easily downloadable and an attempt to add the data to a map using a URL path was unsuccessful. Instead, the shape was manually delineated according to the process outlined in **Appendix 2 Section 3**.

2.3. Ecoatlas.org

The Alex Cook Ranch site was also queried for in PAD-US but not found. Instead, an online search for the site led to the Ecoatlas website (<https://www.ecoatlas.org>), which contains a page for the “One Lake Project Mitigation and Monitoring Plan.” The project contains a map that identifies polygonal boundaries of the ranch; this property was found in an underlying ESRI basemap and its boundaries manually delineated as a standalone spatial layer.

2.4. U.S. Geological Survey National Hydrography Dataset (NHD Plus v. 2)

The NHD Plus v. 2 dataset was used to identify one water body relevant to the core map of the Solano grass. Within the Jepson Prairie, Olcott Lake was identified in the NHD Waterbody data layer and extracted for use in core map development. The site was positively identified using the aid of a map provided by Bay Nature Magazine (George, undated; Figure 5).



Figure 5. Jepson Prairie (George, undated).

The resulting shape was merged with critical habitat and other known occurrence areas to form the core map of the species. See **Appendix 2 Section 3** for more information about the geoprocessing steps used to develop the core map for this species.

2.5. EPA Cultivated Lands Layer

EPA has developed and published its own cultivated layer for use in core map development as a potential refinement of extent. For Solano grass, extent was refined by this layer using the Pairwise Erase tool to remove significant areas of agriculture because the species habitat is not consistent with cultivated land and is therefore considered by CSI to be an “off-field” species. This decision was based on an overall interpretation of the following statements from a recent EPA Biological Evaluation of bicyclopyrone:

- “[Solano grass] is unlikely to establish on agricultural fields as it grows in vernal pools within annual grassland and requires standing water for germination and a dry pool for flowering and seed production” (EPA 2025).

This removed 8.14 % of area (162 acres) and is considered a reasonable refinement for core map development for off-field species.

3. Creating the Core Map

3.1. Defining Extent

The core map extent for Solano grass was developed from multiple sources including critical habitat, NHD Plus, and FWS documentation. The species occurs only at four extant locations; the most recent 5-Year Review document includes information about these populations. These areas were developed for the core map as follows:

1. Load the critical habitat layer into a GIS. Export the feature class to a working geodatabase, saved as a layer with a name recognizable as the species’ critical habitat, “SG_CH”. Ensure that this layer and all subsequent ones developed are in the preferred projection WKID = 102008.
2. Create an empty polygon feature class named after the Yolo Grasslands Regional Park (“YGRP”). In an edit session, create a polygon by attaching vertices to the recognizable boundary of the property, using the map from Yolo County Easements and Public Lands website as a guide. Save edits.
3. Create another empty polygon feature class for the Alex Cook Ranch, “Alex_Cook_NP”. In an edit session, create a polygon by attaching vertices to the recognizable boundary of the property, using the map from the One Lake Project Mitigation and Monitoring Plan found on EcoAtlas.org as a guide. Save edits.
4. Load the NHD Waterbody layer. Use the map of Jepson Prairie published by Bay Nature Magazine (Figure 5) to find the water body polygons associated with Olcott Lake in California. Select these features and export as a new standalone layer, “Jepson_Prairie”.
5. Use the Merge tool to merge the following four polygons associated with extant populations of Solano grass, saved as a layer recognizable as the extend of the species, “SG_extent”.
 - SG_CH
 - YGRP
 - Alex_Cook_NP
 - Jepson_Prairie
6. Use the Pairwise Dissolve tool to dissolve the previous shape (“SG_extent”) into a feature class with a single feature, saved as “SG_extent_pd”.

3.2. Cultivated Lands-based Refinement

Solano grass is not expected to be found in agricultural areas, so a refinement to exclude areas of agriculture was applied. This was determined according to a recent Biological Evaluation (BE) for bicyclopyrone, where the following was said about the species: “The species occurs in multiple habitat types but is not expected to establish on agricultural fields” (EPA 2025). Here agricultural areas are represented by EPA’s modified cultivated layer, which includes areas spanning at least 25 acres. This was done as follows:

1. Use the Pairwise Erase tool to exclude cultivated areas > 25 acres from the previous layer (“SG_extent_pd”) according to a layer developed by EPA (“CultivatedAreas_Over25acres”). Save as a new layer (“SG_extent_pd_peCultivated25ac”).
2. (Optional) Export features from the previous layer (“SG_extent_pd_peCultivated25ac”) into a new layer recognizable as Solano grass core map, “Solano_Grass_CoreMap”.

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