# Interim Core Map Documentation for the Pineland Sandmat

**Version 1**

**Review Completed:** April 2026

**Core Map Developer:** EPA's Office of Pesticide Programs (OPP)

## Species Summary

The pineland sandmat (*Chamaesyce deltoidea ssp. pinetorum*; Entity ID #4253) is a threatened perennial terrestrial plant species. This species is a perennial herb endemic and occurs only in open canopy and understory and a limestone substrate (characteristic of pine rockland habitat) in Miami-Date County in southern Florida. The largest remaining area of pine rockland in Florida was identified in Everglades National Park (ENP). Within ENP, the pineland sandmat occurs in higher elevation pine rocklands throughout Long Pine Key within FMU3. The pineland sandmat flowers and fruits year-round and reaches peak fruiting in the fall. The U.S. Fish and Wildlife Service (FWS) has not finalized a critical habitat for the pineland sandmat, though a proposed rule was submitted in 2022. Additional information is provided in **Appendix 1**.

## Description of Core Map

The core map for the pineland sandmat is developed based on biological information. The outer boundary of this core map is defined by the FWS's species range, which is within Miami-Dade County, Florida. EPA based the core map on known occurrences within the range as described in the 2023 FWS's Five-year Review and characteristic of the preferred habitat of this species.

**Figure 1** depicts the resulting interim core map for the pineland sandmat. The size of this core map is approximately 377,702 acres. Landcover categories within the core map area are included in **Table 1**. Landcover is predominantly emergent herbaceous wetlands.

The core map developed for the pineland sandmat is considered interim. This core map will be used to develop pesticide use limitation areas (PULAs) that include the pineland sandmat. This core map incorporates information developed by FWS and made available to the public; however, the core map has not been formally reviewed by FWS. This interim core map may be revised in the future to incorporate species expert feedback from FWS. This interim core map has an "average" (3) best professional judgment classification to describe major uncertainties/limitations. The map is based on known locations described by FWS, and EPA removed some additional areas based on biological needs of the species. This core map does not replace or revise any range or designated critical habitat developed by FWS for this species.

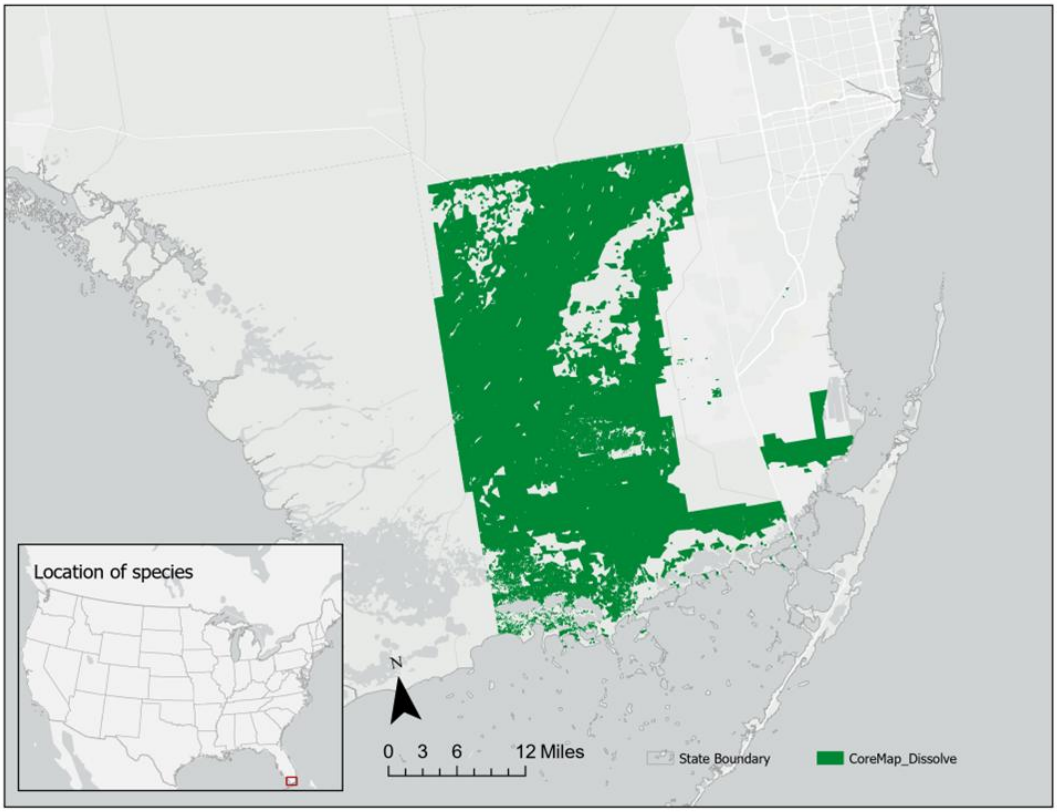


**Figure 1. Interim core map for the pineland sandmat**

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

| Example pesticide use sites/types | NLCD Landcover (Value) | % Area |
|---|---|---|
| Forestry | Deciduous Forest (41) | 0.2% |
| Forestry | Evergreen Forest (42) | 0.2% |
| Forestry | Mixed Forest (43) | 0.3% |
| Agriculture | Pasture/Hay (81) | 0.0% |
| Agriculture | Cultivated Crops (82) | 0.0% |
| Mosquito adulticide, residential | Open space, developed (21) | 0.3% |
| Mosquito adulticide, residential | Developed, Low intensity (22) | 0.1% |
| Mosquito adulticide, residential | Developed, Medium intensity (23) | 0.0% |
| Mosquito adulticide, residential | Developed, High intensity (24) | 0.0% |
| Invasive species control | Woody Wetlands (90) | 2.5% |
| Invasive species control | Emergent Herbaceous Wetlands (95) | 95.4% |
| Invasive species control | Open water (11) | 0.0% |
| Invasive species control | Grassland/herbaceous (71) | 0.0% |
| Invasive species control | Scrub/shrub (52) | 0.6% |
| Invasive species control | Barren land (rock/sand/clay; 31) | 0.0% |
| **Total Acres** | **Interim Core Map Acres** | ~ 377,702 acres |

## Evaluation of Known Location Information

There are four datasets with known location information:

- Descriptions of locations provided by FWS
- Occurrence locations in iNaturalist
- Occurrence locations in NatureServe; the name on NatureServe is Euphorbia deltoidea ssp. pinetorum (T1 critically imperiled subspecies) and
- Occurrence locations in the Global Biodiversity Information facility (GBIF)

EPA assessed these four sets of known location data (Appendix 1) prior to selecting the type and developing the core map. Date from the FWS identified the general population range where the species was discovered (refer to Figure A1-1 in Appendix 1) appeared to have the finest resolution of the location information, providing a map that depicted the current known locations all within the Miami-Dade County, Florida (**Figure A1-2 in Appendix 1**). Occurrences in iNaturalist, GBIF, and NatureServe did not support expanding the core map outside of the Miami-Dade County. **Appendix 1** includes more information on the available known location information.

[1] Dewitz, J., 2023, National Land Cover Database (NLCD) 2021 Products: U.S. Geological Survey data release, https://doi.org/10.5066/P9JZ7AO3

## Approach Used to Create Core Map

The core map was developed using 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 4 steps described in the process document:

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

For step 1, EPA compiled available information for the pineland sandmat from FWS, as well as observation information available from various publicly available sources (including iNaturalist, NatureServe, and GBIF). The information compiled for the pineland sandmat is included in **Appendix 1**. Influential information that impacted the development of the core map included:

- FWS provided range for this species that represents all historical and current occurrence of this species (within the Miami-Dade County, Florida).
- FWS provided known occurrences in the 2023 Five-review document (see Table A1-1 in the Appendix 1).
- The pineland sandmat occurs only in open canopy and understory and a limestone substrate (characteristic of pine rockland habitat) in Miami-Date County in southern Florida.
- Development and agriculture have reduced pine rockland habitat.
- This species is endemic to the pine rocklands of southern Florida and requires open canopy
- Development and agriculture have reduced pine rockland habitat by 90 percent.

For step 2, EPA used the compiled information to identify the core map type, which includes the species range, known occurrences information, and habitat characteristic of the species. The extant populations are in open canopy, non-cultivate areas within Everglades National Park and lands owned by Miami-Dade County, national conservation service, and private ownership.

For step 3, EPA used the best available data sources to generate the core map. Data sources are discussed in the process document. For this core map, EPA used FWS's species range as the outer boundary. To identify the open canopy areas essential for the species, EPA utilized the USA NLCD Tree Canopy Cover data. To identify limestone soil type, EPA utilized EPA utilized the World Soils 250m pH map. To eliminate agricultural area, EPA utilized the USA NLCD Land Cover data. To identify the specific known occurrence locations, EPA utilized the Protected Areas Database of United States. **Appendix 2** provides more details on the GIS analysis and data used to generate 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

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

EPA considered using the FWS's species range as the core map but determined that the range included areas with soil types, tree canopy cover, and land cover types unsuitable for the species' growth. Critical habitat was not considered because the FWS has not finalized their proposed critical habitat for the pineland sandmat.

EPA also examined data repositories such as iNaturalist, which depend on contributions from individuals with individuals with varying levels of expertise. However, due to uncertainties regarding the scale and precision of these observations, EPA did not to utilize these observation records to develop the core map.

# Appendix 1. Information Compiled for the Pineland Sandmat

1. **Recent FWS documents/links and other data sources**
   - Five Year Review (2023) Pineland Sandmat 5-Year Review 2023
   - FWS's Biological Opinion (https://ecos.fws.gov/tails/pub/document/2303919)
   - FWS's Biological Opinion (https://ecos.fws.gov/tails/pub/document/14889739)

2. **Background information**
   - **Status**: Federally listed as Threatened in 2017
   - **Resiliency, redundancy, and representation** (the 3Rs)

     Resiliency: There are 20 known extant populations for this species and 1 is at risk of extirpation. There is no current Recovery Plans available for this species. Species' recovery priority number is 9 (high demographic risk, low to moderate potential for successful recovery efforts). "Due to land modifications, suitable habitat for the pineland sandmat outside of protected areas is limited, severely fragmented, isolated, and degraded. These characteristics contribute to the species low resiliency."

     Redundancy: One of 20 populations are considered possibly extirpated. "Due to land modifications, suitable habitat for the pineland sandmat outside of protected areas is limited, severely fragmented, isolated, and degraded. These characteristics contribute to the species … low redundancy."

     Representation: "Due to land modifications, suitable habitat for the pineland sandmat outside of protected areas is limited, severely fragmented, isolated, and degraded. These characteristics contribute to the species … low representation."
   - **Habitat**
     - The pineland sandmat is endemic to the pine rockland habitat of southern Florida.
     - Open canopy conditions are required to allow sufficient sunlight to reach the herbaceous layer and permit growth and flowering of the pineland sandmat.
     - Subtropical humid climate or tropical humid climate is essential for the pineland sandmat.
     - Calcareous limestone (often exposed with little soil development) can provide nutritional requirements and suitable growing conditions for this species.
     - Pine rockland habitat with short hydroperiods (up to 60 days) is essential feature for the pineland sandmat.

   - **Pollinator/reproduction**
     - Flower and fruit year-round and reaches peak fruiting in the fall
     - Pollinator is not identified or described in FWS documentation

   - **Taxonomy**
     - The pineland sandmat is a perennial herb endemic to the pine rocklands of southern Florida.

   - **Relevant Pesticide Use Sites**
     - No information specific to pesticides.

- **Recovery Criteria/Objectives**
    - No current Recovery Plans available for this species.

- **Recovery Actions (from FWS Five-year review)**
  This species does not have a final recovery plan. In the FWS Five-year review, the following potential recovery activities have been identified the FWS.
    - Conserve pine rocklands and suitable habitat through purchase of land or conservation easements.
    - Develop habitat management plans for the extant populations including a 3-7 year fire regime with summer fires preferred to winter and removal of exotic species.
    - Establish partnerships with private landowners to promote conservation easements and landowner agreements within remaining populations and habitat.
    - Identifying and restoring patches of pine rockland habitat outside the Everglades National Park that may allow for the pineland sandmat to begin to recolonize less populated areas and assist in connectivity.

- **Threats**
    - The primary threat to the species is direct and indirect impacts to habitat suitability. Extensive land modification for development throughout the species historic range has led to habitat loss, fragmentation, and alterations that render the habitat unsuitable for the pineland sandmat.
    - Non-native species have significantly affected pine rocklands habitat dynamics.
    - Fire is a crucial component to maintaining pine rockland habitat.
    - The species also experiences stressors from human activity and inadequate management. The recreational use of off-road vehicles poses a threat to the pineland sandmat.
    - Development and agriculture have reduced pine rockland habitat by 90 percent in mainland south Florida.

**3. Description of Species Range**

- Figure A1-1 depicts the FWS range for the pineland sandmat. The range was last updated on 2/15/2022. The total acreage of the range is around 1,553,136 acres.

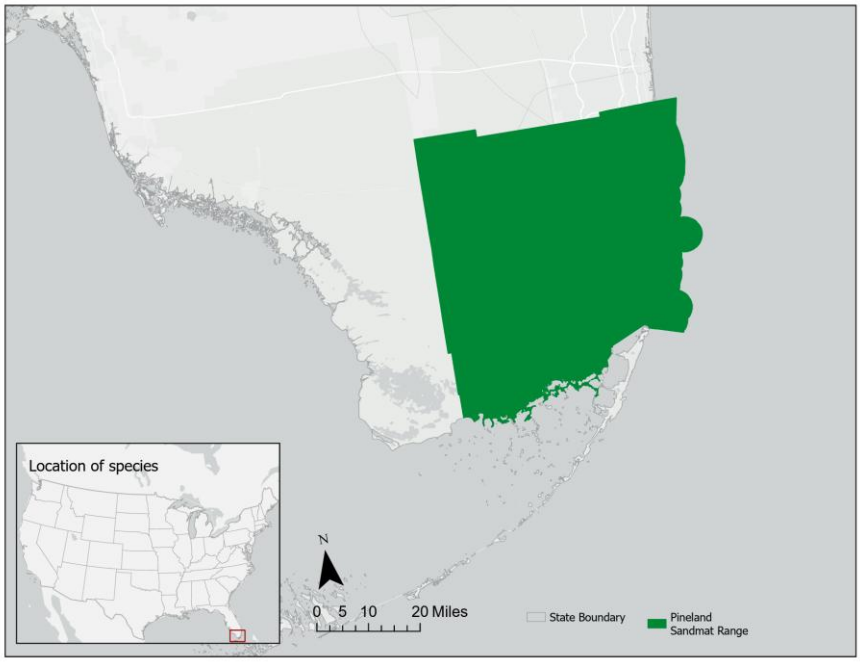


**Figure A1-1. FWS range for the pineland sandmat. The total acreage of the range is around 1,553,136 acres.**

- In the Five-year review document, the FWS stated that there are 20 known extant populations of the pineland sandmat found in Miami-Dade County. Of the twenty populations, eleven populations occur on public lands and nine populations are privately owned. The detailed information is listed in the Five-year Review and cited below in Table A1-1. Detailed information for each population is provided in Table A1-2.

**Table A1-1. Summary of the twenty pineland sandmat populations, ownership, and status.**

| Property Owner | Number of populations Extant | Number of Populations Possibly Extirpated |
|---|---|---|
| National Park service | 1 | 0 |
| Miami-Dade | 8 | 1 |
| Institute for Regional Conservation | 1 | 0 |
| Private | 9 | 0 |

**Table A1-2 Summary of the status and trends of the known occurrences of the pineland sandmat.**

| POPULATION | OWNERSHIP | MOST RECENT POPULATION ESTIMATE | STATUS | TREND |
|---|---|---|---|---|
| Everglades National Park | National Park Service | 10,000 – 100,000 (2011)[3] | Extant | Increasing |
| Florida City Pineland | Miami-Dade County | 33 (2009)[4,5] | Extant | Insufficient data |
| Navy Wells | Miami-Dade County | 1,000-10,000 (2007)[1,4,5] | Extant | Insufficient data |
| Navy Wells #2 | Miami-Dade County | 1000-10,000 (2007)[1,4,5] | Extant | Insufficient data |
| Navy Wells #39 | Miami-Dade County | >500 (2013)[1,4,5] | Extant | Insufficient data |
| Palm Drive Pineland | Miami-Dade County | 0 (2012)[1,4,5] | Possibly Extirpated | Insufficient data |
| Pine Ridge Sanctuary | Private | 10-100 (2011)[2,4,5] | Extant | Insufficient data |
| Rock Pit #39 | Miami-Dade County | 419 (2012)[4,5] | Extant | Insufficient data |
| Seminole Wayside Park | Miami-Dade County | 614 (2015)[4,5] | Extant | Insufficient data |
| Fuchs Hammock Addition | Miami-Dade County | 20 (2011)[5] | Extant | Insufficient data |
| Sunny Palms Pineland | Miami-Dade County | 1,001-10,000 (2015)[4,5] | Extant | Increasing |
| John Kunkel Small Pineland | Institute for Regional Conservation | Present (2006)[4,5] | Extant | Insufficient data |
| Natural Forest Community [NFC] #P330 | private | 11-100 (2007)[1,4,5] | Extant | Insufficient data |
| Natural Forest Community #P338 | private | 1,001-10,000 (2007)[1,4,5] | Extant | Insufficient data |
| Natural Forest Community #P339 | private | 11-100 (2007)[1,4,5] | Extant | Insufficient data |
| Natural Forest Community #P347 | private | 11-100 (2007)[1,4,5] | Extant | Insufficient data |
| Natural Forest Community #P411 | private | 101-1,000 (2007)[1,4,5] | Extant | Insufficient data |
| Natural Forest Community #P413 | private | 11-100 (2007)[1,4,5] | Extant | Insufficient data |
| Natural Forest Community #P416 | private | 11-100 (2007)[1,4,5] | Extant | Insufficient data |
| Natural Forest Community #P445 | private | 1,001-10,000 (2007)[1,4,5] | Extant | Insufficient data |

[1]Bradley, pers. comm. 2007
[2]FNAI 2011
[3]Gann 2015
[4]Lange, pers. comm. 2017
[5]Possley, pers. comm. 2017

## 4. Critical Habitat

- FWS proposed a designated critical habitat for this species, but nothing has been finalized yet. (2022-21604.pdf) The proposed critical habitat units are depicted for Miami-Dade County, Florida. Within these areas, the physical or biological feature essential to the conservation of the species are South Florida pine rockland and adjacent ecotonal areas:
    - Consisting of calcareous limestone substrate
    - Open canopy and understory with a high proportion of native pine rockland species
    - Subjected to a monthly mean temperature characteristic of the subtropical humid classification in Miami-Dade County and short hydroperiods ranging up to 60 days each year
    - Subjected to periodic natural or unnatural disturbance regimes to maintain open canopy conditions

- Containing the presence of native pollinators for natural pollination and reproduction

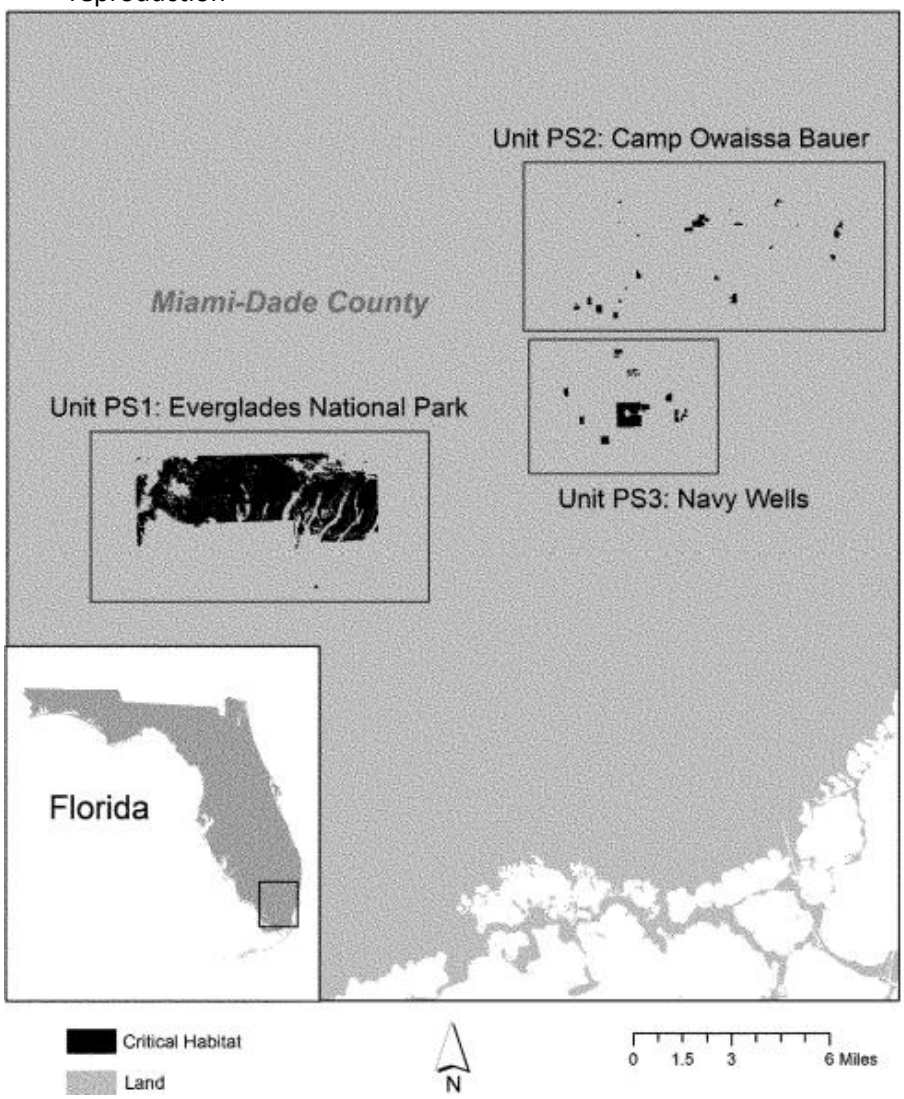


**Figure A1-2. The proposed designated critical habitat for the pineland sandmat by the FWS.**

5. **Known Locations**
   - Restricted to the Miami-Dade County, Florida.
   - Occurrences Included in Public Databases
     - Source 1: iNaturalist https://www.inaturalist.org/observations
     - Source 2: GBIF https://www.gbif.org/
     - Source 3: NatureServe https://explorer.natureserve.org

     EPA queried iNaturalist, GBIF, and NatureServe. iNaturalist (available here) recorded 125 observations for the pineland sandmat (see Figure A1-6). There are also occurrences reported on NatureServe (see Figure A1-7) and GBIF (see Figure A1-8). Although the spatial resolution of the occurrence maps on the NatureServe and GBIF public websites is low to determine the exact locations of the reported occurrences, all the observation

occurred in the Southern Florida.  Confidence in these observations is uncertain. As a result, EPA did not use occurrence data to define the outer range of the core map.

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

EPA developed this interim core map by refining the species range to focus on areas including occupied locations and species habitat. EPA used the PULA provided by FWS during the Enlist consultation as the starting point (outer extent) for developing this core map. The initial PULA consists of three adjacent HUC12s containing Barton's Creek, Spring Creek, and Cedar Creek. These HUC12 sub-watersheds were further refined to remove areas with dense canopy cover.

1. **Dataset References and Software**

- Software used: ArcGIS Pro 3.5
- FWS Species Range – last updated on 2/15/2022 Species Profile for Pineland sandmat(Chamaesyce deltoidea pinetorum)

2. **Datasets Used in Core Map Development**

- FWS Species Range: https://ecos.fws.gov/ecp/species/1914
- Protected Areas Database of the United States (PAD-US) 2.1 – World Databased on Protected Areas (WDPA) Submission (ver 1.1, April 2021) : Protected Areas Database of the United States (PAD-US) 2.1 - World Database on Protected Areas (WDPA) Submission (ver 1.1, April 2021) | U.S. Geological Survey
- USA NLCD Tree Canopy Cover 2021 (updated 04/11/2025) https://www.arcgis.com/home/item.html?id=3ccf118ed80748909eb85c6d262b426f
- USA NLCD Land Cover https://www.arcgis.com/home/item.html?id=3ccf118ed80748909eb85c6d262b426f
- World Soils 250m pH World Soils 250m pH - Overview (updated: Apr 3, 2025)

3. **Core Map Development**

- Determined 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, the FWS has no finalized critical habitat for this species.
- Prepared raster layers to identify known occurrence locations, suitable habitats (including sunlight and soil types), and non-agriculture areas
  - *Known occurrence locations layer*. As detailed in Appendix 1, the FWS's Five-year Review has listed the current known occurrence locations, ownership and other information (see Table A1-1 and Table A1-2). To identify these locations, EPA utilized the PAD-US layer and filtered polygon units based on either "unit-Nm" (i.e., unit name) or "owner_Name" for matching names of the units. The detailed selection is listed below.
    *"Loc_Own = 'Institute for Regional Conservation' Or Unit_Nm IN ('Palm Drive Pineland') Or Unit_Nm = 'Pine Ridge Sanctuary' Or Unit_Nm = 'Rock Pit #39' Or Unit_Nm = 'Navy Wells Pineland #39' Or Unit_Nm = 'Navy Wells Park' Or Unit_Nm = 'Navy Wells Pineland #23' Or Unit_Nm = 'Seminole Wayside Park' Or Unit_Nm = 'Fuchs Hammock Addition' Or Unit_Nm = 'Sunny Palms Pineland' Or Unit_Nm = 'Goulds Pineland Preserve' Or Unit_Nm = 'John Pennekamp Coral Reef State Park' Or Own_Name = 'PVT' Or Unit_Nm = 'Everglades National Park'"*
  - *Open canopy land cover layer*. Sunlight is essential to the pineland sandmat. To identify open canopy land cover, EPA utilized the USA NLCD Tree Canopy Cover data for year

2021, a raster dataset contains percent tree canopy estimates. EPA applied a filter of 25 percent and lower tree canopy to identify areas with full sunlight.

- *Calcareous limestone soil type layer*. Calcareous limestone soils are typically alkaline due to their high calcium carbonate content. The pH of this type of soil is generally above 7, often ranging from slightly above neutral to as has as 8.5. EPA utilized the World Soils 250m pH layer to identify areas containing pH 7 and above soils.
- *Non-agriculture and non-open water layer*. Agriculture is one of the primary threats to the pineland sandmat causing the loss of the populations. In addition, the pineland sandmat cannot survive in open water or areas with hay and pasture. EPA used the USA NLCD Land Cover layer to remove areas that are categorized as cultivated land (category 81), hay and pasture (category 82), and open water (category 11).

a) Converted above refined raster layers to polygon layers
b) Overlaid the FWS range layer with the above stated four raster-converted polygon layers to refine the species range into a core map for the pineland sandmat.