Interim Core Map Documentation for Garber's Spurge

Version 1

Review Completed: April 2026

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

Species Summary

The Garber's spurge (*Chamaesyce garberi*; Entity ID #663) is an endangered terrestrial plant (dicot). There is no designated critical habitat for this species. The Garber's spurge occurs at low elevations either on thin sandy soils composed largely of Pamlico sands or directly on limestone in Miami-Dade and Monroe Counties in Florida. It is found in a variety of open to moderately shaded habitat types. In pine rocklands, it grows out of crevices in oolitic limestone. On Cape Sable, Everglades National Park, it has been reported from hammock edges, open grassy prairies, and backdune swales. In the Florida Keys, it grows on semi-exposed limestone shores, open calcareous salt flats, pine rocklands, calcareous sands of beach ridges, and along disturbed roadsides. Additional information is provided in **Appendix 1**.

Description of Core Map

The core map for the Garber's spurge is based on biological information. The species range is disjunct and includes three or more areas in Miami-Dade and Monroe Counties, including Everglades National Park and the Florida Keys. There is uncertainty around the species range because the species has not been comprehensively surveyed in 10-15 years; the last range-wide survey was in 2006-2007. The species range may therefore include populations that have been extirpated. There is no designated critical habitat for this species. **Figure 1** depicts the interim core map for the Garber's spurge. The size of this core map is approximately 8,200 acres. Landcover categories within the core map area are included in **Table 1**. Landcover is predominantly wetlands, scrub, and forest.

Figure 1 depicts the resulting interim core map for the Garber's spurge. The outer extent of the core map is the species range, which was last updated by the U.S. Fish and Wildlife Service (FWS) in 2022. As a further refinement, EPA limited the core map to only reflect locations with populations of the Garber's spurge that were considered potentially extant as of the 2022 5-Year Review.

The core map developed for the Garber's spurge is considered interim. This core map will be used to develop pesticide use limitation areas (PULAs) that include the Garber's spurge. 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 expert feedback from FWS. This interim core map has an "average" (3) best professional classification to describe major uncertainties/limitations. The map is based on known locations described by FWS, and EPA removed some additional areas based on whether the species is likely to be present according to the most recent available information.

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

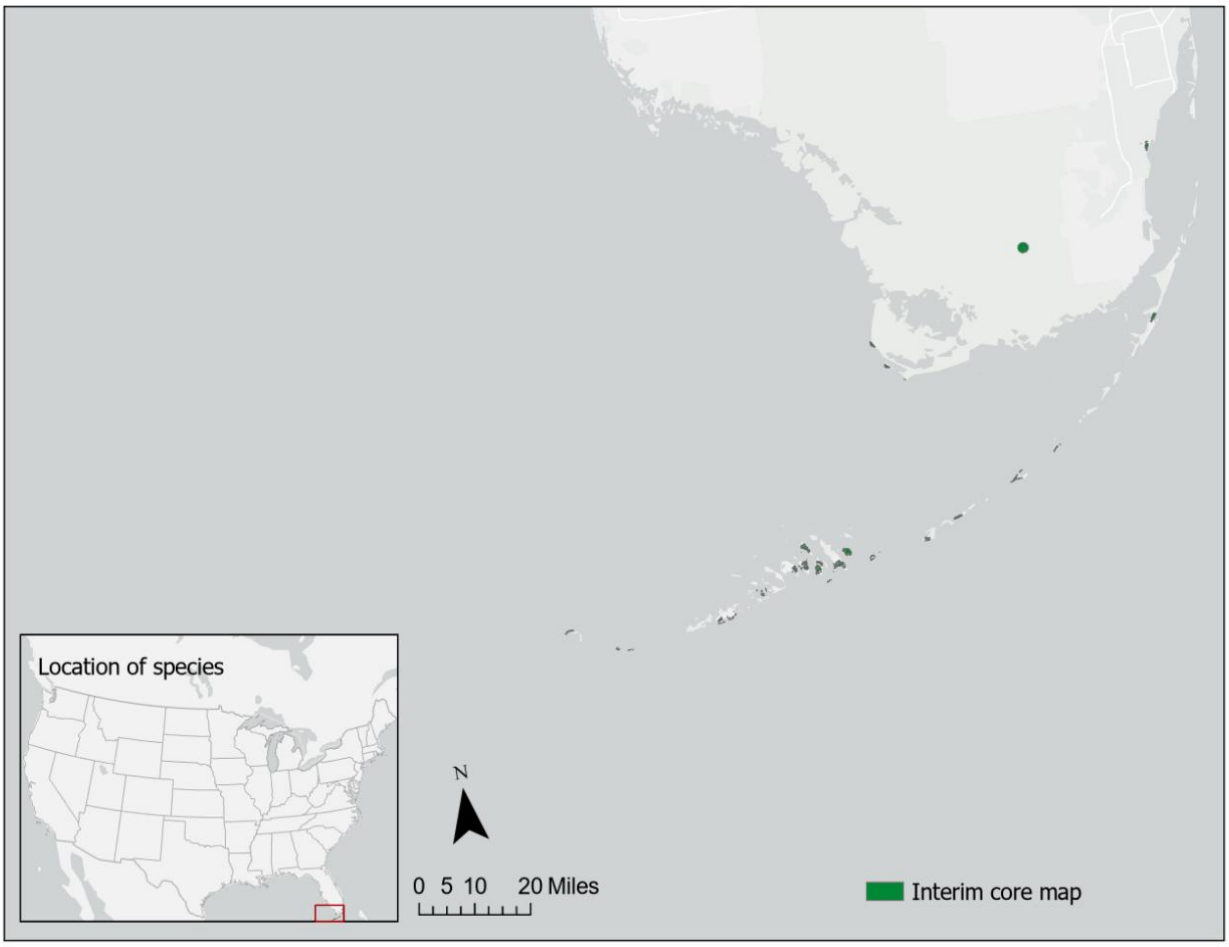

Figure 1. Interim core map for the Garber's spurge.

Table 1. Percentage of Interim Core Map Represented by National Land Cover Database (NLCD)[1] Land Covers and Associated Example Pesticide Use Sites/Types.

Example pesticide use sites/types	NLCD Landcover (Value)	% of core map represented by landcover
Forestry	Deciduous Forest (41)	0
Forestry	Evergreen Forest (42)	3
Forestry	Mixed Forest (43)	9
Agriculture	Pasture/Hay (81)	0
Agriculture	Cultivated Crops (82)	0
Mosquito adulticide, residential	Open space, developed (21)	5
Mosquito adulticide, residential	Developed, Low intensity (22)	3
Mosquito adulticide, residential	Developed, Medium intensity (23)	1
Mosquito adulticide, residential	Developed, High intensity (24)	0
Invasive species control	Woody Wetlands (90)	26
Invasive species control	Emergent Herbaceous Wetlands (95)	36
Invasive species control	Open water (11)	2
Invasive species control	Grassland/herbaceous (71)	3
Invasive species control	Scrub/shrub (52)	10
Invasive species control	Barren land (rock/sand/clay; 31)	0
Total Acres	**Interim Core Map Acres**	**~8,200**

Evaluation of Known Location Information

There are four datasets with known location information for this species:

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

EPA evaluated these four sets of data to inform or support the core map. FWS provided the most refined descriptions of the occurrence information and confirmed that all known locations of extant populations are located within the range. iNaturalist had 14 research grade observations, which are consistent with the species range, all of them occurring in the Florida Keys. GBIF includes 56 observations consistent with the species range in the Florida Keys. NatureServe included 11 documented areas, all of which were consistent with the location of the species range in Miami-Dade and Monroe Counties. **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"). This core map was developed by EPA 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 Garber's spurge from FWS, as well as observation information available from various publicly available sources (including iNaturalist, GBIF and NatureServe). The information compiled for the Garber's spurge is included in **Appendix 1**. Influential information that impacted the development of the core map included:

- The species range is disjunct, occurring in patches in Miami-Dade and Monroe Counties, including the Florida Keys.
- The last comprehensive survey of the species was conducted in 2006-2007, and therefore information on the current status of many populations is unknown.
- Occurrence data from other sources are generally consistent with the FWS species range location information, though the occurrence data are concentrated in the Florida Keys.

For step 2, EPA used the compiled information to identify the core map type including species range and known location information. The extant populations are located at sites identified by FWS within the species' range. Therefore, EPA based the core map on the species range identified by FWS and refined the area using a map of known locations from the 2022 5-Year Review. The entire range of the species was not used as the core map because the range contains areas where no known extant populations are present.

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 the 2022 species range from FWS to define the outer extent, and further refined this area by limiting the core map to those segments of species range that fell within a 1.5 mi radius of one of the points identified in Figure 1 of the 2022 5-Year Review (and reproduced in Figure A1-2 below). The radius around these points was based on area estimates for select populations described by Green et al. (2008) in which the length and widths of the boundaries of characterized populations could reach 2-3 mi. **Appendix 2** provides more details on the Geographic Information System (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 explored using GIS datasets that describe the species' habitat to further refine the core map; however, the existing species range already appears to reflect some degree refinement based on habitat information. Consequently, further habitat-based refinement was deemed unlikely to yield significant improvement.

Appendix 1. Information Compiled for Species During Step 1

1. **Recent FWS Documents**
   - South Florida Multi-Species Recovery Plan 1999
   - Garber's Spurge 5-Year Review 2007
   - Garber's Spurge 5-Year Review 2022

2. **Background information on Species**
   - **Status:** Federally listed as threatened in 1985
   - **Taxonomy:** FWS plant group 11: dicot flowering plants that require outcrossing with biotic pollination vectors, other reproductive mechanisms unknown; also called *Euphorbia garberi*.
   - **Resiliency, Redundancy, and Representation:** Available FWS documents for Garber's spurge do not specifically describe the 3Rs for this species. Some relevant information included in the documents is:
     - "Many populations of Garber's spurge are found in highly disturbed locations, such as roadsides, the edge of an abandoned marina on Key Largo, and a cleared and exotic invaded Keys tidal rock barren on Boca Chica Key. Garber's spurge is in part resilient to disturbance and has in some cases responded positively to light-moderate levels of disturbance on some islands. For example, mowing along roadsides where the species occurs may mimic the disturbance of fire and benefit the species, if timed appropriately. However, in contrast to populations in natural, high-quality habitats, these more ruderal populations are typically smaller in size, and probably do not have high long-term viability due to the disturbances they can be subjected to, such as herbicide spraying or road maintenance. Additionally, these roadside and other disturbed populations, while often adjacent to conservation lands, are not adequately protected themselves as many have become extirpated (Green et al. 2008)." (5-Year Review 2022, 17-18)

     - "The distribution of habitat (pine rockland, coastal dune, coastal grassland, and Keys tidal rock barren) within the Garber's spurge historical range remains fragmented. Florida Natural Areas Inventory (FNAI) ranks pine rocklands as critically imperiled globally and statewide, coastal dune and grasslands as globally rare and imperiled statewide, and Keys tidal rock barren as rare globally and statewide (FNAI 2010). Extensive land clearing for human population growth, development, and agriculture has altered, degraded, or destroyed millions of acres of these once abundant ecosystems." (5-Year Review 2022, 15)

     - "Habitats supporting Garber's spurge in the Keys have also experienced degradation and destruction. Ecosystems throughout the Keys have suffered from a wide variety of disturbances since permanent settlement began in 1821. Extensive hammock areas were cleared for agriculture and timber; exotic plants have invaded all habitats; pine rocklands have been altered due to fire suppression and sea level rise; and large areas have been converted by road construction and development. Similar to peninsular Florida, fire management in the Lower Keys and National Key Deer Refuge (NKDR), which has a few small to mid-size populations of Garber's spurge, is hampered by the fragmented pattern of land ownership and development; residential and commercial properties are embedded within or in close proximity to pine rockland habitat (Snyder et al. 2005; Bradley and Saha 2009; S. Saha et al. 2011). As a result, many of the pine rockland

habitat parcels throughout the NKDR are being compromised by succession to rockland hammock. Many coastal dune habitats in the Keys have been lost due to development, and those that do exist and have Garber's spurge have been invaded by a variety of invasive nonnative plants and, in some instances have constant pressures from trampling due to beachgoers." (5-Year Review 2022, 17)

- FWS documents also indicate the relevance of potential negative effects of climate change, especially in terms of rising sea levels and increased likelihood of hurricane/storm damage, to the health of Garber's spurge populations.

- **Habitat Description**

"Garber's spurge occurs at low elevations either on thin sandy soils composed largely of Pamlico sands or directly on limestone. It is found in a variety of open to moderately shaded habitat types. In pine rocklands, it grows out of crevices in oolitic limestone. On Cape Sable, Everglades NP, it has been reported from hammock edges, open grassy prairies, and backdune swales. In the Florida Keys, it grows on semi-exposed limestone shores, open calcareous salt flats, pine rocklands, calcareous sands of beach ridges, and along disturbed roadsides." (Multi-Species Recovery Plan 1999, 4-852).

"Garber's spurge occurs in a variety of habitats in the Florida Keys and Miami-Dade County and will require management practices specific to each habitat. Although there are differences between the habitats, they are all early successional and require some type of disturbance (i.e. fire or wash over). The habitats in the Florida Keys have a slower growth rate than similar habitats in Miami-Dade County and require less frequent disturbance." (Multi-Species Recovery Plan 1999, 4-854).

"Pine rockland habitat in Miami-Dade County, including in the ENP, was reduced to about 11 percent of its natural extent, from approximately 183,000 acres (ac) (74,000 hectares [ha]) in the early 1900s, to only 20,100 ac (8,140 ha) in 1996 (Kernan and Bradley 1996). Outside of the Everglades, only about 1 percent of the pine rocklands on the Miami Rock Ridge have escaped clearing and much of what is left are small remnants scattered throughout the Miami metropolitan area, isolated from other natural areas (Herndon 1998). Within the Everglades, pine rockland habitat still exists in good ecological condition at Long Pine Key where one of the largest Garber's spurge population remains. As the only population located sufficiently far from the coast to avoid the effects of sea level rise, the intact nature of the habitat here is significant and can be at least partly attributed to the frequent fire applied to the landscape, approximately every 3-4 years (Sadle 2022). In the Keys, pine rockland historically occurred on Key Largo and throughout the Lower Keys but is now mainly restricted to the NKDR in the Lower Keys due to development and sea level rise (Ross et al. 1994)." (5-Year Review 2022, 15-16)

"Most remaining pine rocklands occur on public conservation lands, with extensive habitat management plans. While non-native plant species control efforts are relatively sufficient, conducting prescribed fires is difficult, especially in Miami and the NKDR, due to the wildland-urban interface. In Miami-Dade County, the CDE went approximately 13 years without fire (Possley 2022a) due to the logistical difficulties of burning at this location, which has significant wildland/urban interface. Miami-Dade County Parks and Recreation staff have burned several of their conservation lands on a fire-return interval of approximately 3 to 7

years. However, implementation of a prescribed fire program of this frequency at the CDE has been hampered by public concern for burning next to residential areas. Fortunately, in the fall of 2021, burns were conducted within the CDE, including habitat containing the Garber's spurge population. Nonprofit organizations such as the Institute for Regional Conservation (IRC) have had similar difficulties with conducting prescribed burns. Additionally, few private landowners have the means and/or desire to implement prescribed fire on their property and doing so in a fragmented urban environment is logistically difficult and costly." (5-Year Review 2022, 16)

- **Relevant Life History Information:**
  "Reproductive ecology in *Chamaesyce* has been poorly studied but is known to be highly variable (Ehrenfeld 1976 and 1979; Webster 1967). Some species are completely reliant on insects for pollination and seed production while others are self-pollinating. Pollinators may include bees, flies, ants, and wasps (Ehrenfeld 1979). The seed capsules of many *Euphorbiaceae* are explosively dehiscent, ejecting seeds a short distance from the parent plant. Some seeds are dispersed by ants (Pemberton 1988)." (Recovery Plan 1999, 4-852)

  The Garber's spurge "is a short-lived perennial occupying pine rockland, coastal dune, coastal grassland, Keys tidal rock barren habitat and disturbed sites, and it produces small many-seeded capsules that explosively dehisce (burst open). It is distinguished by dense pubescence (fine short hairs) that covers all parts of the plant, unlike other cooccurring *Chamaesyce* spp. which have at least some glabrous (smooth) parts." (5-Year Review 2022, 7)

  "Garber's spurge occurs in association with *Randia aculeata*, *Lantana involucrata*, *Sideroxylon salicifolium*, and *Brysonima lucida* and many more scrub understory species. Relationships to pollinators and seed dispersers are not known." (Recovery Plan 1999, 4-852)

- **Ecology**
  The Garber's spurge "is a short-lived perennial occupying pine rockland, coastal dune, coastal grassland, Keys tidal rock barren habitat and disturbed sites, and it produces small many-seeded capsules that explosively dehisce (burst open). It is distinguished by dense pubescence (fine short hairs) that covers all parts of the plant, unlike other cooccurring *Chamaesyce* spp. which have at least some glabrous (smooth) parts." (5-Year Review 2022, 7).

- **Relevant Pesticide Use Sites**
  "Management for invasive plants has occurred more frequently and been effective at several conservation lands with Garber's spurge populations but is still lacking for private or hard to access populations. Several Garber's spurge populations occur in non-natural habitats, especially disturbed roadsides and other places with dry rocky fill. In some cases, these populations are mowed regularly. Regular mowing is probably beneficial in preventing encroachment of shrubs and hardwoods which would shade out Garber's spurge (Austin et al. 1980). Mowing too frequently or at the wrong time, however, would probably eliminate populations if plants could not grow enough to set flower and fruit between mowing episodes. Additionally, herbicide application for invasive plants could also harm Garber's spurge if not applied appropriately." (5-Year Review 2022, 6)
  "Herbicides used to control invasive species and overgrowth of native vegetation, if not properly applied, also pose a threat to Garber's spurge." (5-Year Review 2022, 20)

"Populations on private properties, disturbed sites on public properties, and roadside populations are threatened by development and other anthropogenic disturbances, such as mowing too frequently, herbicide application, trampling, and habitat degradation." (5-Year Review 2022, 24)

"The increased use of pesticides to control salt marsh mosquitoes (*Aedes taeniorhynchus*) in south Florida presents a potential risk to non-target species, including listed insects and plant pollinators, in general. Based on research for related species in the same clade as Garber's spurge, it is likely that Garber's spurge experiences much higher fecundity with the help of insect pollination (i.e., not completely self-incompatible without insect pollinators but not as reproductively successful; Ehrenfeld 1979). Thus, any indirect, harmful impacts from these pesticides on potential Garber's spurge insect pollinators could decrease the seed set of plants and reduce the viability of populations." (5-Year Review 2022, 22).

Two recovery activities, invasive species removal and management of roadside habitat include "apply herbicides carefully [to reduce the risk of non-target damage." (5-Year Review 2022, 24-25).

- **Threats**
  "Habitat for the Garber's spurge has been lost to development, fire suppression, and invasive exotics. In addition, the remaining habitat is relatively fragmented, and most populations are small. These small, disjunct populations are more susceptible to extirpation from a single disturbance, natural or manmade, without the chance of recruitment from a nearby population. Fire suppression and the invasion of exotic plants can result in over-shading of the understory, reducing the quality of the habitat. Over time this could lead to the extirpation of Garber's spurge at these sites."
  (Multi-Species Recovery Plan 1999, 4-853)

- **Reclassification Criteria**
  The Recovery Plan for the Gerber's spurge does not include reclassification criteria and only includes the delisting criteria described below. The 2007 5-Year Review refers to the delisting criteria as "criteria for reclassifying the Garber's spurge" (5-Year Review 2007 4).

- **Delisting Criteria**
  Delisting will be considered when:
  - Enough demographic data are available to determine the appropriate numbers of self-sustaining populations required to ensure 95 percent probability of persistence for 100 years.
  - These populations, within the historic range of *C. garberi*, are adequately protected from further habitat loss, degradation, exotic plant invasion, and fire suppression.
  - These sites are managed to maintain the pine rocklands to support *C. garberi*.
  - Monitoring programs demonstrate that populations of *C. garberi* on these sites support sufficient population sizes, are distributed throughout the historic range, and are sexually or vegetatively reproducing at sufficient rates to maintain the population. (Multi-Species Recovery Plan 1999, 4-857)

"Criterion 3 [of the delisting criteria] refers specifically and only to pine rockland habitat in terms of target areas for Garber's spurge habitat. The MSRP [Multi-Species Recovery Plan] was written before a comprehensive status Garber's Spurge 5-Year Review 4 survey had been done, and prior to results being received from Herndon's (1998, 2002) demographic, cultivation, and reintroduction studies. A status survey initiated in 2006 (Green et al. 2008) generated additional range and status data not included in the MSRP. While Garber's spurge does grow in pine rocklands, it also grows in other community types such as coastal dunes, coastal grasslands, and Keys tidal rock barrens and these should be included in the criteria. Opportunistic roadside habitat should also be considered." (5-Year Review 2022, 3-4).

- **Recovery Actions**
  - Conduct surveys to determine distribution of pine rockland plants
  - Protect and enhance existing populations
  - Collect biological information important to species recovery
  - Monitor *C. garberi* populations
  - Continue implementation of the fire education program and modify as necessary any fire management education program that has been developed

  (Multi-Species Recovery Plan 1999, 4-857-859)

3. Description of Species Range

"Garber's spurge is estimated to occur in 31 populations in Monroe and Miami-Dade Counties, though many of them (24) have not been surveyed for 10-15 years. The previous status review (Service 2007) reported 17 populations, but only two new populations have been discovered since then. The main difference in the number of populations is how they were grouped together in the previous review. Some islands in the Keys have more than one population, or clusters of plants more than 1.0 kilometers (0.62 miles) from other clusters (NatureServe 2020), but the previous review counted them as one population since they occurred on one island. Also, the previous review grouped all the Cape Sable populations into one instead of counting each Cape as a separate population." (5-Year Review 2022, 7-8)

"The largest populations occurring in the Keys are located on Vaca, Bahia Honda, Big Torch, Woman, and Marquesas Keys, but updated population estimates were not available for this review. Like the largest mainland populations, these mostly occur in protected areas or on remote islands. Many smaller populations occur throughout the Keys and some of them were observed to still have plants within the last 6 years (Long Key State Park, No Name Key, Big Munson, and Boca Grande) but have not been thoroughly surveyed since 2006-2007." (5-Year Review 2022, 9)

"Additional populations may occur in the Keys on private properties with fragments of suitable habitat where botanists have not yet been able to obtain access. For example, Boot Key is mostly privately owned and was noted for having suitable habitat, but permission was not granted to conduct a thorough survey of the island (Green et al. 2008). However, plants were found along an accessible right-of-way and so it is entirely plausible that additional Garber's spurge exists within the privately-owned areas. Other islands with intact habitat may harbor additional populations as well." (5-Year Review 2022, 9)

Figure A1-1 depicts the FWS range. The range was last updated on 6/22/2022. The total acreage of the range is around 60,300 acres.

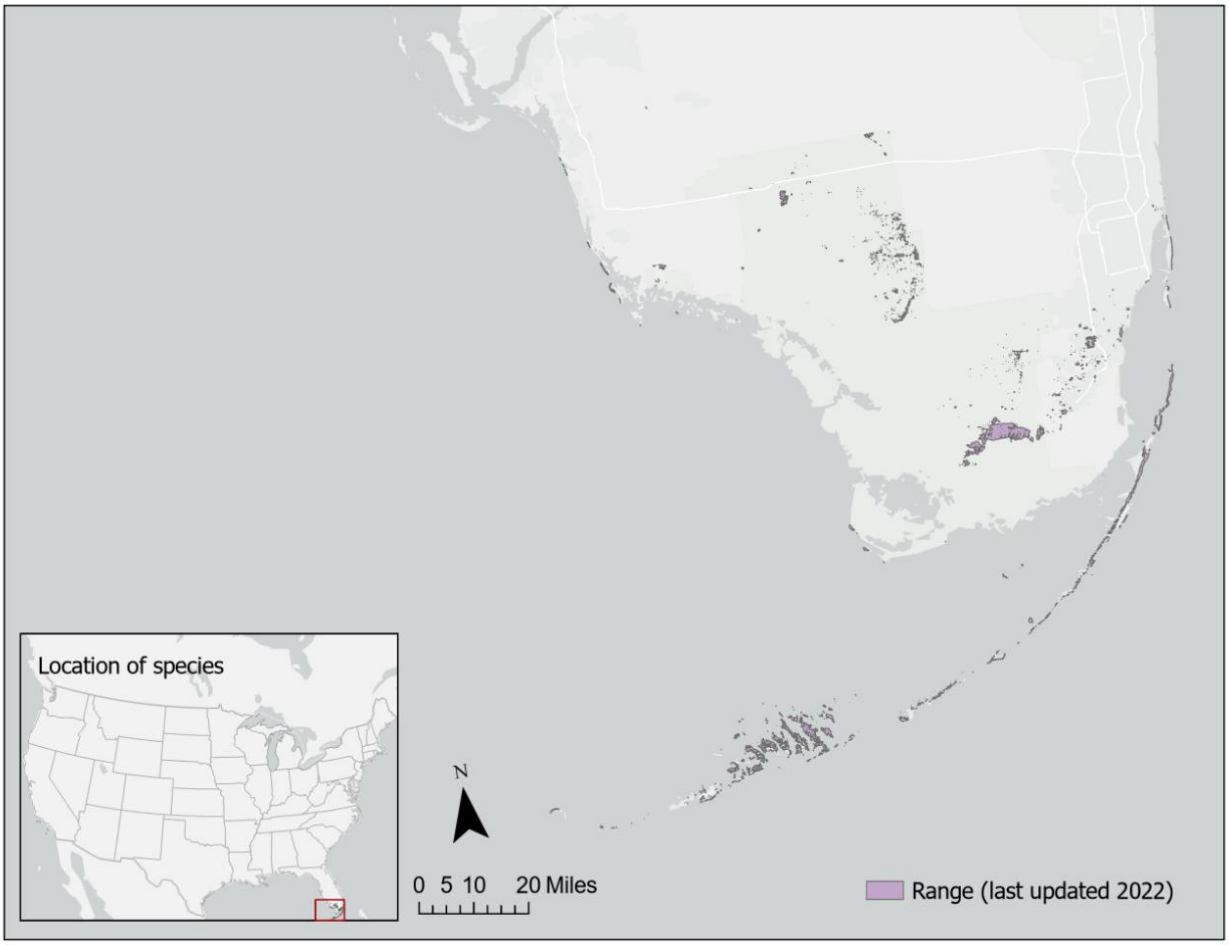

Figure A1-1. FWS range for the Garber's spurge. The total acreage of the range is around 60,300 acres.

4. Critical Habitat

There is no designated critical habitat for this species.

5. Known Locations

- Occurrences Described in FWS Documents; see **Figure A-1** below for a depiction of known and extirpated populations of Garber's spurge.
    - "Garber's spurge is still found nearly throughout its historical range, though it has been extirpated from Collier County, three locations in Miami-Dade County and at least five islands in the Florida Keys. Currently, there are an estimated 31 extant populations, though many have not been visited or surveyed in 10-15 years and are only presumed extant. There have been insufficient monitoring studies to determine long-term population trends at most sites. In addition, the species is very short lived and can have very wide population fluctuations, making determinations of long-term trends and total range-wide population estimates difficult to determine. Only three populations (Long Pine Key, Northwest Cape Sable, and Marquesas Key – Snook Beach) have over 1,000 individuals and are likely self-sustaining if habitat management persists, though two of

these are extremely vulnerable to impacts from climate change." (5-Year Review 2022, 23-24)

- "General population abundance, trends, and demography are unknown since no population has been monitored consistently on an annual or semi-annual basis to track this information. The current status of many populations of Garber's spurge is also unknown due to a lack of surveys since Green's extensive range-wide status survey in 2006-2007. Population sizes for most occurrences are still based on Green's work and presume that these populations are still extant, though updated surveys are needed to confirm this. Green's report revealed that Garber's spurge population sizes vary widely, ranging from over 1,000,000 plants in two locations (at the time) to less than 10 plants at other sites (Green et al. 2008). For populations that have been monitored more recently, only two are estimated to be stable, one may be increasing, and two are likely decreasing. Twenty-four are presumed extant with an unknown trend due to lack of recent surveys. Approximately 16 have been extirpated and 2 have an unknown status (no plants observed in 2006-2007 surveys but had potential to re-appear) (Green et al. 2008; FNAI 2022)." (5-Year Review 2022, 8)

- "One of the largest documented populations was that in Northwest Cape Sable where over 1,000,000 plants were estimated to occur in 2007 (Green et al. 2008; Lange 2017). This is the only population where a thorough, updated survey has taken place which showed an approximate 86 percent decrease in the number of plants observed along transects used in both the 2007 and 2017 surveys (Lange et al. 2020). Extrapolated out to the whole population, this means that there may be about 90,000 plants remaining at this location. While this still represents one of the largest and most robust populations of this species, the rapid and steep decline in abundance is still great cause for concern. The decline is most likely due to a lack of fire on the landscape, as evidenced by a significant increase in tree and shrub cover in what should be open habitat (Lange et al. 2020)." (5-Year Review 2022, 8-9)

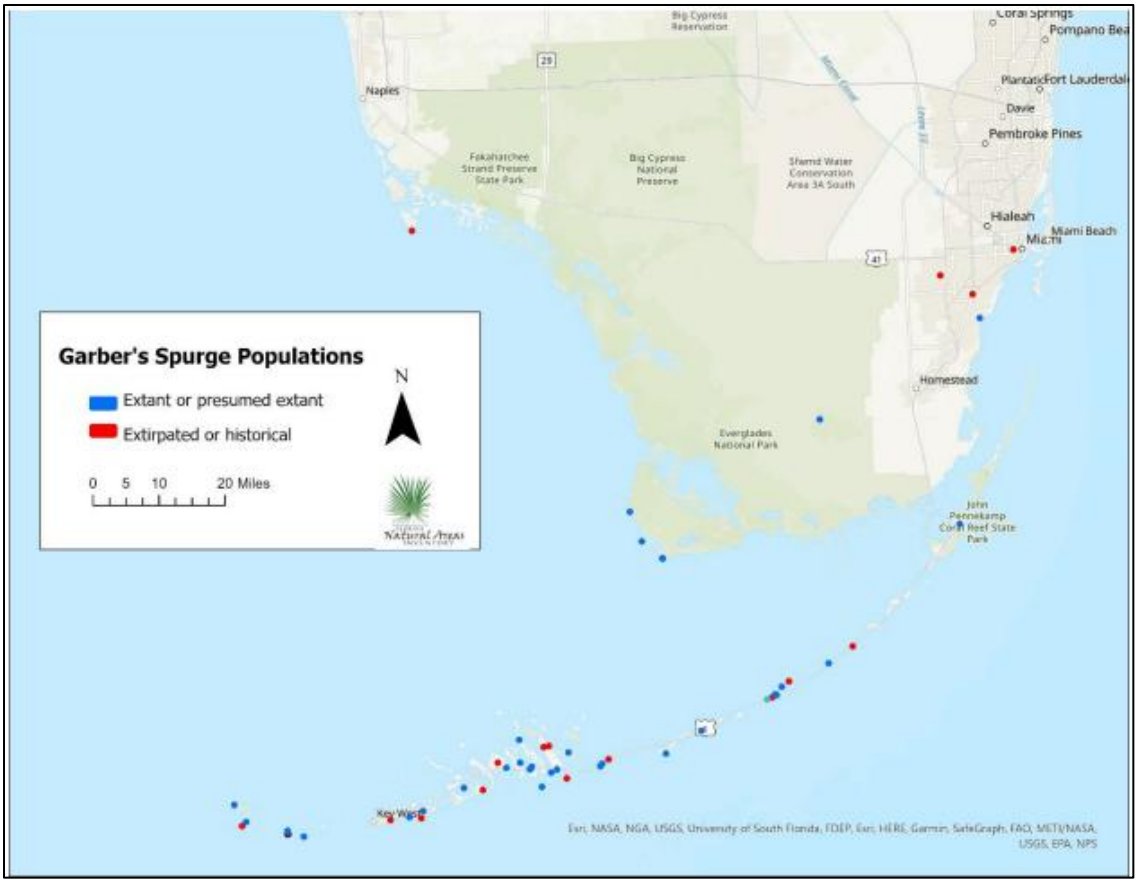

Figure A1-2. From FWS 5-Year Review (2022): "Map of all documented Garber's spurge populations, including extant and extirpated. Note that many of the 'extant' populations have not been observed in 10-15 years and are simply presumed extant. Map created by Hanna Rosner-Kratz, Florida Natural Areas Inventory."

- Occurrences included in public databases
  - EPA queried iNaturalist, GBIF, and NatureServe. Collectively, the occurrence data are consistent with the three watersheds used to identify the core map.
- Occurrences described in iNaturalist: https://www.inaturalist.org/observations?quality_grade=research&subview=map&taxon_id=487616&verifiable=any
  - iNaturalist includes 14 observations consistent with the species range (all in the Florida Keys); the species is called "Garber's sandmat (*Euphorbia garberi*)" in the database.
  - **Figure A1-3** depicts the locations of these observations.

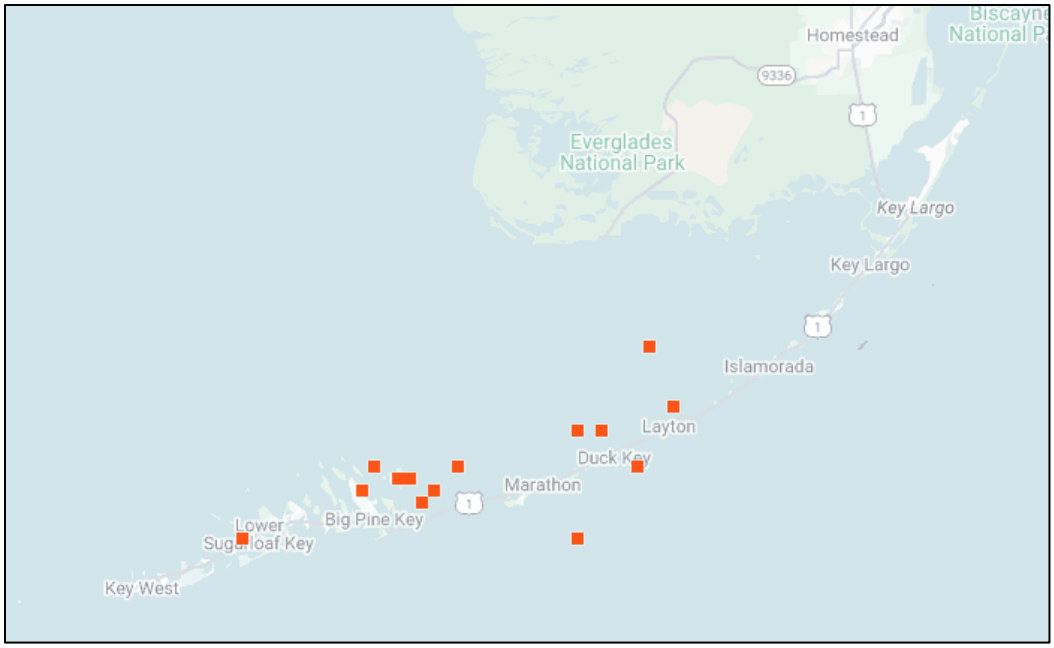

Figure A1-3. Occurrences of the Garber's spurge available in iNaturalist.

- Occurrences described in GBIF: https://www.gbif.org/occurrence/map?basis_of_record=HUMAN_OBSERVATION&taxon_key=3069538
    - GBIF includes 56 observations consistent with the species range (all in the Florida Keys; **Figure A1-4**). The species is "*Euphorbia garberi*" in the database, but the species records also include "*Chamaesyce garberi*".

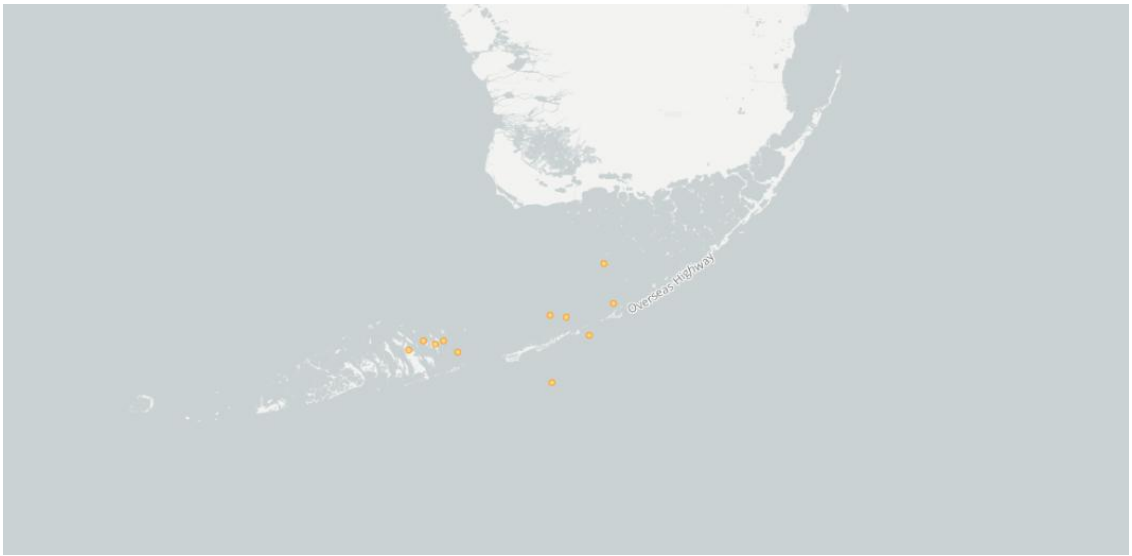

Figure A1-4. Occurrences of the Garber's spurge available in GBIF.

- Occurrences described in NatureServe: https://explorer.natureserve.org/pro/Welcome
    - NatureServe has several documented locations consistent with the species range (all in southern Florida, including the Florida Keys).
    - The species is "*Euphorbia garberi*" in the database.

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

This core map was created based on biological information, including occupied location and species range. EPA used the 2022 species range as the starting point (outer extent) for developing this core map. The species range was then further refined based on known location data from the 2022 5-year review to remove areas without known extant populations of the Garber's spurge.

1. **Dataset References and Software**

- Garber's Spurge 5-Year Review (2022) (Available Here)
- Green, S.E., K.A. Bradley, and S.W. Woodmansee. 2008. Status survey of the Federally threatened Chamaesyce garberi in south Florida. Final Report. The Institute for Regional Conservation, Miami, Florida. Submitted to U.S. Fish and Wildlife Service, Vero Beach, Florida.
- Software used: ArcGIS Pro 3.3.0
- FWS Species Range – last updated on 6/22/2022

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

All datasets used in core map development are described in EPA's process document.

3. **Core Map Development**

- EPA started with the 2022 species range to define the outer extent of the core map.
- Known locations for all extant populations of the species were described in the 2022 5-Year Review. Population coordinates were extracted from Figure 1 of the 2022 5-Year Review into a table of lat/long coordinates.
- Extracted known population coordinates were added to the existing map as points using the XY Table to Point tool.
- Based on areas of select populations described in Green et al. 2008, it was determined that a 1.5-mile radius around population centroids would be sufficient to cover individuals within a given population of Garber's spurge. As such, a 1.5-mile buffer was added around each point extracted from the 2022 5-Year Review using the Buffer tool to create a polygon.
- The range layer was then clipped to the extent of the buffered known population centroids, using the Clip tool, to generate the final core map.