Deltoid Spurge
(*Chamaesyce deltoidea ssp. deltoidea)*

5-Year Status Review:
Summary and Evaluation

Deltoid spurge at Rockdale Pineland. Photo Credit: Jennifer Possley

U.S. Fish and Wildlife Service
Southeast Region
Florida Ecological Services Field Office
Vero Beach, Florida

December 2023

5-YEAR STATUS REVIEW
Deltoid spurge (*Chamaesyce deltoidea ssp. deltoidea*)

GENERAL INFORMATION

Current Classification: Endangered

Lead Field Office: Florida Ecological Services Field Office

Review Authors:

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Date of original listing: August 19, 1985 (50 FR 29345; July 18, 1985)

Methodology used to complete the review:
In accordance with section 4(c)(2) of the Endangered Species Act of 1973, as amended (Act), the purpose of a status review is to assess each threatened or endangered species to determine whether its status has changed and if it should be classified differently or removed from the Lists of Threatened and Endangered Wildlife and Plants (50 CFR 424.11). We announced initiation of this review in the Federal Register on June 30, 2017 (82 FR 29916) with a 60-day comment period and did not receive any comments. The primary sources of information used in this analysis were the previous status review (Service 2010), South Florida Multi-Species Recovery Plan (Service 1999), Pine Rockland Recovery Plan Amendment (Service 2019), peer-reviewed reports, agency reports, unpublished survey data, and personal communication with recognized experts. The review was contracted to Fairchild Tropical Botanic Garden (Fairchild) biologists, and it was reviewed and finalized by biologists in Florida Ecological Services. Literature and documents used for this 5-year review are on file in the Florida Ecological Service's office. All recommendations resulting from this review are a result of the Service's thorough review of the best available information on deltoid spurge's biology, habitat, and threats.

FR Notice citation announcing the species is under active review: June 30, 2017 (82 FR 29916).

Species' Recovery Priority Number at start of 5-year review (48 FR 43098):
6C. Indicating deltoid spurge is a subspecies, with a high degree of threat and low recovery potential. The subspecies may be in conflict with construction or other economic interests.

Review History:
A previous 5-year review was signed on June 15, 2010 (70 FR 35689) and it recommended no change in listing status (Service 2010).

REVIEW ANALYSIS

Listed Entity

Taxonomy and nomenclature
This subspecies was first described in 1883 (Chapman, 1883) as *Euphorbia deltoidei* and has since undergone a series of taxonomic changes. The Service recognizes the scientific name as *Chamaesyce deltoidea* ssp*. deltoidea*. However, the taxonomic status of deltoid spurge as *Euphorbia deltoidea* ssp*. deltoidea* is universally accepted by the Integrated Taxonomic Information System (ITIS), NatureServe, and Florida Plant Atlas (ITIS 2016, NatureServe 2023, Wunderlin et al. 2023). Although the Service recognizes that there is suggested new taxonomic information related to the subspecies, this review addresses the entity as listed under the Act because the taxonomic uncertainty does not alter the subspecies range or population analysis. We will review these taxonomic changes again as more science becomes available.

Synonyms for deltoid spurge: *Chamaesyce deltoidea* ssp. *deltoidea, Euphorbia deltoidea* var. *deltoidea* and *Chamaesyce deltoidea* ssp. *deltoidea* var. *deltoidea.*

Distinct Population Segment (DPS) (61 FR 4722)
The Act defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. This definition limits listing of a DPS to only vertebrate species. Because the species under review is a not a vertebrate, the DPS policy does not apply.

Recovery Criteria

Recovery Plan or Outline
Recovery plans are not regulatory documents. Their purpose is to provide guidance to the Service, States, and other partners on methods of minimizing threats to listed species and on criteria that may be used to determine when recovery is achieved. Meeting recovery criteria can indicate that the species no longer requires protections under the Act. However, when recommending whether a listed species should be delisted, the Service must apply the factors in section 4(a) of the Act (84 FR 45020).

The Pine Rocklands Recovery Plan Amendment (Service 2019) propose the deltoid spurge will be considered for delisting when the following criteria are met:

1. Existing natural populations (ranging from 5 to 24, based on species) achieve and maintain a stable or increasing trend, evidenced by natural recruitment and multiple age classes (addresses Factors A and E).

2. A network of new populations (5 for *Amorpha crenulata* and *Galactia smallii* and 6 for *Chamaesyce deltoidea ssp. deltoidea* and *Polygala smallii*) are either discovered or reintroduced that exhibit a stable or increasing trend, evidenced by natural recruitment and multiple age classes. (addresses Factors A and E).

3. All populations (criteria 1 and 2) are protected by a conservation mechanism (addresses Factors A, D, and E).

4. Threats have been reduced or eliminated to the degree that these species will remain viable for the foreseeable future (addresses Factors A, D, and E).

The Service believes these criteria are appropriate and relevant; however, no criteria have currently been met for this subspecies.

Biology and Habitat Summary

Deltoid spurge is an herbaceous long-lived perennial plant that is endemic to the pine rocklands of the Miami rock ridge in Miami-Dade County, Florida (Figure 1). Currently the subspecies is found between southern Miami and Homestead Florida. Habitat fragmentation, degradation, urbanization, and fire suppression have likely played a large role in the current abundance and distribution of deltoid spurge. Due to the low-lying nature of this subspecies, periodic disturbance, such as prescribed fires, is required to maintain low shrub canopy and reduced organic litter accumulation.

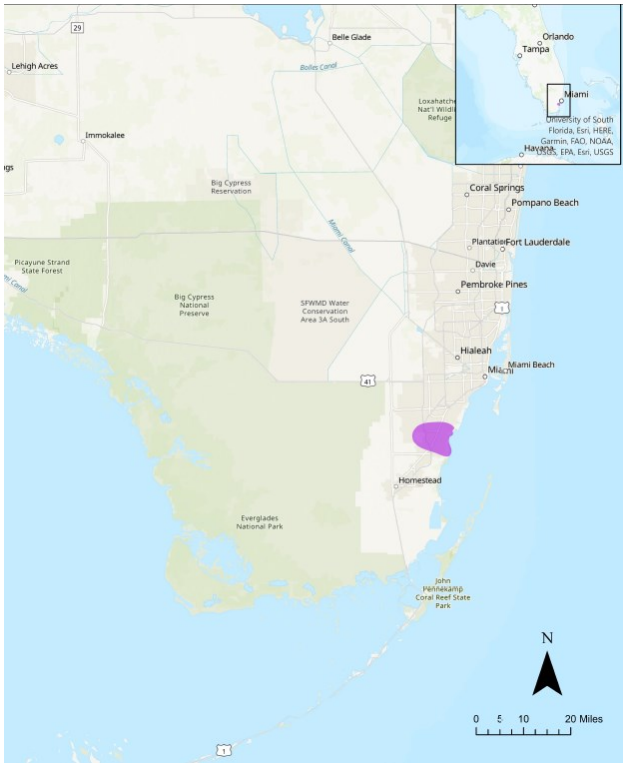

Figure 1: Map of the current range of deltoid spurge.

The listing rule (Service 1985) identified a total of eight know sites, but did not go into detail about population name, size, or ownership. The last status review (Service 2010) specified the species occurred on 14 public lands (12 County, one State, and one Federal) and on an undetermined number of private lands. Since the last status review five of the known populations

and three previously unknown populations have become extirpated. More detailed information on extant and extirpated populations can be found in Appendix A.

The current known populations of deltoid spurge include 13 public and 2 private sites (Table 1). The largest populations of this subspecies were recorded at Zoo Miami with 10,000 plants, followed by Larry and Penny Thompson Park with 5,300 plants and 808 plants at Ludlam Pineland (Appendix A). These three locations account for over 80 percent of the total known density of the deltoid spurge plant population. Eight populations have been extirpated due to habitat fragmentation, degradation, and fire suppression (Service 2019). Seven of the extirpated populations occurred on public conservation lands. The Bill Sadowski Park population had three plants in a 2016 population estimate (Bradley, pers. comm 2010, Lange pers comm 2017, and Possley pers. comm 2017a). However, a Fairchild survey in 2023 could not find any deltoid spurge at this location, and it is now presumed extirpated (Possley pers. comm 2023). Fairchild reintroduced seeds in one known extirpated location (Trinity Pineland) in summer 2023 (Possley, pers comm 2023). It is too early at the time of this review to determine successful reestablishment, and therefore we continue to assume extirpation at this location.

Table 1: Summary of deltoid spurge populations based on ownership. A more comprehensive table is in Appendix A of this document. * Indicates the one population that has on going reintroduction efforts.

Ownership	Number of Extant Populations	Number of Presumed Extirpated Populations
Miami-Dade County	10	7*
Federal	3	0
Florida Power and Light (FPL)	1	0
Private	1	1
Total	**15**	**8**

Threats (Five-Factor Analysis) Summary

The status of a species is determined from an assessment of factors specified in section 4 (a)(1) of the Act, including: Factor A: the present or threatened destruction, modification, or curtailment of its habitat or range; Factor D: the inadequacy of existing regulatory mechanisms; Factor E: other natural or manmade factors affecting its continued existence. A summary of this assessment is detailed below. We have no indication that overutilization for commercial, recreational, scientific, or educational purposes (Factor B) or disease or predation (Factor C) are threats to the subspecies.

Extensive land modification for development throughout the species historic range has led to habitat loss, fragmentation, and alterations that render the habitat unsuitable for deltoid spurge (Factor A). Due to land modifications of pine rocklands, suitable habitat for deltoid spurge outside of protected areas is limited, severely fragmented, isolated, and degraded. These characteristics contribute to the species low resiliency (ability to withstand stochastic events), low redundancy (ability to recover from catastrophic events), and low representation (low genetic dispersal).

Pine rockland habitat in Miami-Dade County are increasingly encroached upon by development, which decreases the likelihood of using fire to manage the habitat. Without a proper fire regimen of burning every two to ten years, succession of pine rocklands into rockland hammock habitat occurs (Figueroa et al. 2023). Rockland hammock habitat is not ideal for deltoid spurge due to the dense canopy and the alterations in light availability to understory plants (Snyder et al. 1990). In addition, fire suppression causes buildup of organic matter on the forest floor that alters the moisture levels and nutrient cycling that impacts seed germination (Hiers et al. 2007). Constraints on fire as a management tool are primarily caused by negative public views, liability, and limited funding (Figueroa et al. 2023). Suppression of natural fire and limitations of prescribed fire in proximity to urban landscapes have created unnatural fire regimes that result in inappropriate conditions for many of the endemic pine rockland species. (Factor A, D, and E).

With severe fragmentation increasing the amount of urban interface, pine rockland habitats become highly susceptible to nonnative plant invasion. Human activities have resulted in the introduction of over 100 taxa of nonnative plants in the pine rocklands habitat (Service 1999, Florida Natural Areas Inventory [FNAI] 2010). Brazilian pepper is one of the most detrimental nonnative plants to the subspecies. If not controlled, this tree forms dense thickets that shades out understory plants and causes fires to burn hotter and longer which can negatively impact rootstocks and seed banks of native plants (Loflin 1991, Langeland and Craddock Burks 1998).

To help regulate and protect important environments, like the pine rocklands, Miami-Dade County established two programs: Natural Forest Communities (NFC) and Environmentally Endangered Lands (EEL). Land that contains NFCs are subject to regulations that limit a landowner's ability to cut and clear pine rockland habitat. However, some permits allow disturbance of up to 20 percent of a pineland site (Miami-Dade County Code, Chapter 24-49.2). The 20 percent that can be permitted for disturbances may host at-risk, threatened, or endangered species. Seven of the known eight extirpated populations of deltoid spurge occurred on public conservation lands. Existing regulatory mechanisms vary in strength and scope and do not provide substantive protection of the subspecies or its habitat (Factor D).

Climate change will impact pine rockland habitat through sea level rise, variability in precipitation and temperature that can cause shifts in vegetation types, increases in freezing conditions, and increase in intensity and frequency of storm and fire events (Wanless et al. 2008, Wear and Greis 2012, Intergovernmental Panel on Climate Change 2021, Runkle et al. 2022). By 2100, direct losses of pine rockland plant populations are expected due to habitat loss and successions caused by sea level rise (Vargas-Moreno and Flaxman 2010, Zhang et al. 2011, Park and Sweet 2015, Rahmstorf et al. 2015, University of Florida Geoplan Center 2015, Sweet et al. 2022). Additionally, changes in regional hydrology may have impacts on the pine rockland habitats. Increased and longer-duration hydroperiods in the areas inhabited by endangered pine rockland species may lead to a reduction in the amount of suitable habitat, a potential reduction in the area occupied, and a reduction in the number of deltoid spurge individuals found (Factors A, D, and E).

Synthesis

Deltoid spurge is an herbaceous perennial subspecies that is endemic to pine rockland habitat in Miami-Dade County, Florida. Its limited range coupled with habitat fragmentation makes it

vulnerable to anthropogenic impacts, genetic deficits, and stochastic events. Although deltoid spurge is found on 13 public lands, implementation of specific conservation efforts is lacking. Only three sites account for over 80 percent density of the known plant populations, making this subspecies extremely susceptible to stochastic and catastrophic events. Deltoid spurge experiences a wide array of complex threats throughout the entirety of its range. The species is threatened by habitat loss, modification, fragmentation, lack of proper fire management, nonnative invasive species, climate change, and hydrological alterations. All these threats are expected to continue into the foreseeable future. With the dynamic scope of ongoing threats and the current condition of the subspecies, deltoid spurge continues to meet the definition of an endangered species.

RECOMMENDED FUTURE ACTIVITIES

A detailed discussion of recovery actions and criteria are presented in the Recovery Plan (Service 1999) and the Recovery Plan amendment (Service 2019). In the course of this status review new and/or targeted potential recovery activities were identified and are included below.

Recovery Activities

- Implement, continue, or increase habitat restoration efforts (exotic species removal and prescribed burns/similar disturbance) where deltoid spurge is located (recovery criteria 4).
- Identify and pursue conservation agreements or other agreements that protect pine rocklands and deltoid spurge populations (recovery criteria 2 and 3).
- Identify and restore patches of pine rocklands that have been historically occupied by deltoid spurge (recovery criteria 1).
- Additional partnerships should be promoted to share information, conduct collaborative research, and provide land managers and interested public with information (recovery criteria 1 & 4).
- Develop a translocation/reintroduction plan to identify potential recipient sites for reintroducing or establishment of populations within the historical range (recovery criteria 2).

Monitoring and Research Activities

- Evaluate ‘unknown’ population locations to determine number of individuals or extirpation of the species at those locations (recovery criteria 1).
- Monitor extant populations annually and document individual number estimates to determine population trends (recovery criteria 1).
- Survey areas that have suitable habitat for the species to identify new populations and/or translocation sites (recovery criteria 2).
- Research ex situ propagation and seed bank viability (recovery criteria 2).
- Examine the demography and reproductive biology of the deltoid spurge to determine population trends and growth and establishment rates (recovery criteria 1).
- Study individual populations to determine genetic diversity (recovery criteria 1).
- Research management techniques and impacts particularly with prescribed fire impacts on the biology and life history of deltoid spurge (recovery criteria 4).

Outreach Activities

- Increase public awareness and appreciation for native plants and habitats.
- Attend public events when appropriate to improve the communities understanding of management techniques and policies, such as prescribed fire, in pine rockland habitats.

REFERENCES

Bradley, K. A. 2010. Email to Mark Salvato. Institute for Regional Conservation. Miami, Florida. March 18, 2010.

Chapman, A. W. 1883. Flora of the southern United States: containing an abridged description of the flowering plants and ferns of Tennessee, North and South Carolina, Georgia, Alabama, Mississippi, and Florida: arranged according to the natural system. Second Edition. American Book Company, New York, New York.

Figueroa, Adrian, Joel T. Heinen, Frank N. Ridgley, Steven M. Whitfield, and Hong Liu. 2023. Management of a Globally Imperiled and Fire-Dependent Ecosystem in the Urban Matrix of Miami–Dade County, Florida: A Case Study of the Richmond Tract Pine Rocklands. Diversity 15, no. 3: 426.

Florida Natural Areas Inventory (FNAI). 2010. Guide to the natural communities of Florida: 2010 edition. FNAI, Tallahassee, Florida.

Herndon, A. 2002. Monitoring protocol development and seed germination requirements in endemic plants of the Miami Rock Ridge Pinelands. Unpublished final report prepared for the U.S. Fish and Wildlife Service, Vero Beach, Florida.

Hiers, J. K., J. J. O'Brien, R. E. Will, and R. J. Mitchell. 2007. Forest floor depth mediates understory vigor in xeric *Pinus palustris* ecosystems. Ecological Applications 17:806–814.

Integrated Taxonomic Information System (ITIS). 2016. ITIS standard report page: *Euphorbia deltoidea* ssp. *deltoidea*. https://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=845642#null. Accessed 05 September 2023.

Intergovernmental Panel on Climate Change. 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [MassonDelmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press.

Lange, J. 2017. Email to Service. Fairchild Tropical Botanic Garden, Miami, Florida. February 7, 2017.

Langeland, K. A., and K. Craddock Burks. 1998. Identification and biology of non-native plants in Florida's natural areas. University of Florida, Gainesville, Florida.

Loflin, R. K. 1991. The Bocilla Preserve management plan. Lee County Division of Land Management Department of Community Services, Fort Myers, Florida.

NatureServe. 2023. NatureServe Explorer. NatureServe, Arlington, Virginia. https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.1102616/Chamaesyce_deltoidea_ssp_deltoidea. Accessed 05 September 2023.

Park, J. and W. Sweet. 2015. Accelerated sea level rise and Florida current transport. Ocean Science 11:607-615.

Possley, J. 2017a. Email to Service. Fairchild Tropical Botanic Garden, Miami, Florida. February 7, 2017.

Possley, J. 2017b. Email to Mark Salvato. Fairchild Tropical Botanic Garden, Miami, Florida. February 8, 2017.

Possley, J. 2022. Email to Samantha Hermann. Fairchild Tropical Botanic Garden, Miami, Florida. January 18, 2022.

Possley, J. 2023. Email to Samantha Hermann. Fairchild Tropical Botanic Garden, Miami, Florida. September 18, 2023.

Rahmstorf, S., J.E. Box, G. Feulner, M.E. Mann, A. Robinson, S. Rutherford, and E.J. Schaffernicht. 2015. Exceptional twentieth-century slowdown in Atlantic Ocean overturning circulation. Nature Climate Change 5:475-480.

Runkle, J., K.E. Kunkel, S.M. Champion, R. Frankson, B.C. Stewart, W. Sweet, and S. Rayne. 2022. Florida State Climate Summary 2022. NOAA Technical Report NESDIS 150-FL. NOAA/NESDIS, Silver Spring, MD, 5 pp. https://statesummaries.ncics.org/chapter/fl/

Snyder, J.R., A. Herndon, and W.B. Robertson, Jr. 1990. South Florida rocklands. Pages 230-277 *in* R.L. Myers and J.J. Ewel, eds. Ecosystems of Florida. University of Central Florida Press, Orlando, Florida.

Sweet, W.V., B.D. Hamlington, R.E. Kopp, C.P. Weaver, P.L. Barnard, D. Bekaert, W. Brooks, M. Craghan, G. Dusek, T. Frederikse, G. Garner, A.S. Genz, J.P. Krasting, E. Larour, D. Marcy, J.J. Marra, J. Obeysekera, M. Osler, M. Pendleton, D. Roman, L. Schmied, W. Veatch, K.D. White, and C. Zuzak. 2022. Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along U.S. Coastlines. NOAA Technical Report NOS 01. National Oceanic and Atmospheric Administration, National Ocean Service, Silver Spring, MD. 111 pp.

U.S. Fish and Wildlife Service (Service). 1985. Endangered and Threatened Status for Five Florida Pine Rockland Plants; 50 FR 29345-29349. U.S. Fish and Wildlife Service, Atlanta, Georgia.

U.S. Fish and Wildlife Service (Service). 1999. South Florida multi-species recovery plan. U.S. Fish and Wildlife Service, Atlanta, Georgia.

U.S. Fish and Wildlife Service (Service). 2010. Deltoid Spurge (*Chamaesyce deltoidea* ssp. *deltoidea*) 5-Year Review: Summary and Evaluation. Finalized June, 2010.

U.S. Fish and Wildlife Service (Service). 2019. Recovery Plan for the endangered *Amorpha crenulata* (crenulate lead-plant), *Chamaesyce deltoidea* ssp. *deltoidea* (deltoid spurge), *Galactia smallii* (Small's milkpea), and *Polygala smallii* (tiny polygala). U.S. Fish and Wildlife Service, Atlanta, Georgia.

University of Florida GeoPlan Center. 2015. Testing and enhancement of the Florida Sea Level Scenario Sketch Planning Tool. Final report submitted to the Florida Department of Transportation Office of Policy Planning, Tallahassee, Florida. University of Florida GeoPlan Center, Gainesville, Florida.

Vargas-Moreno, J.C and M. Flaxman. 2010. Addressing the challenges of climate change in the Greater Everglades landscape. Project Sheet, November 2010. Massachusetts Institute of Technology, Department of Urban Studies and Planning; Cambridge, Massachusetts.

Wanless, H.R., S. Leatherman, J.R. Bethea, A. Cantillo, D. Cornley, W. Drennan, D. Enfield, P. Harlem, J.S. Klaus, O. Lavassas, J.F. Meeder, G. Tachiev, J. Van Leer, and D. Yoder. 2008. Statement on sea level in the coming century. Miami-Dade County Climate Change Task Force, Science and Technology Committee, Miami, Florida. January 17, 2008.

Wear, D.N. and J.G. Greis, editors. 2012. The Southern Forest Futures Project: Summary report. General Technical Report SRS-168. U.S. Department of Agriculture, Forest Service, Southern Research Station, Asheville, North Carolina.

Wright, S. 2009. Email to David Bender. Fairchild Tropical Gardens. Coral Gables, Florida. August 26, 2009.

Wunderlin, R. P., B. F. Hansen, A. R. Franck, and F. B. Essig. 2023. Atlas of Florida Plants (https://florida.plantatlas.usf.edu/Plant.aspx?id=1134). Institute for Systematic Botany, University of South Florida, Tampa. Accessed 05 September 2023.

Zhang, K., J. Dittmar, M. Ross, and C. Bergh. 2011. Assessment of sea level rise impacts on human population and real property in the Florida Keys. Climate Change 107:129–146.

RESULTS / SIGNATURES

U.S. Fish and Wildlife Service
Status Review of Deltoid Spurge

Status Recommendation:

On the basis of this review, we recommend the following status for this species. A 5-year review presents a recommendation of the species status. Any change to the status requires a separate rulemaking process that includes public review and comment, as defined in the Act.

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist:
    ____ *The species is extinct*
    ____ *The species does not meet the definition of an endangered or threatened species*
    ____ *The listed entity does not meet the statutory definition of a species*
_X_ No change needed

FIELD OFFICE APPROVAL:

Division Manager, Florida Classification and Recovery, Florida Ecological Services Field Office, U.S. Fish and Wildlife Service

Approve LOURDES MENA Digitally signed by LOURDES MENA Date: 2023.12.14 14:18:17 -05'00' Adobe Acrobat version: 2023.008.20421

APPENDIX A. SUPPORTING DOCUMENTATION

Summary of known extant deltoid spurge populations based on most recent surveys. Note: The surveys used in the Service 2010 status review lumped populations together that are now identified as individual populations.

Population	Ownership	Population Est. from last status review	Most Recent Population Estimate (Year)	Trend
Rockdale Pineland	Miami-Dade County	50-500[8]	70 (2015)[1,2,3]	Decreasing
Larry and Penny Thompson Park– Richmond Pine Rocklands	Miami-Dade County	Extant[1]	5,300 (2016)[2,3]	Increasing
Richmond Prison- Richmond Pine Rocklands	U.S. Federal Bureau of Prisons	Extant[1****]	537 (2009)[5]	Insufficient data
Gold Coast Railroad Museum- Richmond Pine Rocklands**	Miami-Dade County	Extant[8]	0 (2022)[5]	Insufficient data
Martinez Pineland– Richmond Pine Rocklands	Miami-Dade County	NA	567 (2015)[2,3]	Insufficient data
Coral Reef Park	Miami-Dade County	Extant[1]	17 (2016)[2,3]	Insufficient data
Deering Estate at Cutler	Miami-Dade County	800-8000[7]	100-200 (2016)[2,3]	Insufficient data
Ludlam Pineland	Miami-Dade County	Extant[1]	808 (2010)[2,3]	Increasing
FPL easement (adjacent to Ludlam Pineland)	Florida Power & Light	1001-10000[1]	50 (2015)[2,3]	Decreasing
Zoo Miami– Richmond Pine Rocklands	Miami-Dade County	Extant[1****]	10,000 (2010)[2,3]	Increasing
US Coast Guard – Richmond Pine Rocklands	U.S. Coast Guard	NA	Extant[2]	Insufficient data
Pine Shore Preserve	Miami-Dade County	Extant[1]	110 (2015)[2,3]	Insufficient data
Ned Glenn Nature Preserve	Miami-Dade County	Extant[1]	781 (2010)[2,3]	Insufficient data
US Department of Agriculture Subtropical Horticulture Research Station	United States Department of Agriculture	Extant[1]	90 (2009)[4]	Insufficient data
Woodlawn Park Cemetery	Private	2-10[1]	10 (2010)[1,4]	Insufficient data

Summary of the presumed extirpated populations of sand flax.

Population	Ownership	Population Est. from last status review	Most Recent Population Estimate (Year)	Status
Bill Sadowski Park	Miami-Dade County	6[8]	Extirpated (2023)[6]	Extirpated
Palmetto Bay Village Center*	Private	Extant[1]	Extirpated[4]	Extirpated
Eachus Pineland Preserve	Miami-Dade County	NA	Extirpated[2]	Extirpated
Trinity Pineland***	Miami-Dade County	Extant[1]	0 (2016)[2,3]	Extirpated
Tropical Park Pineland	Miami-Dade County	NA	Extirpated[2]	Extirpated
Ron Ehmann Park	Miami-Dade County	Extant[1]	Extirpated (2016)[2,3]	Extirpated
Quail Roost Pineland	Miami-Dade County	Extant[1]	Extirpated[4]	Extirpated
Tamiami Pineland Complex Addition	Miami-Dade County	NA	Extirpated (2013)[2,3]	Extirpated

[1]Bradley, pers. comm 2010
[2]Lange, pers. comm 2017
[3]Possley, pers. comm 2017a
[4]Possley, pers. comm 2017b
[5]Possley, pers. comm 2022
[6]Possley, pers. comm 2023
[7] Herndon 2002
[8]Wright, pers. comm 2009
[9]Bradley, pers. comm 2010
*Palmetto Bay Village Center used to be Burger Kind World HQ.
** Gold Coast Railroad Museum transferred the corner of the property that had the known population to the Richmond Prison. The species is not currently found on the current footprint of the Gold Coast Railroad Museum.[5]
*** Indicates the location where reintroduction efforts took place but have yet been deemed successful (Possley, pers.comm. 2023).
**** In the 2010 review status, the Zoo Miami and the Larry & Penny Thompson Park were considered the same population (Richmond pine rocklands).