

Interim Core Map Documentation for Four-Petal Pawpaw

Version 1

Review Completed: April 2026

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

Species Summary

The four-petal pawpaw (*Asimina tetramera*, Entity ID 637) is an endangered terrestrial plant (dicot). The U.S. Fish and Wildlife Service (FWS) has not designated a critical habitat for this species. This species is found in coastal sand pine scrub habitat on the Atlantic Coastal Ridge of Florida in Martin and Palm Beach Counties. Pollination for this species is believed to use odiferous mimicry to attract pollinators with beetles being the most frequently observed pollinators. Additional information on the species is provided in **Appendix 1**.

Description of Core Map

The core map for the four-petal pawpaw is based on biological information, specifically named known locations identified in FWS documents (i.e., the 2022 Five Year Review). The outer extent of this core map is defined by locations that FWS identified as occupied in Martin and Palm Beach Counties in Florida. Locations of populations identified by FWS as extirpated were not included in this core map.

FWS (2022) discusses the following named locations in Martins County, Florida:

- Savannas Preserve State Park Hawk's Bluff Trail
- Sugar Hill
- Jensen Beach dunes
- Silver Maple Way Scrub
- Arch Street
- Jonathan Dickinson State Park

FWS (2022) discusses the following named locations in Palm Beach County:

- Jupiter Inlet Lighthouse Outstanding Natural Area
- Jupiter Ridge Natural Area
- Karen Marcus Ocean Park Preserve (formerly Radnor Park)
- Juno Dunes Natural Area North
- Juno Dunes Natural Area South
- Florida Power and Light Juno Beach
- Pawpaw Preserve
- Lake Park Scrub

Figure 1 depicts the resulting interim core map for the four-petal pawpaw. The size of this core map is approximately 12,930 acres. Landcover categories within the core map area are included in **Table 1**. Landcover is predominantly woody wetlands.

The core map developed for the four-petal pawpaw is considered interim. This core map will be used to develop pesticide use limitation areas (PULAs) that include the four-petal pawpaw. 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” best professional judgment classification to describe major uncertainties/limitations. The map is based on known locations described by FWS. This core map does not replace or revise any range or designated critical habitat developed by FWS for this species.

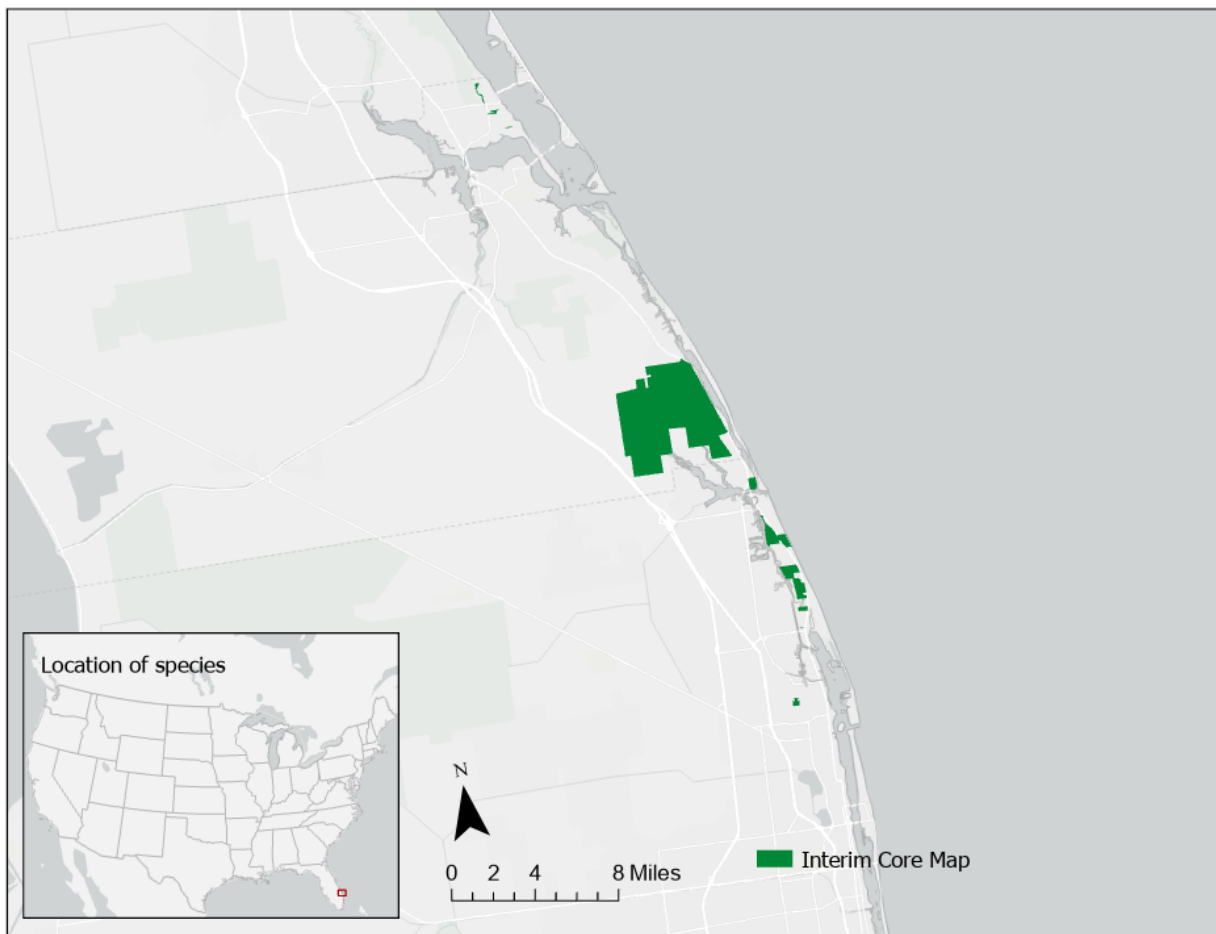


Figure 1. Interim core map for the four-petal pawpaw. The interim core map is approximately 12,930 acres.

Table 1. Percentage of Interim Core Map Represented by National Land Cover Database (NLCD)² 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)	10
Forestry	Mixed Forest (43)	0
Agriculture	Pasture/Hay (81)	0
Agriculture	Cultivated Crops (82)	1
Mosquito adulticide, residential	Open space, developed (21)	3
Mosquito adulticide, residential	Developed, Low intensity (22)	6
Mosquito adulticide, residential	Developed, Medium intensity (23)	3
Mosquito adulticide, residential	Developed, High intensity (24)	0
Invasive species control	Woody Wetlands (90)	62
Invasive species control	Emergent Herbaceous Wetlands (95)	7
Invasive species control	Open water (11)	1
Invasive species control	Grassland/herbaceous (71)	3
Invasive species control	Scrub/shrub (52)	4
Invasive species control	Barren land (rock/sand/clay; 31)	0
Total Acres	Interim Core Map Acres	~12,921

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
- Occurrence locations in the Global Biodiversity Information Facility (GBIF)

EPA evaluated these sets of data before selecting the type of and developing the core map. FWS appeared to have the finest resolution of the location information, providing a map that depicted the current known locations all within Martin and Palm Beach Counties in Florida. Occurrences in iNaturalist, GBIF, and NatureServe did not support expanding the core map outside of these listed locations.

Appendix 1 includes more information on the available known location information.

Approach Used to Create Core Map

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

- The species only occurs in two counties in Florida (Martin and Palm Beach).
- The species has no established critical habitat.
- The FWS identified locations with known population.

EPA used the compiled information to identify the core map type including species range and known location information. The extant populations are in Martin and Palm Beach Counties of Florida within the species' range. Therefore, EPA based the core map on the locations of the known populations identified by FWS. The entire range of the species was not used as the core map because the range contains areas where the species is unlikely to occur.

EPA used the best available data sources to generate the core map. Data sources are discussed in the process document. **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

The species range was considered for the core map but was ultimately not chosen because it encompasses a large amount of area where the species is not likely to be present.

Appendix 1. Information Compiled for the four-petal Pawpaw

1. Recent FWS documents/links and other data sources

- [Five Year Review](#) (2022)
- [Five Year Review](#) (2009)
- [Four Petal PawPaw Recovery Plan Amendment](#) (2019)
- [South Florida Multi-Species Recovery Plan](#) (1999)

2. Background information

- **Status:** Federally listed as endangered in 1986
- **Resiliency, redundancy, and representation** (the 3Rs)
 - No specific mention of the 3Rs, but the FWS (2022) states: “This species specializes in a restricted habitat type and naturally has a limited geographic distribution, reducing the potential for resiliency and representation.”
- **Habitat**
 - FWS (2022) states: ...coastal sand pine scrub habitat on the Atlantic Coastal Ridge of Florida in Martin and Palm Beach Counties.
- **Pollinator/reproduction**
 - FWS (2022) states: The presence of both fermentation odors along with the fetid volatiles suggest that the four-petal pawpaw uses two types of odiferous mimicry to attract pollinators: fermenting fruit mimicry and feces mimicry, thus allowing for a broader range of insect visitation. The most thorough observations of insect visitation to four-petal pawpaw flowers were made by Cox (1998) which showed beetles in the Cerambycidae, Scarabaeidae, and Tenebrionidae families as the most frequent visitors. Notably, even with the fetid-smelling odor that Goodrich and Raguso (2009) found, no flies were ever observed visiting flowers.
- **Taxonomy**
 - Terrestrial plant
- **Relevant Pesticide Use Sites**
 - No information found in FWS documents
- **Recovery Criteria/Objectives (2019 Recovery Plan)**
 - FWS (2019) states:
 - At least 25 populations exhibit a stable or increasing trend, evidenced by natural recruitment and multiple age classes.
 - Populations (meeting criterion 1) occur in coastal sand pine scrub and are distributed across the historical range of the species.
 - Populations (meeting criterion 1) must be protected via a conservation mechanism and/or managed such that enough suitable habitat is present for the species to remain viable for the foreseeable future.

- **Recovery Actions**
 - FWS (1999) states:
 - Determine the distribution of the species in South Florida
 - Protect and enhance populations
 - Conduct research on biology/ecology
 - Monitor populations
 - Inform and involve stakeholders and the general public in the recovery process
 - Prevent degradation of existing habitat
 - Restore degraded or unsuitable habitat
 - Conduct research to determine the applicability and effectiveness of management techniques
 - Monitor habitat-level responses to management actions
 - Increase public awareness of the species/habitat relationship
 - FWS (2022) states:
 - Recovery Activities:
 - Collect germplasm from the remaining sites not currently represented in the Center for Plant Conservation’s National Collection of Endangered Plants for ex situ safeguarding.
 - As informed by research on best methods and site characteristics (see Research/Monitoring below), continue seed collection, propagation, and direct planting for both augmentations and introductions.
 - Identify the most suitable introduction sites and carefully monitor any plants translocated or seeds planted. Use irrigation to help increase plant survival the first year.
 - If suitable habitat remains on publicly owned sites with extirpated populations, consider re-introducing the four-petal pawpaw. Where habitat has degraded in areas of historical populations, perform restoration to return to suitable scrub pine habitat.
 - Carefully apply herbicide to invasive plant species in pawpaw habitat as needed and avoid pawpaw plants by ensuring all applicators know exactly where it is safe to spray.
 - Conduct prescribed fires, preferably in the spring lightning season, within appropriate fire return intervals to prevent accumulation of large fuel loads and create more favorable conditions for pawpaw reproduction.
 - If habitat/landscape level burns are not feasible because of wildland-urban interface or other challenges, experiment with conducting micro-burns around pawpaw plants.
 - As informed by additional genetic analysis (see Research/Monitoring below), focus conservation efforts on marginal and small sites to preserve genetic diversity.
 - As landowners are willing, acquire private sites with remaining pawpaw populations to ensure their protection or alternatively, enact conservation easements.

- As a last resort and where needed, perform rescues of plants on private sites to be developed and translocate to protected land with suitable habitat.
- Research/Monitoring:
 - Investigate methods and site characteristics that lead to long-term introduction success.
 - Continue to survey potential coastal sand pine scrub habitat for new occurrences and provide updated information to FNAI.
 - Continue demographic monitoring on sites where populations have been followed and begin demographic monitoring on those sites where populations only have been periodically observed. Data on population size, reproductive rates, age class structure, and habitat conditions should all be documented.
 - Closely monitor for recruitment and determine the conditions required for growth.
 - Obtain permission from private landowners with historical pawpaw occurrences to survey and determine the status of these populations. If present, foster partnerships/working relationships with these landowners to protect plants.
 - Complete genetic analysis of populations to determine the amount and spatial distribution of diversity remaining to help inform further conservation actions, such as appropriate translocation material and locations.
 - Collect and analyze RAPD data on leaf samples from unsampled populations and create an updated dendrogram.
 - Continue to evaluate insect pollinators associated with the species and determine the status of these insect populations.
 - Evaluate the effects of climate change on the species, including those that result from precipitation pattern changes and temperature rise.
- Outreach/Collaboration Activities:
 - Promote partnerships between county, state, and federal agencies to share information and conduct collaborative research on coastal scrub habitat conservation.
 - Convene another ad hoc meeting to compile new information, discuss recovery actions, share land management strategies, and set and prioritize five- and ten-year goals.
 - Seek opportunities to include the media in conservation efforts to provide information about this species to the public.
 - Continue educating landowners with properties near pawpaw-occupied protected lands on the benefits of prescribed fire.
 - Continue using volunteer assistance (e.g., Florida Native Plant Society) and engaging youth in the monitoring and recovery of this species.

3. Description of Species Range

- Martin and Palm Beach Counties in Florida.

- **Figure A1-1** depicts the FWS range. The range was last updated on 02/16/2022. The total acreage of range is approximately 2,009,524 acres.

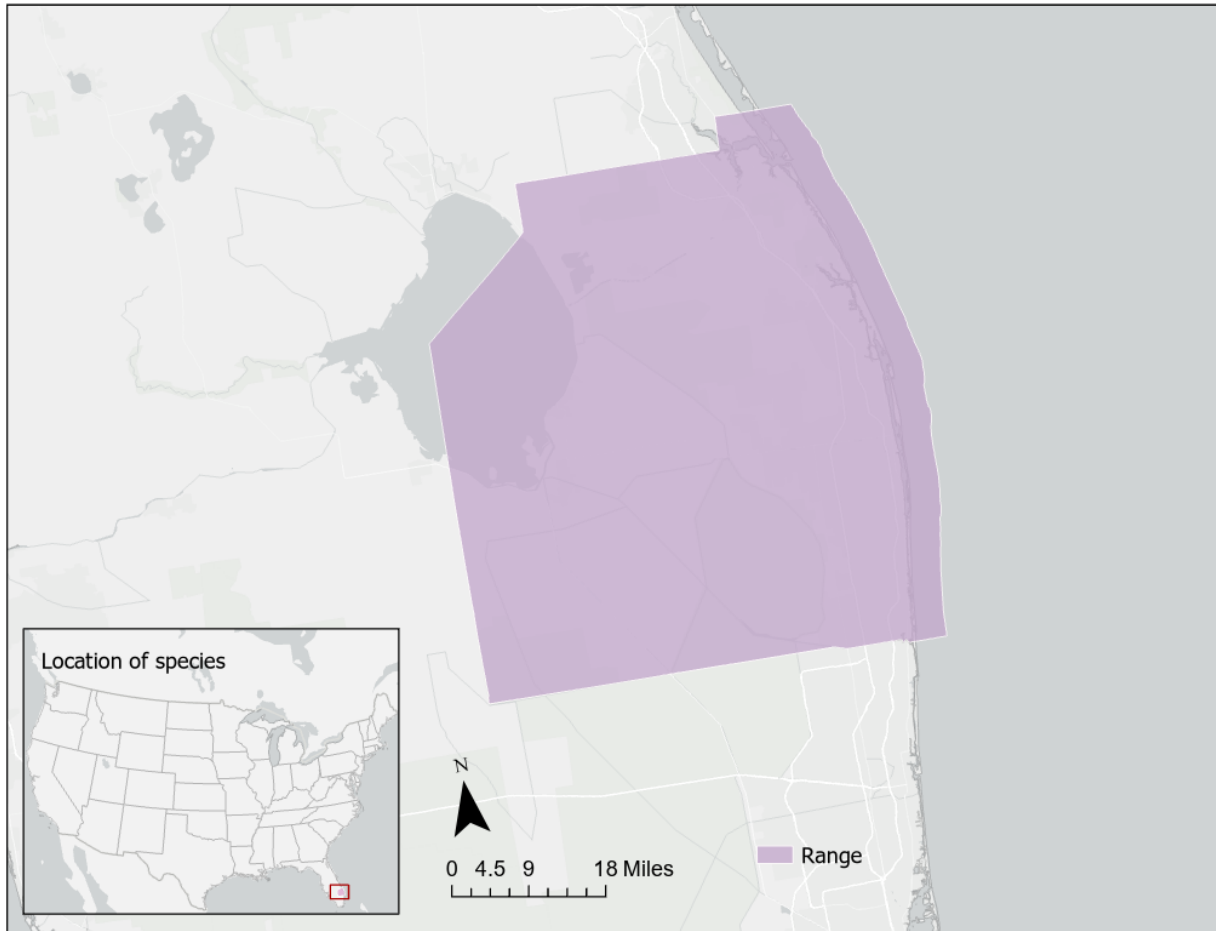


Figure A1-1. FWS range for the four-petal pawpaw. The total acreage of the range is approximately 2,009,524 acres.

4. Critical Habitat

- FWS has not designated a critical habitat for this species (<https://ecos.fws.gov/ecp/species/3461>)

5. Known Locations

- Known Locations Described in FWS Recovery Documents
 - See **Table 1** in FWS (2022). All locations occur within Martin and Palm Beach Counties in Florida.
- [iNaturalist](#)
 - 45 research grade observations for this species between January 2016 – June 2025
 - All fall within the species range when accounting for positional obscurity.

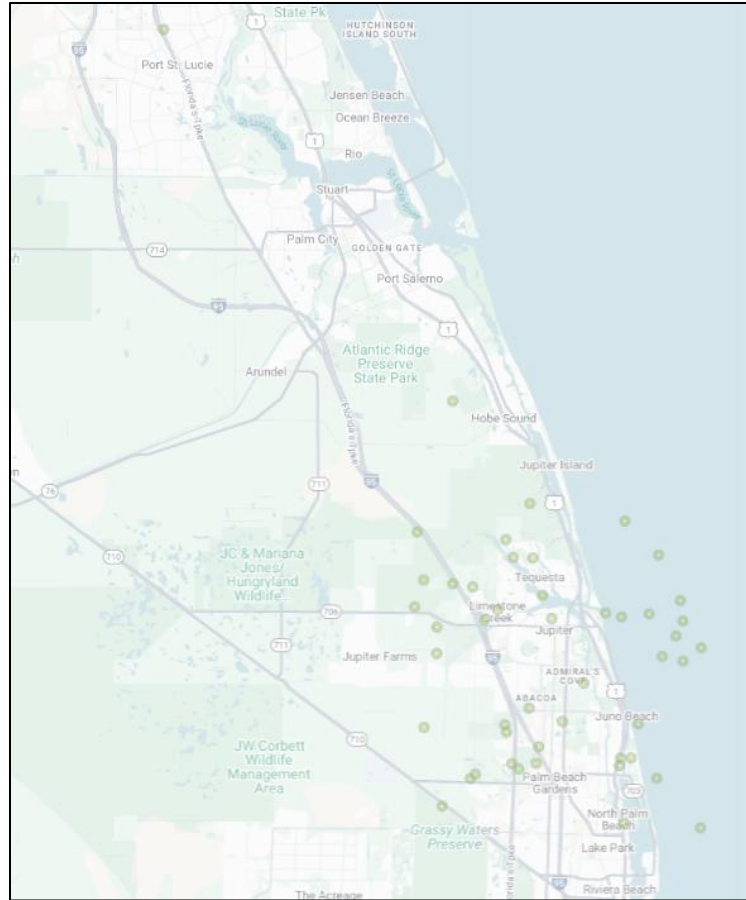


Figure A1 – 2. Screenshot of observations of the four-petal pawpaw in iNaturalist.

- [GBIF](#)
 - 49 human observations from 2000 - 2025. All but 1 of these observations are also included in iNaturalist or NatureServe. As shown in **Figure A1-2**, this occurrence occurs far outside the species range, in the central Florida, and is therefore not included in the core map.

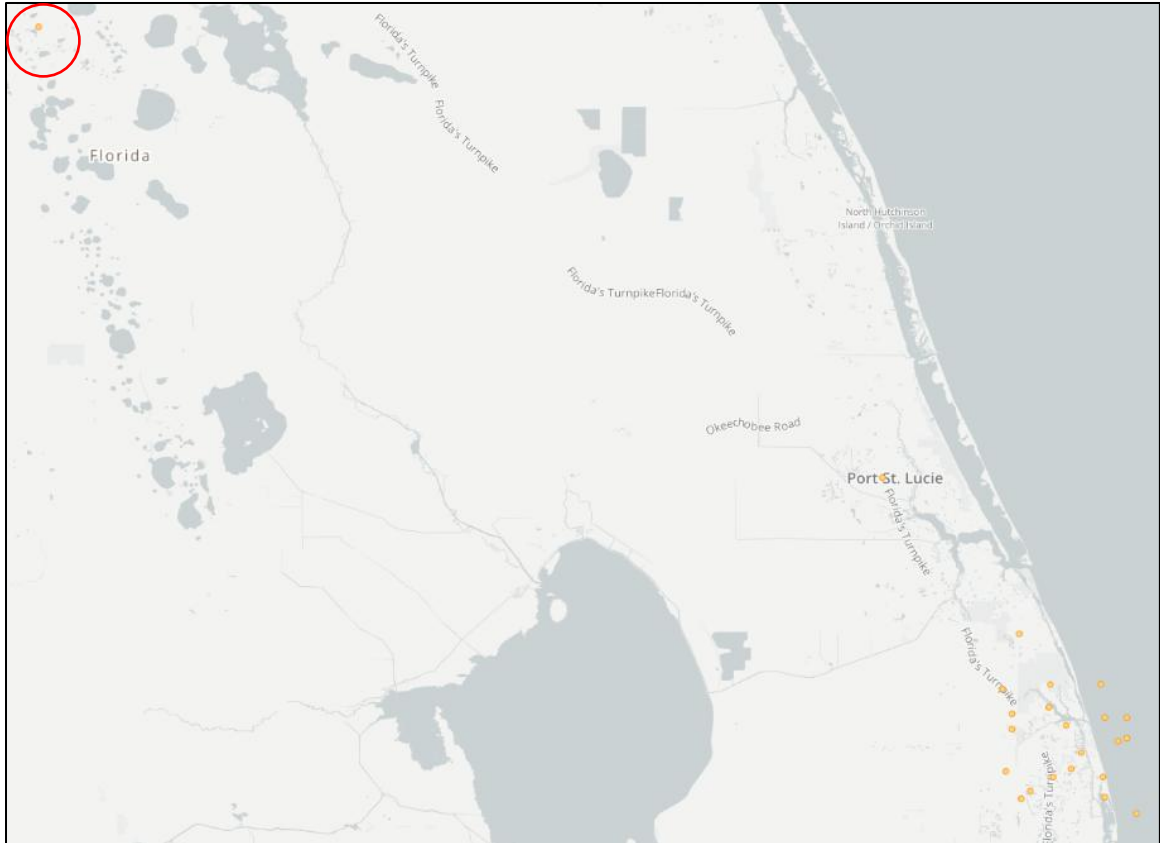


Figure A1 – 2. Screenshot of observations of the four-petal pawpaw in GBIF. The observation outside of the species' range is circled in red.

- [NatureServe](#)
 - Occurrences are consistent with those seen in iNaturalist, GBIF, and FWS given the scale of the occurrence datasets.

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

This core map was created based on biological information, specifically named known locations in FWS (2022) excluding extirpated locations. In addition, a 100 ft buffer was added on streets and water bodies.

1. Dataset References and Software

- Software used: ArcGIS Pro 3.2
- FWS Species Range – last updated on 2/17/2022

2. Datasets Used in Core Map Development

The map was entirely hand drawn by referencing existing maps/images to determine the borders of known locations identified by FWS.

3. Core Map Development

- EPA located all known populations provided in FWS (2022) and created the map using those locations where the species is extant.
- FWS (2022) identifies the following locations in Martins County, Florida:
 - Savannas Preserve State Park Hawk's Bluff Trail
 - Sugar Hill, Jensen Beach dunes
 - Silver Maple Way Scrub
 - Arch Street
 - and Jonathan Dickinson State Park
- FWS (2022) identifies the following locations identified in Palm Beach County, Florida:
 - Jupiter Inlet Lighthouse Outstanding Natural Area
 - Jupiter Ridge Natural Area
 - Karen Marcus Ocean Park Preserve (formerly Radnor Park)
 - Juno Dunes Natural Area North
 - Juno Dunes Natural Area South
 - Florida Power and Light Juno Beach
 - Pawpaw Preserve
 - Lake Park Scrub
- The type of location (street, preserve, public park, etc.) of the named locations above were identified using the ownership information in the FWS (2022) (private, city, county, state, federal), county name, and by searching on google using the provided names in the FWS (2022) . Given the named locations were public parks or preserves, private businesses, and street names, it was possible to identify locations using this method.
- Once the location was identified using the given information, the next step was determining the boundaries of the location. For city, county, state, and federal locations, if a map of the location was available online (for instance, public parks or preserves often had maps of the locations easily available online) were referenced to draw the border of the location to be included in the core map. For street locations, the streets were used for the initial boundaries and then a 100 ft buffer was added to create the core map boundary for that named location.

- See **Figure A1-2** for comparison of FWS species range and the Interim Core Map based on FWS known populations locations of the four-petal pawpaw.

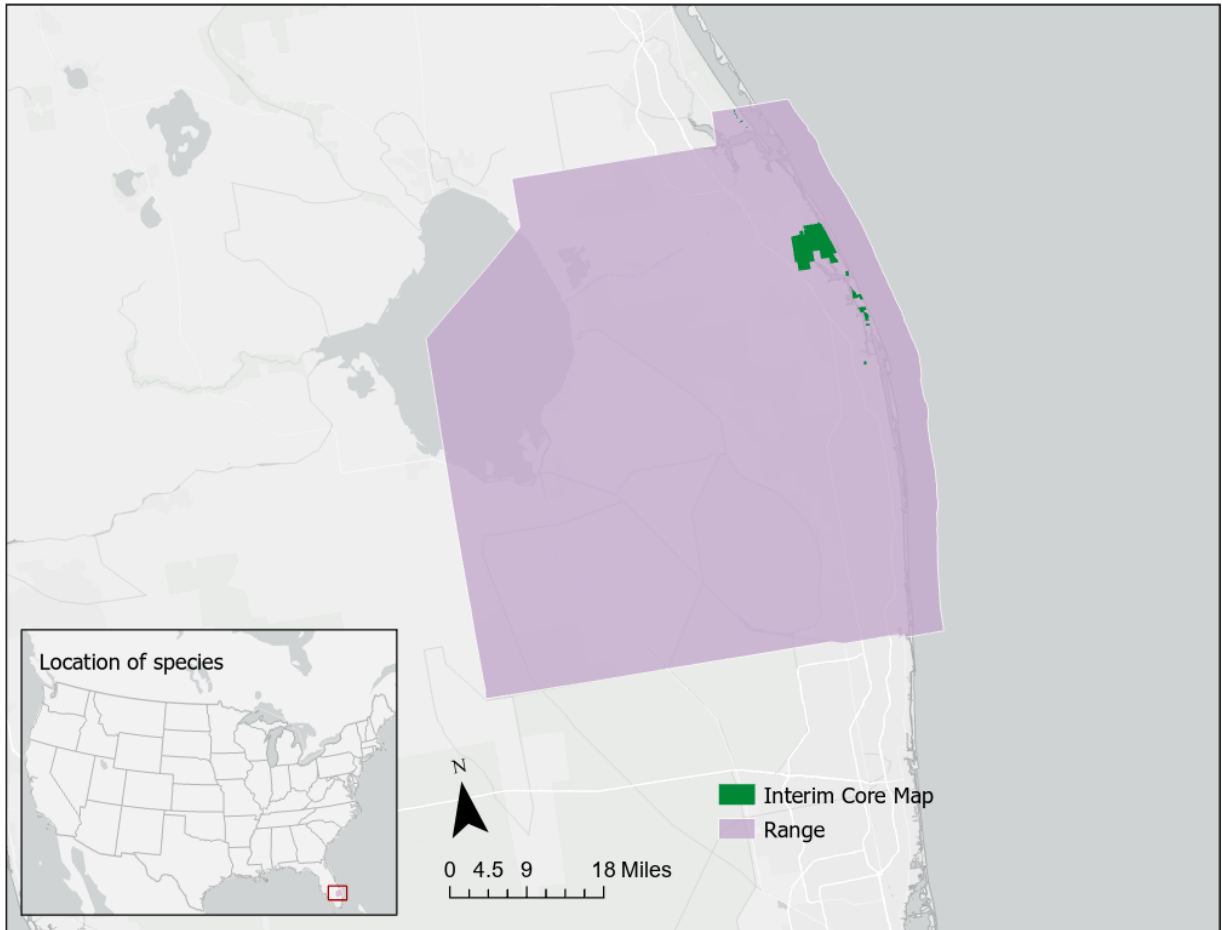


Figure A1-2. FWS species range and Interim Core Map of the four-petal pawpaw. The range is approximately 2,009,524 acres and the interim core map is approximately 12,930 acres.

References

- Cox, A. C. 1998. Thesis: *Comparative reproductive biology of two Florida pawpaws *asimina reticulata chapman* and *asimina tetramera small**. Florida International University.
- Goodrich, K. R., & Raguso, R. A. 2009. The olfactory component of floral display in *Asimina* and *Deeringothamnus* (Annonaceae). *New Phytologist*, 183(2), 457-469.
- FWS, 1999. South Florida Multi-Species Recovery Plan. March 1999. Southeast Region, U.S. Fish and Wildlife Service.
- FWS, 2019. Recovery Plan for the endangered *Asimina tetramera* (four-petal pawpaw). September 2019. South Florida Ecological Services Office, U.S. Fish and Wildlife Service.

FWS, 2022. Four-petal pawpaw (*Asimina tetramera*) 5-Year Review: Summary and Evaluation. January 2022. Florida Ecological Services Field Office, South Atlantic-Gulf Region, U.S. Fish and Wildlife Service.