

Interim Core Map Documentation for the Sandplain Gerardia

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

Species Summary

The sandplain gerardia (*Agalinis acuta*; Entity ID #876) is an endangered terrestrial plant (dicot). There is no designated critical habitat for this species. This species occurs on dry, sandy, nutrient-poor soils of sparsely vegetated sandplain environments and serpentine barrens in Connecticut, Maryland, Massachusetts, New York, and Rhode Island. The sandplain gerardia flowers in late summer or early fall. Individual flowers bloom for a single day, blooming in the morning and dropping their petals by late afternoon. Pollination does not appear to be a limiting factor in this species based on fruit development, indicating that the sandplain gerardia may be self-fertilizing. The U.S. Fish and Wildlife Service (FWS) is currently assessing the listing status of sandplain gerardia,¹ as the most recent 5-Year Review (2019) concluded that the sandplain gerardia may not be a distinct species and recommended synonymizing *A. acuta* under *Agalinis decemloba*. Additional information is provided in **Appendix 1**.

Description of Core Map

The core map for the sandplain gerardia is biological information type based on the range refined by the species' habitat requirements. The range and known locations are consistent with the core map. A core map based on critical habitat was not selected because critical habitat has not been designated for this species. **Figure 1** depicts the interim core map for the sandplain gerardia. The core map represents approximately 270,600 acres in Connecticut, Maryland, Massachusetts, New York, and Rhode Island.

The sandplain gerardia generally occupies nutrient-poor, acidic, and excessively drained soils. Evidence of disturbance at all extant sites may indicate that habitat disturbance, whether through fire, grazing, soil scarification or other disturbance, may play a key role in the species' life history. However, the type, regularity, and amount of disturbance favorable to the species is not clearly understood. Landcover categories within the core map area are included in **Table 1**. Given this species' habitat requirements, the Agency refined the species range to developed areas (except for high intensity areas), grasslands, shrub/scrub land, barren lands, and agricultural areas.

FWS is currently assessing the listing status of the sandplain gerardia, as the most recent 5-Year Review (2019) concluded that sandplain gerardia may not be a distinct species.

The core map developed for the sandplain gerardia is considered interim. This core map will be used to develop pesticide use limitation areas (PULAs) that include the sandplain gerardia. 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 a "average" (3) best professional classification because it consists of limited removal of unsuitable habitat and occurrence data largely

¹ See: <https://www.reginfo.gov/public/do/eAgendaViewRule?pubId=202204&RIN=1018-BD68>.

converge and predominantly support the boundaries of the core map. This core map does not replace or revise any range or designated critical habitat developed by FWS for this species.

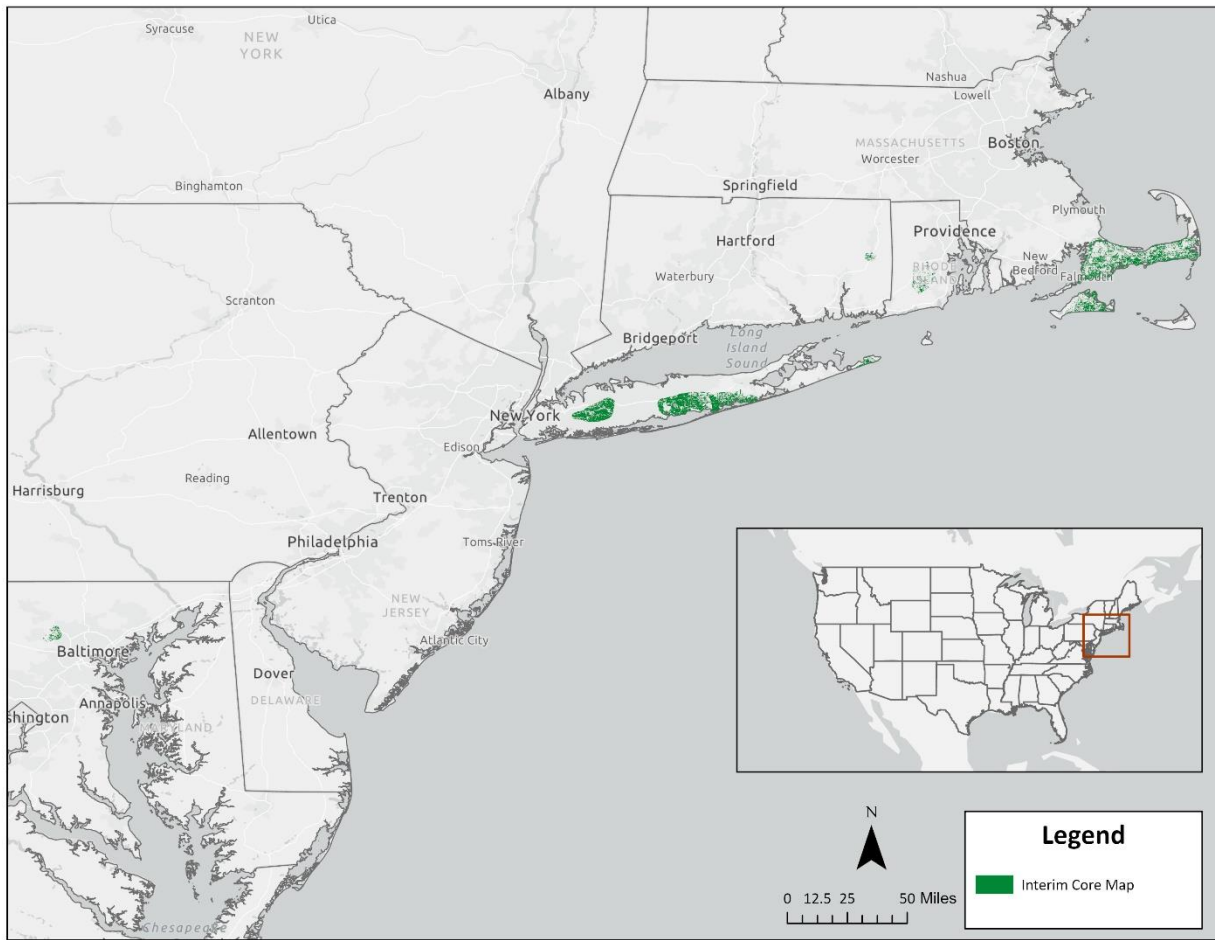


Figure 1. Interim core map for the sandplain gerardia. The total acreage of the interim core map is approximately 270,600 acres.

Table 1. Percentage of Interim Core Map Represented by NLCD² Land Covers and Associated Example Pesticide Use Sites/Types.

Example pesticide use sites/types	NLCD Landcover (Value)	% of core map represented by landcover	% of core map represented by example pesticide use
Forestry	Deciduous Forest (41)	0	0
Forestry	Evergreen Forest (42)	0	0
Forestry	Mixed Forest (43)	0	0
Agriculture	Pasture/Hay (81)	3	4
Agriculture	Cultivated Crops (82)	1	4
Mosquito adulticide, residential	Open space, developed (21)	23	85
Mosquito adulticide, residential	Developed, Low intensity (22)	33	85
Mosquito adulticide, residential	Developed, Medium intensity (23)	29	85
Mosquito adulticide, residential	Developed, High intensity (24)	0	85
Invasive species control	Woody Wetlands (90)	0	11
Invasive species control	Emergent Herbaceous Wetlands (95)	0	11
Invasive species control	Open water (11)	0	11
Invasive species control	Grassland/herbaceous (71)	4	11
Invasive species control	Scrub/shrub (52)	4	11
Invasive species control	Barren land (rock/sand/clay; 31)	3	11
Total Acres	Interim Core Map Acres	~270,600	

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); and
- 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 did not include any observations for “sandplain gerardia”; all observations for *Agalinis acuta* are combined with those of tenlobe false foxglove (*Agalinis decemloba*). Tenlobe false foxglove had 102 research grade observations consistent with the species range of the sandplain gerardia in Maryland, Massachusetts, New York, and Rhode. GBIF did not include any observations with coordinates for sandplain gerardia. NatureServe included nine documented areas, all

² Dewitz, J., 2023, National Land Cover Database (NLCD) 2021 Products: U.S. Geological Survey data release, <https://doi.org/10.5066/P9JZ7AO3>

of which were consistent with part of the species range (Connecticut, Massachusetts, and Rhode Island). **Appendix 1** includes more information on the available known location information.

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 Habitats³” (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 sandplain gerardia from FWS, as well as observation information available from various publicly available sources (including iNaturalist, GBIF and NatureServe). The information compiled for the sandplain gerardia is included in **Appendix 1**. Influential information that impacted the development of the core map included known location and habitat information.

For step 2, EPA used the compiled information to identify the core map type. EPA compared known location data to the range and found that these known locations are consistent with the species range. However, EPA noted that parts of the species range included areas that were inconsistent with this species’ habitat requirements (i.e., dry, nutrient-poor, excessively drained, sandy soils with some level of disturbance). Therefore, EPA based this core map on the species range but with some habitat refinements.

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 2021 NLCD Land Cover data to remove NLCD classes inconsistent with this species habitat requirements (e.g., open water; deciduous, evergreen, and mixed forests; woody and emergent herbaceous wetlands). EPA also removed the “developed high intensity” class because more robust development is more likely to negatively affect this species’ distribution. **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

Known locations provided in the Recovery Plan were considered, but the information is from 1989 and therefore likely outdated. Other alternative approaches and data not described in this documentation were not explored in the development of this interim core map.

³ Dated 2024, available online at: <https://www.epa.gov/endangered-species/process-epa-uses-develop-core-maps-pesticide-use-limitation-areas>

Appendix 1. Information Compiled for Species During Step 1

1. Recent FWS Documents

- a. [2019 Five Year Review](#)
- b. [1989 Recovery Plan](#)

2. Background information on Species

- **Status:** Federally listed as endangered in 1988
- **Taxonomy.** FWS plant group 9: dicot flowering plants that require outcrossing with biotic pollination vectors.

- **Resiliency, Redundancy, Representation**

The 3Rs are not specifically described in the FWS documents for the sandplain gerardia.

- **Habitat Description**

"*A. acuta* typically occurs on dry, sandy, poor-nutrient soils of sparsely vegetated sandplain environments and serpentine barrens, whose harshness may eliminate potentially competitive species. Rawinski (1983) found *Andropogon* sp. (beardgrass) and *Chrysopsis mariana* (Maryland golden aster) occupying the same openings of bare mineral soil as *A. acuta* on one Long Island site to be stunted. Similarly, Ludwig (1988) found vegetation other than *A. acuta* to be sparse in the low-nutrient, mineral soils of the Maryland population." (Recovery Plan, 12)

"The soils supporting *Agalinis* are generally nutrient-poor, acidic, and excessively drained. Few studies of soils have been done at the known *A. acuta* sites. Sandy, silty soils associated with the Massachusetts locations were reported to be acidic (pH 5.1), low in macronutrients and high in the trace metals aluminum, zinc and iron (DiGregorio and Wallner, 1986). The soils at the disjunct southern population in the Maryland serpentine barrens were found to be xeric and nutrient-poor, with a pH from 6 to 7 (Ludwig, 1988)." (Recovery Plan, 13)

- **Relevant Life History Information:**

"*A. acuta* fluctuate widely from year to year in the number of plants. Such fluctuations are not uncommon in annual species; however, it is unknown at this time whether population fluctuations are intrinsic in the species, or if they reflect the influence of external factors limiting the overall population size and survivability of the species. Further, it is unknown what role seed dormancy may play in the life history of this species. Seed banks probably play a major role in the maintenance of populations." (Recovery Plan, 13)

"Sandplain gerardia is an annual species, and the populations are generally characterized as small and disjunct. These factors, in addition to the species' narrow microhabitat requirements and fluctuating weather conditions, account for significant increases or decreases from year to year. A long-lived seedbank often allows the species to persist at a site through years when no germination occurs." (5-Year Review 2019, 4)

"To date there has been no study of pollination in this species. However, evidence of fruit set at known sites suggests that pollination is not a limiting factor. Flower flies (Syrphidae) were observed at New York and Massachusetts populations and were collected from one Massachusetts site. Maier (1985) found the specimens to be very similar to *Toxomerus marginatus*, however, the small size of the specimens precluded a positive identification.

Adults of *T. marginatus* are thought to feed on over 200 species of plants, thus they are probably not a dependable pollinator of *A. acuta* (Maier, 1985). Canne-Hilliker (1989a) suggests the possibility that flowers may be self-pollinated when the corolla detaches and drags the stamens over the stigma." (Recovery Plan, 15-16)

"The mode of seed dispersal is not well understood. Herbivores may ingest and distribute seeds. Zaremba (1985) reported evidence of herbivory on almost all of the plants at a Long Island population numbering from 1000 to 2000 plants. Herbivory was also noted at the other Long Island populations and both Massachusetts sites (Zaremba, 1988a). Herbivory was not significant at the Maryland site in 1988 (Bartgis, 1988b). Canne-Hilliker (1989a) suggests that seed dispersal may occur when wind causes oscillation of capsules on their slender pedicels and branches." (Recovery Plan, 16)

"Evidence of disturbance at all extant sites has led some experts to believe that habitat disturbance, whether through fire, grazing, soil scarification or other disturbance, may play a key role in the species life history. Potential disturbances at sites of known populations include the following: mowing, soil scarification; herbicide or pesticide use; trampling from human and nonhuman activities; dumping; salt spray associated with road maintenance and oceanic storms; small confined or possible sporadic fires; off-road vehicle use; disking; and herbivory." (Recovery Plan, 16-17)

"The most significant threat to *A. acuta* is the direct loss or degradation of its habitat. Residential, commercial and recreational development has encroached on the species community. Shopping malls, condominiums and expanding highway systems have taken the place of much of the species natural habitat. Agricultural development and sand and gravel mining have destroyed large amounts of potential habitat." (Recovery Plan, 17)

- **Ecology**

"Some investigation into specific habitat characteristics has been accomplished. Vegetation of the grassland communities supporting *Agalinis* is typically dominated by one of three grasses: little bluestem (*Schizachyrium scoparium*), Virginia broomgrass (*Andropogon virginicus*) or Indian grass (*Sorghastrum nutans*). Other common associates include poverty grass (*Danthonia spicata*), panic grasses (*Panicum* sp.), fescue (*Festuca rubra*) and winter bent grass (*Agrostis stolonifera*; *A. spp*) (Sorrie, 1988b; Caljouw, et al., 1988)." (Recovery Plan, 18)

- **Relevant Pesticide Use Sites**

Herbicides and pesticides are mentioned as possible types of habitat disturbance that the sandplain gerardia may experience. (Recovery Plan, 16-17)

- **Threats**

"The continuing threats to the species, cited in the listing of the species as endangered, include habitat loss and degradation from development, change in land use, vegetation succession, and the loss of the natural processes that maintain suitable habitat. With the exception of 3 privately owned cemeteries (where development is not likely to occur), each of the 21 sites [where sandplain gerardia is known to occur] are considered protected from development. The protection of populations (including the seedbank) at these sites

addresses direct loss/degradation of habitat, identified in the Service's Recovery Plan (UFWS 1989) as the most significant threat to this species." (Recovery Plan 2019, 4)

- **Reclassification Criteria**

"The Fish and Wildlife Service will consider reclassifying sandplain gerardia from an endangered to a threatened species when all of the following conditions have been met:

- "There are 20 stable, wild populations located throughout the species historic range to ensure against any unpredictable events that could lead to reproductive failure and subsequent population decline. In order to be deemed "stable," a population must maintain a 5-year running geometric average population size of at least 100 individuals. The geometric average is considered a better indicator of the stability of a population that exhibits wide year-to-year size fluctuations than is the arithmetic average.
- "At least 15 of these populations are located on protected sites. Protection may be accomplished through: 1) ownership by government agency or a private organization that considers maintenance of the *A. acuta* population to be the predominating management objective for the site; or, 2) a deeded easement or covenant that effectively commits present and future landowners to implementing any management activities needed to perpetuate the population. This high level of landowner commitment to site protection is necessary because of the species' apparent need for active habitat manipulation to counteract the effects of removing natural sources of disturbance from the plant's environment.
- "There must be a proven technology for: 1) propagating the species in a cultivated setting; or, 2) storing seed in a seed bank and successfully sowing then on a wild site." (Recovery Plan 1989, 23-24)

- **Delisting Criteria**

Delisting criteria are not presented in the FWS documents. However, the 2019 5-Year Review includes a detailed summary of the taxonomic debate around whether sandplain gerardia is a distinct species (5-Year Review 2019, 6-10). Under "Service Position", the 5-Year Review states:

"The Service places particular importance on the fact that Pettengill and Neel (2011) is the peer-reviewed, best-available information regarding the evolutionary distinctiveness of *Agalinis acuta*. This study forms the basis for the FNA's [Flora of North America's] decision, accepted by the IT IS [Integrated Taxonomic Information System], the CPC [Center for Plant Conservation], and the UNC [University of North Carolina Herbarium/Botanical Garden], to synonymize *A. acuta* with *A. decemloba*. The Service acknowledges that not all reviewers agreed with the methodologies, results, and conclusions of the microsatellite and morphological analyses. However, based on our review of all the available scientific and commercial information, it is the Service's position that the taxonomic entity known as *A. acuta* is not a distinct species (Neel and Pettengill 2009; Pettengill 2010; Pettengill and Neel 2011; Hays pers. comm. 2018a, 2018b). The Service therefore concurs with the taxonomic revision recommended by Pettengill and Neel (2011) and the FNA synonymizing *A. acuta* under *A. decemloba*." (5-Year Review 2019, 10)

Furthermore, since FWS concurs with the taxonomic revision, FWS also recommended delisting *A. acuta* because, if revised, *A. acuta* will "no longer meet the statutory definition of a species." However, since delisting due to taxonomic revision is only a recommendation and not yet finalized, the Agency developed this core map per ESA.

- **Recovery Actions**

Protect extant and introduced populations.

Establish additional populations.

Evaluate status of existing populations.

Manage habitat.

Bank seeds and perfect propagation and transplantation techniques

(Recovery Plan 1989, vi)

3. Description of Species Range

“Sandplain gerardia is currently known from 21 sites in Connecticut, Maryland, Massachusetts, New York, and Rhode Island. With the exception of 3 privately owned cemeteries (where development is not likely to occur), each of the 21 sites described below are considered protected from development. The protection of populations (including the seedbank) at these sites addresses direct loss/degradation of habitat, identified in the Service’s Recovery Plan (FWS 1989) as the most significant threat to this species.” (5-Year Review 2019, 4)

Figure A1-1 depicts the FWS range map of sandplain gerardia. This range was last updated on 12/20/2021 and has an area of approximately 522,722 acres. Close-up views of the core map are shown in **Figure A1-2**, **Figure A1-3**, and **Figure A1-4**.

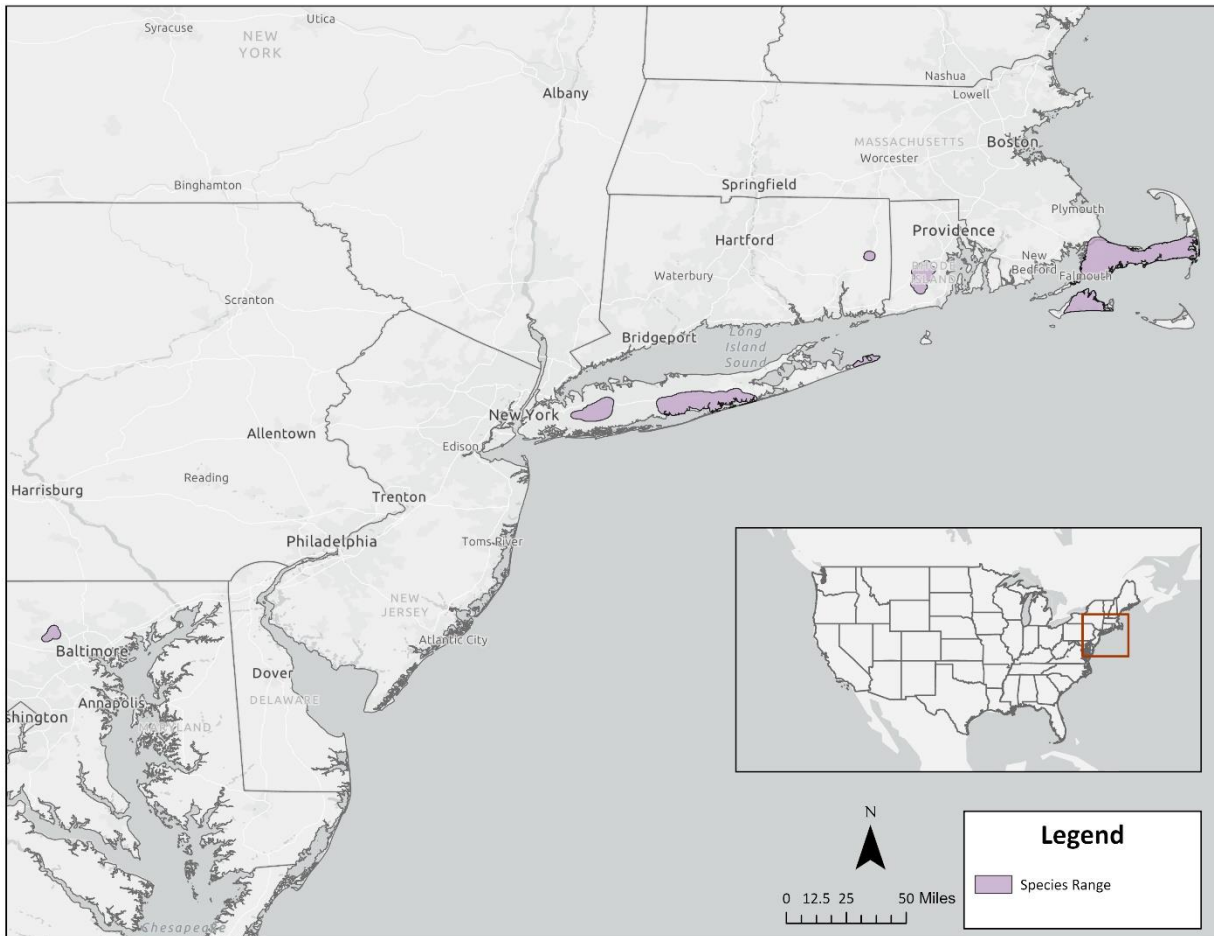


Figure A1-1. FWS range map of the sandplain gerardia.

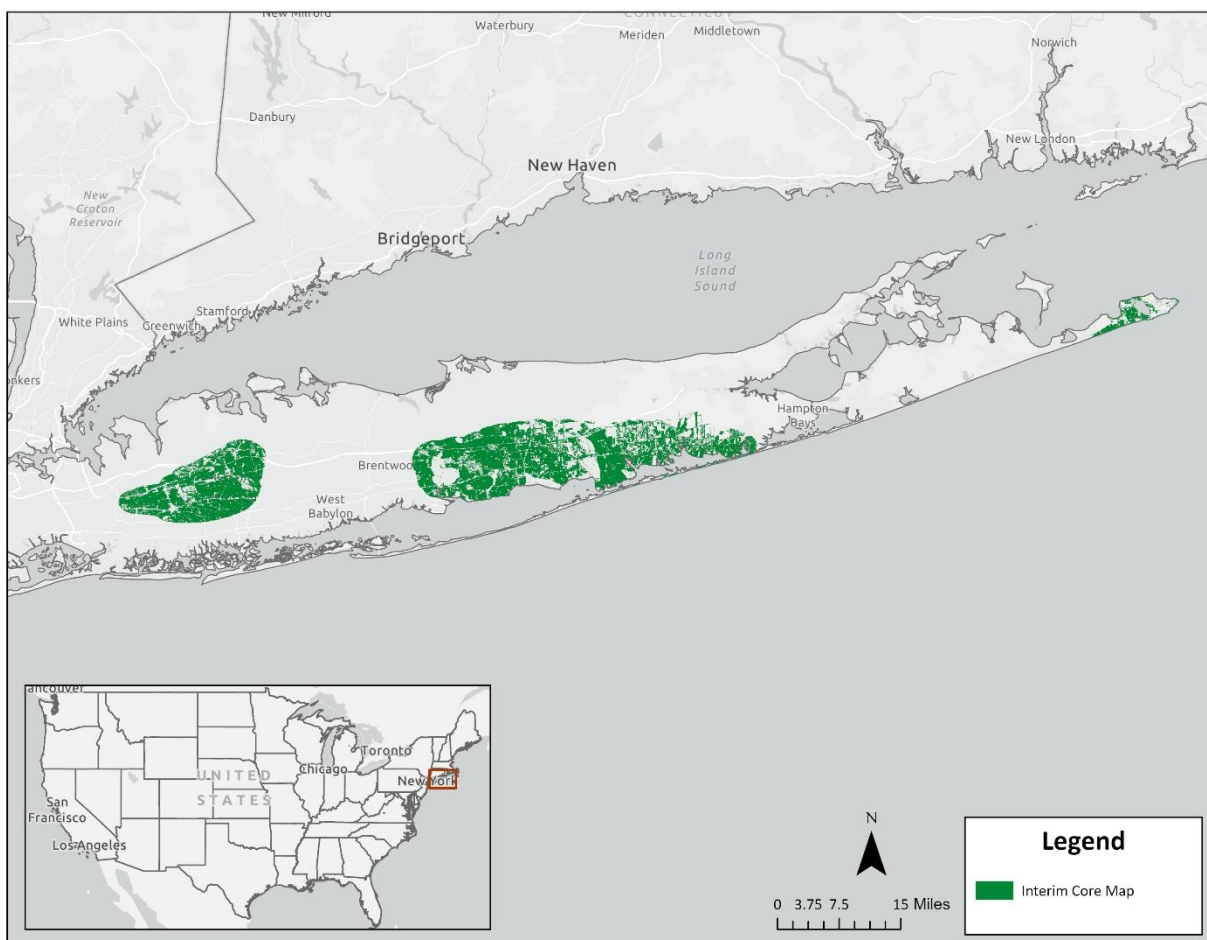


Figure A1-2. Sandplain gerardia interim core map, Long Island, NY.

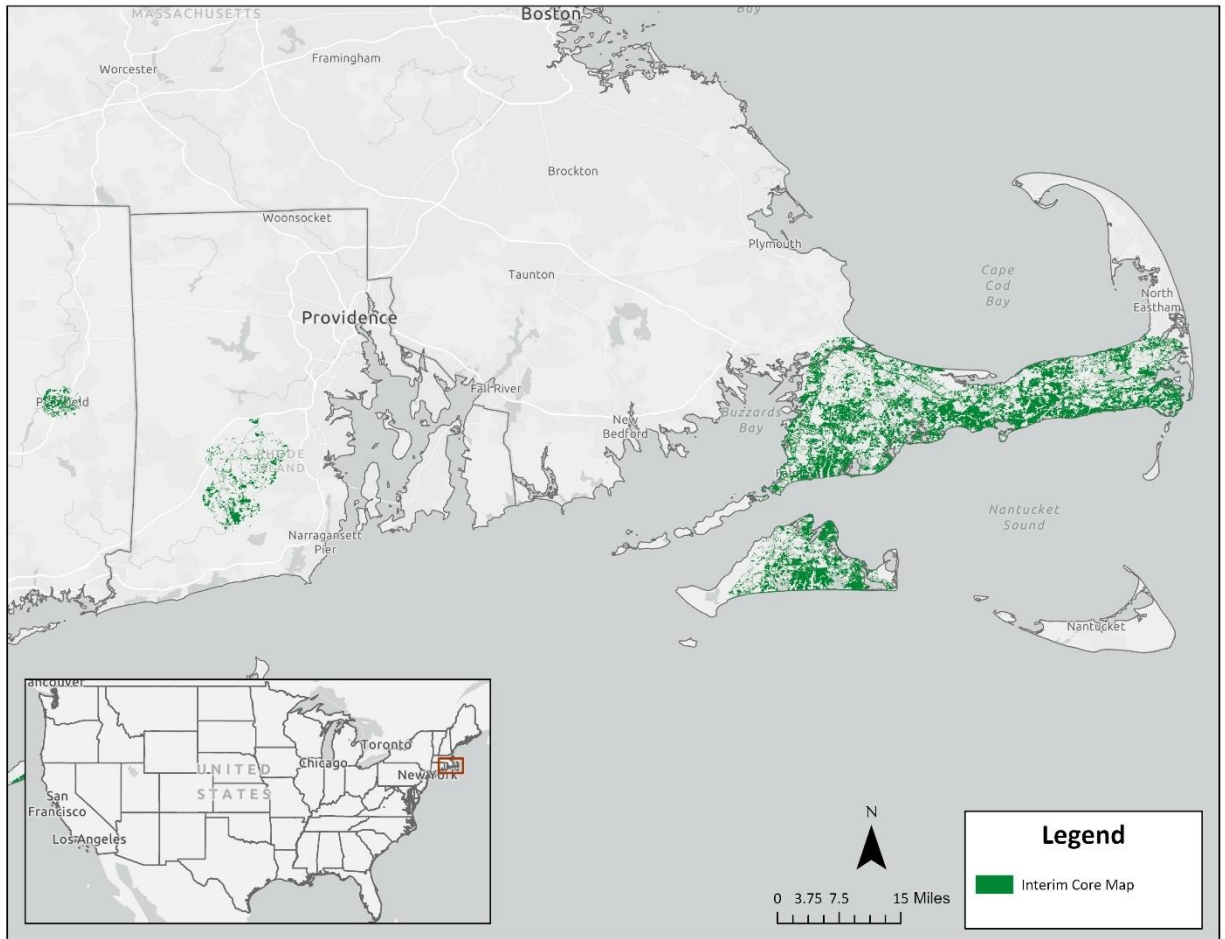


Figure A1-3. Sandplain gerardia interim core map, northeast area (Connecticut, Rhode Island, Massachusetts).

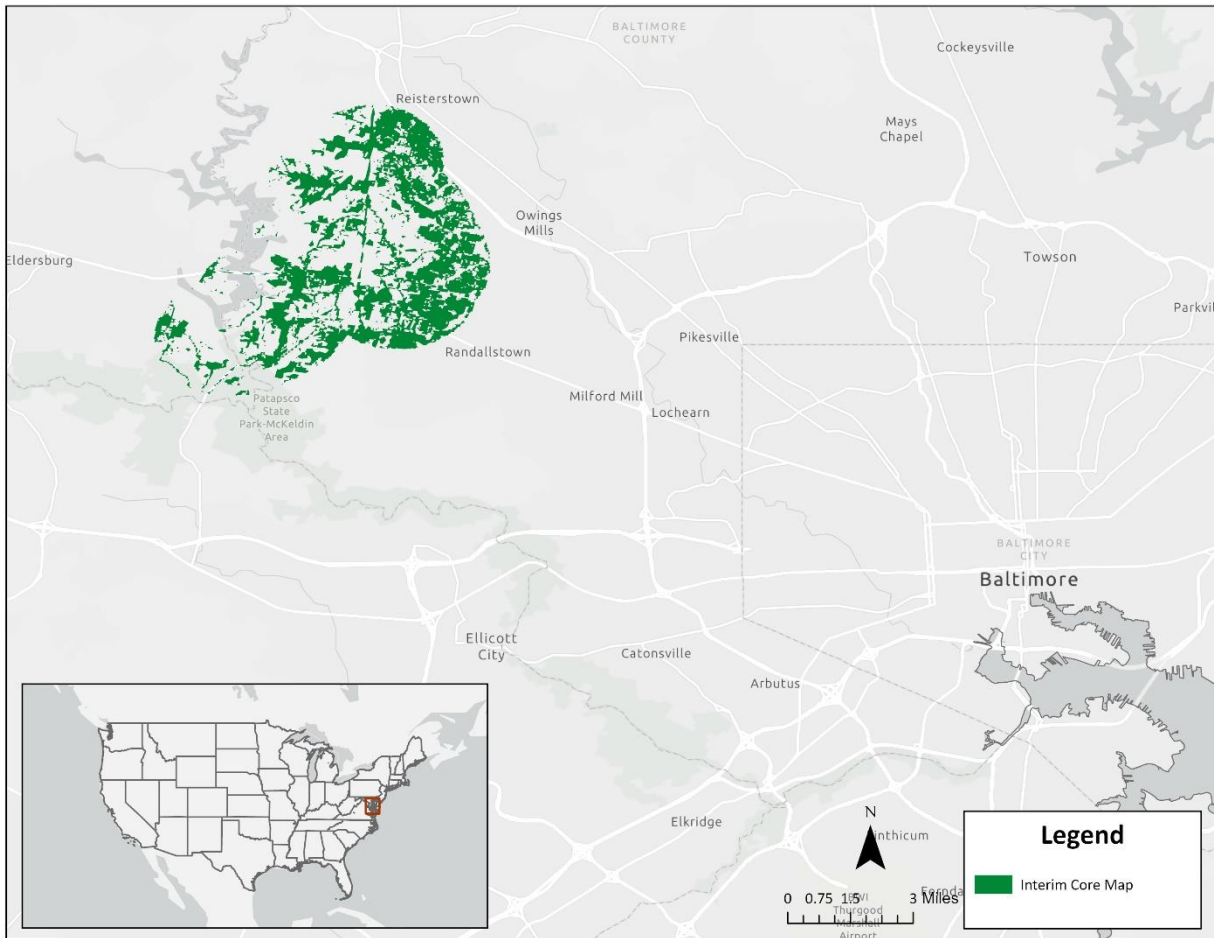


Figure A1-4. Sandplain gerardia interim core map area in Maryland.

4. Critical Habitat

There is no designated critical habitat for this species.

5. Known Locations

- Occurrences Described in FWS Documents

The Five-Year Summary indicates that sandplain gerardia was documented at 21 sites consistent with this core map. Eighteen of the sites are in areas that are protected from development, and three sites are within privately owned cemeteries (where development is not expected). There were eight sites in New York, seven sites in Massachusetts, one in Maryland, four in Rhode Island, and one in Connecticut. (Five-Year Summary, 4-6)

Table 2 shows the number of plants observed in each state where surveys in the range of the species as listed were conducted from 2010-2017. In addition, more than 100,000 plants were discovered at a Barnstable, MA, site in 2018. Surveys are typically conducted in late summer or early fall. (2019 5-Year Review, 4)

Table 2. Number of plants observed in each state where surveys in the range of the species as listed were conducted since 2010 (2019 5-Year Review, 4).

State	2010	2011	2012	2013	2014	2015	2016	2017
Maryland ¹	2,308	5,825	12,160	6,000	49,681	46,522	48,824	12,206
New York ²	6,790	47,972	5,221	4,380	7,112	8,821	20,158	15,572
Rhode Island ³	2,910	3,248	776	515	1,014	2,591	3,000	3,118
Massachusetts ⁴	32,435	174,873	1,422	16,115	57,330	10,039	45,590	22,198
Connecticut ⁵	86	0	14	2	21	0	6	11
Total	44,529	231,918	19,593	27,012	115,158	67,973	53,055	41,382

¹ Tyndall, Wayne. 2017. Personal communication. Maryland Natural Heritage Program, Department of Natural Resources.

² Long Island, NY, Cooperators (Monica Williams, USFWS; Annie McIntyre, New York State Office of Parks, Recreation and Historic Preservation [NYSOPRHP]; Betsy Gulotta, Friends of the Hempstead Plains; Paul D’Andrea, The Nature Conservancy [TNC]; Diana Sanford, Suffolk County Dept. of Parks, Recreation and Conservation). 2017. Personal communication.

³ Raithel, Christopher. 2017. Personal communication. Rhode Island Department of Environmental Management.

⁴ Wernerehl, Robert. 2017. Personal communication. Massachusetts Natural Heritage and Endangered Species Program.

⁵ Moorhead, Bill. 2017. Personal communication. Connecticut Consulting Botanist.

- Occurrences Described in iNaturalist:
 - https://www.inaturalist.org/observations?quality_grade=research&subview=map&taxon_id=1131697&verifiable=any
 - iNaturalist does not include any observations for “sandplain gerardia”; all observations for *Agalinis acuta* are combined with those of tenlobe false foxglove (*Agalinis decemloba*).
 - iNaturalist includes 102 research-grade observations consistent with the species range of sandplain gerardia (all in Maryland, Massachusetts, New York, and Rhode Island). No observations are shown in Connecticut.
 - **Figure A1-5** depicts the locations of these observations.

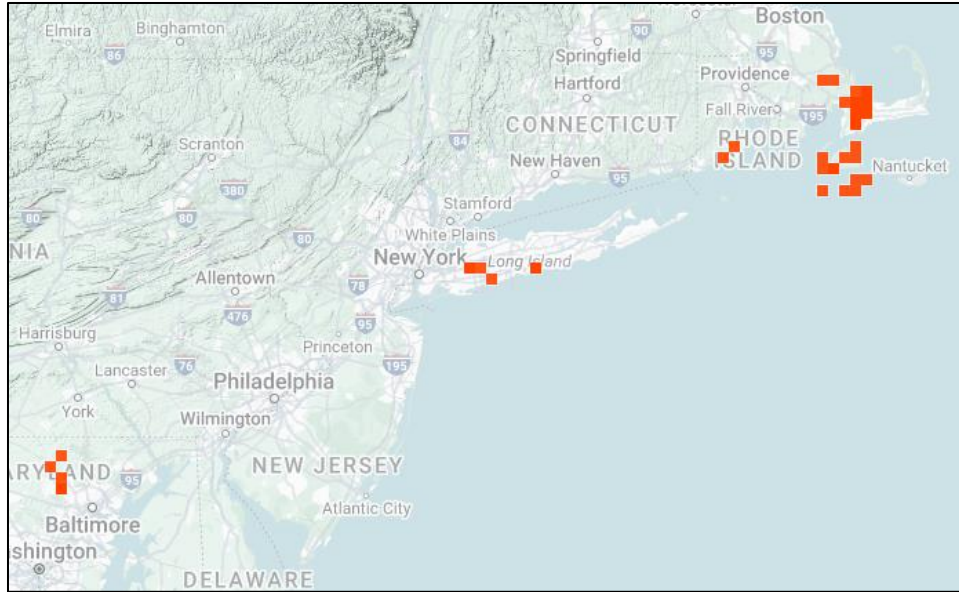


Figure A1-5. Occurrences of the tenlobe false foxglove (*Agalinis decemloba*) available in iNaturalist that coincide with the species range of sandplain gerardia.

- Occurrences Described in GBIF: <https://www.gbif.org/>
 - GBIF does not include any observations with coordinates for sandplain gerardia. Eighteen of the GBIF observations are human observations; the vast majority (236 observations) are preserved specimens.
- Occurrences Described in NatureServe: https://explorer.natureserve.org/pro/Map?taxonUniquelid=ELEMENT_GLOBAL.2.140310
 - NatureServe has several documented locations consistent with part of the species range (all in Connecticut, Massachusetts, and Rhode Island; **Figure A1-6**). Populations in Maryland and New York are not represented in the database.