Plantago pusilla

Dwarf Plantain

Plantaginaceae

Plantago pusilla by J. S. Dodds, 2023

***Plantago pusilla* Rare Plant Profile**

New Jersey Department of Environmental Protection
State Parks, Forests & Historic Sites
State Forest Fire Service & Forestry
Office of Natural Lands Management
New Jersey Natural Heritage Program

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November, 2023

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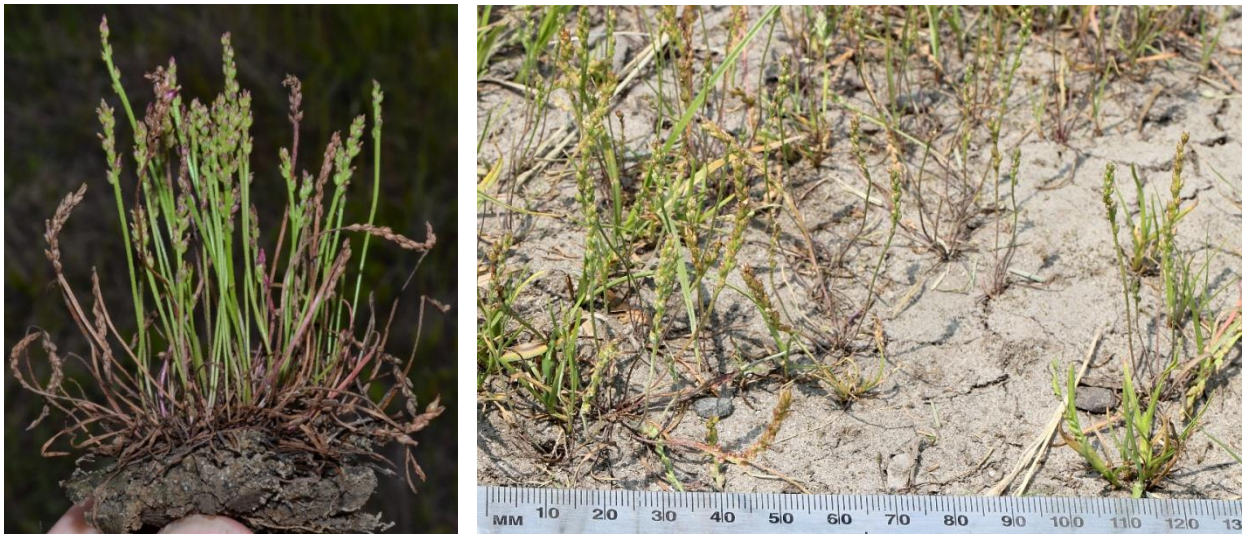
This report should be cited as follows: Dodds, Jill S. 2023. *Plantago pusilla* Rare Plant Profile. New Jersey Department of Environmental Protection, State Parks, Forests & Historic Sites, State Forest Fire Service & Forestry, Office of Natural Lands Management, New Jersey Natural Heritage Program, Trenton, NJ. 15 pp.

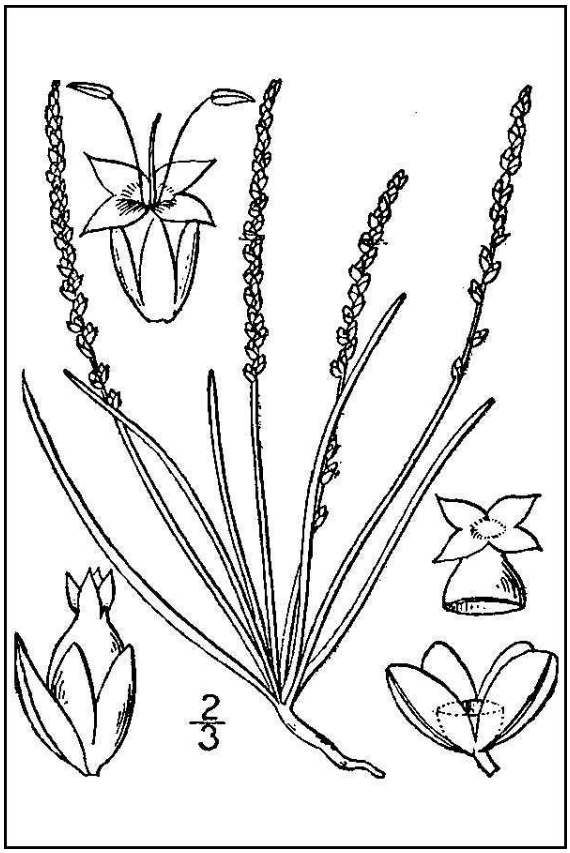
Life History

Plantago pusilla (Dwarf Plantain) is a tiny annual herb in the Plantaginaceae. The specific name is derived from a Latin word meaning 'very small' and Torrey (1843) thought that *P. pusilla* was likely to be the most diminutive species in the genus, noting that it often flowered on scapes that were under 2 cm tall. A short taproot may be present among the numerous fibrous roots but Chambers (2001) observed that the taproots of *P. pusilla* tend to become detached, leaving only the secondary roots. All of the leaves are basal: They are 2–7 cm long and 1–2 mm wide, narrowing slightly toward the somewhat clasping bases. The leaves generally have smooth edges although a few small teeth may occasionally be present. Individual plants can produce multiple flowering scapes—Morris (1909) reported that 160 had been observed on a single plant from New York. The scapes are green or brownish and typically range from 2–10 cm in height: Short hairs are usually present but they may also be smooth. The inflorescence of *P. pusilla* is a loose or dense spike of flowers that are 2 mm or less in length. Each flower is subtended by a triangular-ovate bract that is about the same length as the four sepals, and as the fruit develops the lobes of the four petals are held upright, forming a beak about 0.5 mm long. The fruit is an ovoid capsule that opens from the top. (See Nuttall 1818, Morris 1909, Britton and Brown 1913, Fernald 1950, Bassett 1966, Gleason and Cronquist 1991, Shipunov 2020).



Scale of mature plants: Handheld (J. Richard Abbott 2021) and with ruler (J. S. Dodds 2023).

Plantago pusilla is a winter annual. Winter annuals typically germinate during the autumn months, overwinter as rosettes, and reproduce during the following growing season (Baskin and Baskin 1974). *P. pusilla* plants in the northeast flower between April and June (Torrey 1843, Hough 1983, Rhoads and Block 2007) but in some places blooming can begin as early as March (Weakley et al. 2022). In 2014 the Dwarf Plantain plants in one New Jersey population were noted to be in flower and fruit during the latter part of May (NJNHP 2022). Blooming times can vary depending on climactic conditions: Baskin and Baskin (1974) reported that *P. pusilla* plants which were maintained at higher temperatures flowered about a month earlier than those kept at cooler temperatures.



Left: Britton and Brown 1913, courtesy USDA NRCS 2023a. Right: Carnegie Museum 2019.

Because the genus *Plantago* contains more than 200 species taxonomists frequently divide it into subgenera and sections. *Plantago pusilla* has been placed in Subgenus *Plantago*, Section Micropsyllium (Rahn 1996). All of the species in Section Micropsyllium are spring-blooming annuals with linear leaves, elongate spikes, and small flowers (Primack 1979, Rosatti 1984). Two other species in that section are adventive in New Jersey: *P. elongata* and *P. heterophylla* (Kartesz 2015). *P. elongata* was formerly conflated with *P. pusilla* (see Synonyms section) but differs in having spreading or reflexed corolla lobes, larger seeds, and pouchlike bracts. *P. heterophylla* usually has toothed leaves but sometimes lacks teeth and *P. pusilla* occasionally produces slightly toothed leaves; however the two species can be readily distinguished in fruit because *P. heterophylla* has 10–30 seeds per capsule whereas *P. pusilla* has four (Morris 1909, Bassett 1966). Two additional *Plantago* species with narrow basal leaves also occur in New Jersey: *P. maritima* var. *juncoides* has fleshier leaves, four stamens (*P. pusilla* has two), and spreading or reflexed corolla lobes, and *P. patagonica* has conspicuous dense pubescence on the inflorescence (Shipunov 2020, Weakley et al. 2022).

Pollinator Dynamics

The majority of *Plantago* species are pollinated mainly by wind (Rosatti 1984) but at least eleven species are strictly self-pollinated, including *Plantago pusilla* (Bassett and Crompton 1968). The flowers of the self-pollinated plantains are cleistogamous, meaning that they never open. Since pollen is shed directly onto the stigmas while the flowers are closed, the

cleistogamous *Plantago* species make a very limited investment in pollen production (Primack 1978a). *P. pusilla* only develops about 60 pollen grains per anther, each with a diameter less than 22 μ (Bassett and Crompton 1968).

Seed Dispersal

When the seeds of *Plantago pusilla* are fully developed the upper part of the capsule separates like a lid, permitting their release. A detailed description of the dehiscence process was recorded by Rethke (1946). The seeds are dark brown, coarsely pitted, 0.8–1.3 mm long and about a third as wide (Morris 1909, Bassett 1966, Shipunov 2020). Although *P. pusilla* only develops four seeds per flower it makes a relatively high investment in seed production when compared to other *Plantago* species, and there is a strong correlation between the number of flowers per inflorescence and successful fruit set (Primack 1978b, 1979).

Plantago pusilla probably utilizes multiple means of dispersal (Chen et al. 2002). Ahlstrand et al. (2018) reviewed propagule distribution modes in the genus: Long-distance dispersal is generally carried out by animals, either via adherence or by the consumption and defecation of seeds. Many *Plantago* species have seeds that become gelatinous when wet, allowing them to stick to the fur, feathers, or feet of passing animals, and that property was observed in *P. pusilla* by Engelmann (1883). *Plantago* seeds are also known to be eaten by birds and the plantains frequently co-occur with graminoids and other plants widely used as food sources for birds prior to migration (Ahlstrand et al. 2018). The seeds of *Plantago major*, a larger species with an inflorescence structure similar to that of *P. pusilla*, have been reported as abundant in mammal dung (Panter and Dolman 2012) and have germinated readily when recovered from deer feces (Myers et al. 2004).

Plantago pusilla seeds can either sprout at the end of the growing season in which they were produced or remain in the soil for a year or two. A study by Baskin and Baskin (1988) found that *P. pusilla* germination peaked the first autumn after sowing but its seeds continued to germinate during both spring and autumn for the next two years.

Habitat

The habitat noted in the original description of *Plantago pusilla* was "arid, saline hills" (Nuttall 1818). *P. pusilla* typically grows in sunny places on dry, sandy or rocky ground including fields, dunes, open woods, or woodland edges (Torrey 1843, Stone 1911, Bassett 1966, Hough 1983, Lamont and Young 2005, Rhoads and Block 2007). Reported elevations range from 0–200 meters above sea level (Shipunov 2020). Natural habitats may include saline prairies, cedar glades, or woodlands along glade perimeters (Cofer et al. 2008, Reid et al. 2010, Thomas 2017) but *P. pusilla* is most often associated with disturbed sites (Rossati 1884). Throughout its range, Dwarf Plantain has been found in cultivated or abandoned fields, in pastures, along roadsides, and in parking lots (Willis 1874, Bassett 1966, Belden et al. 2004, Ladd 2019, Weakley et al. 2022). Most of New Jersey's historic occurrences were associated with roadsides or fallow fields, although one was situated on an exposed trap rock cliff. Habitats for extant occurrences

in the state include mowed lawns, parking areas, and compacted soils in a roadway adjacent to a railroad track (NJNHP 2022). *Plantago pusilla* plants that happen to grow in more favorable microsites within a given habitat are likely to produce more flowers and fruits than those that establish in less advantageous locations (Primack 1978b).

Wetland Indicator Status

The U. S. Army Corps of Engineers divided the country into a number of regions for use with the National Wetlands Plant List and portions of New Jersey fall into three different regions (Figure 1). *Plantago pusilla* has more than one wetland indicator status within the state. In the Eastern Mountains and Piedmont region it is an upland species, meaning that it almost never occurs in wetlands. In other parts of the state *P. pusilla* is a facultative upland species, meaning that it usually occurs in nonwetlands but may occur in wetlands (U. S. Army Corps of Engineers 2020).

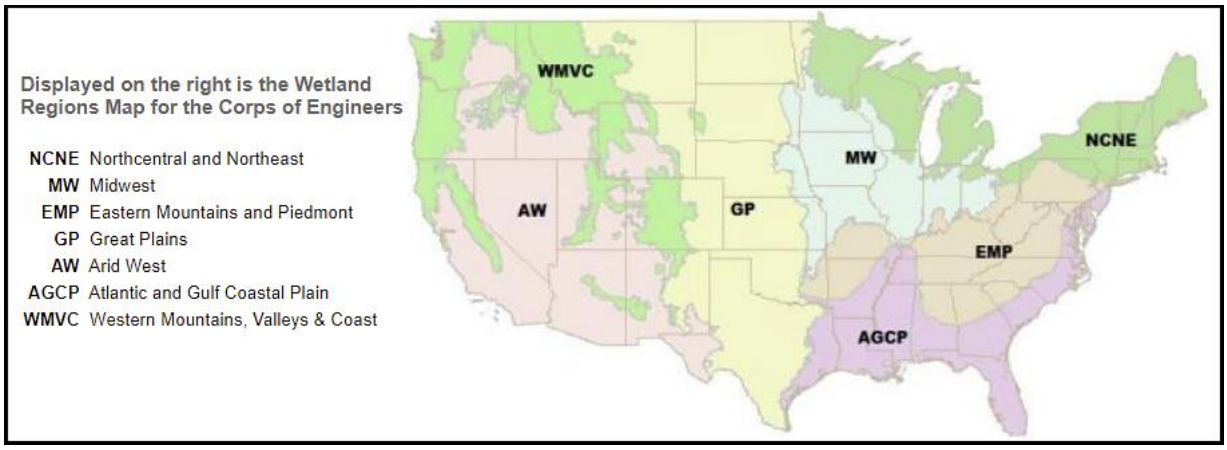


Figure 1. Mainland U. S. wetland regions, adapted from U. S. Army Corps of Engineers (2020).

USDA Plants Code (USDA, NRCS 2023b)

PLPU

Coefficient of Conservancy (Walz et al. 2020)

CoC = 5. Criteria for a value of 3 to 5: Native with an intermediate range of ecological tolerances and may typify a stable native community, but may also persist under some anthropogenic disturbance (Faber-Langendoen 2018).

Distribution and Range

The global range of *Plantago pusilla* is restricted to the United States (POWO 2023). The map in Figure 2 depicts the extent of Dwarf Plantain in North America. *P. pusilla* is thought to be introduced in the states on the west coast (Chambers 2001, Shipunov 2020, POWO 2023), and

there is some debate as to whether the species is native or adventive in the eastern part of the country (Lamont and Young 2005, Nordman 2023).

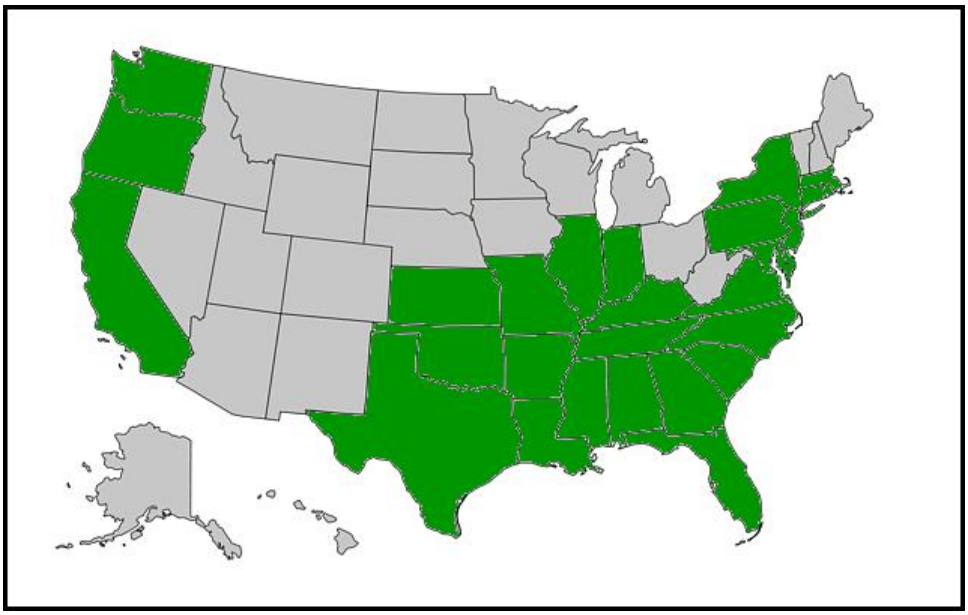


Figure 2. Distribution of P. pusilla in the United States (source data from Shipunov 2020).

The USDA PLANTS Database (2023b) shows records of *Plantago pusilla* in six New Jersey counties: Burlington, Camden, Cape May, Monmouth, Ocean, and Somerset (Figure 3). The data include historic observations and do not reflect the current distribution of the species.

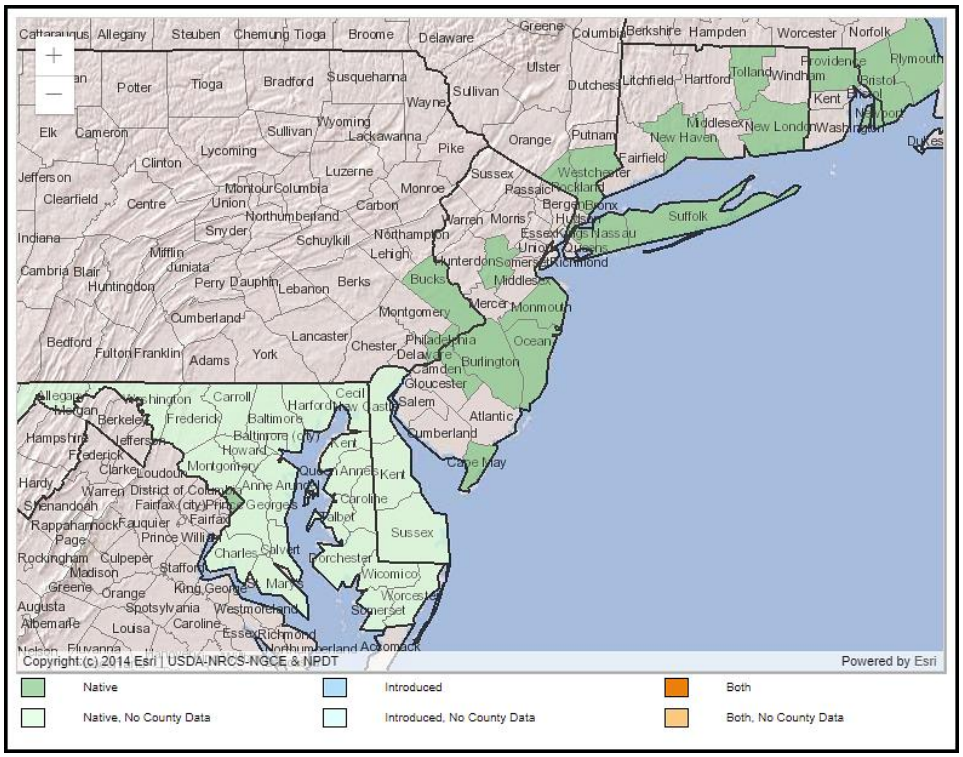


Figure 3. County records of P. pusilla in New Jersey and vicinity (USDA NRCS 2023b).

Conservation Status

Plantago pusilla has a global rank of G4G5, meaning there is some uncertainty as to whether it should be considered apparently secure or secure. A G4 species has a fairly low risk of extinction or collapse due to an extensive range and/or many populations or occurrences, although there is some cause for concern as a result of recent local declines, threats, or other factors. A G5 species has a very low risk of extinction or collapse due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats (NatureServe 2023). The map below (Figure 4) illustrates the conservation status of *Plantago pusilla* throughout its range. In most of the places where Dwarf Plantain occurs it has not been ranked. *P. pusilla* is critically imperiled (very high risk of extinction) in two states and vulnerable (moderate risk of extinction) in one state. It is not accepted as a native species in Connecticut, Delaware, New York, or Oregon.

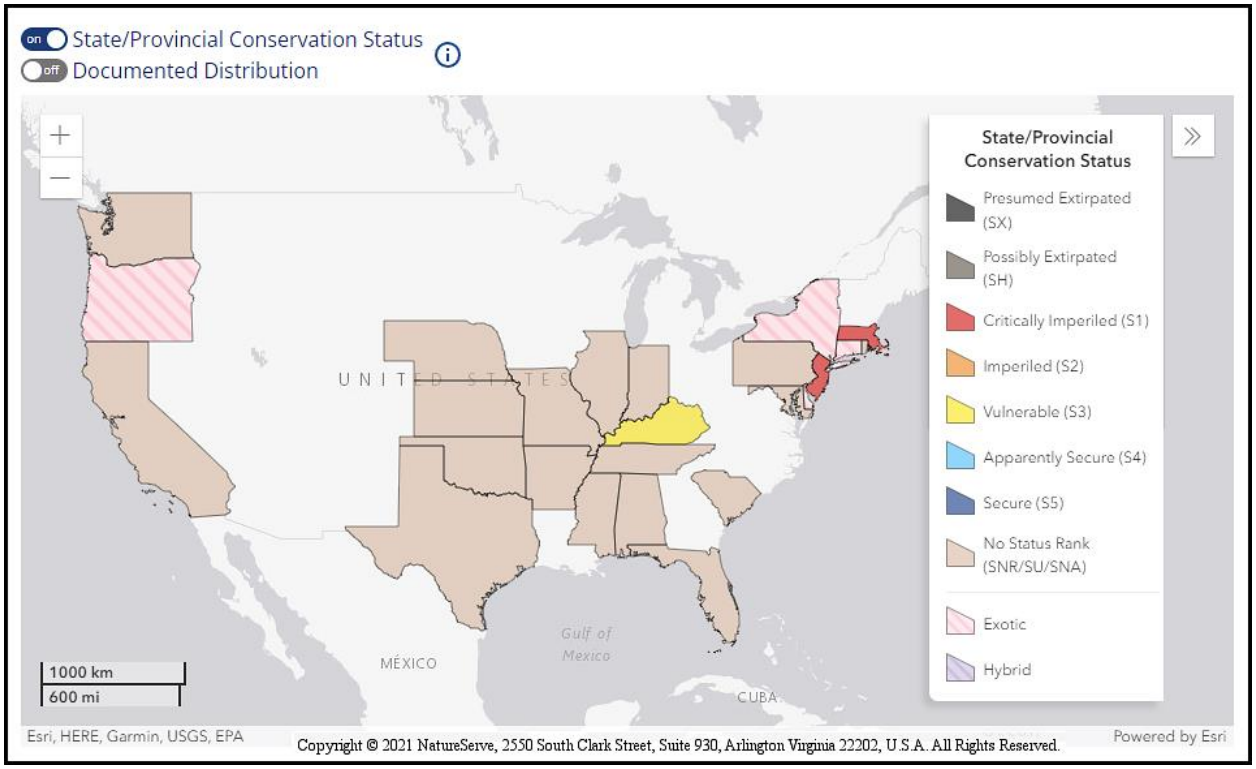


Figure 4. Conservation status of P. pusilla in North America (NatureServe 2023).

New Jersey is one of the states where *Plantago pusilla* is critically imperiled. The S1 rank signifies five or fewer occurrences in the state. A species with an S1 rank is typically either restricted to specialized habitats, geographically limited to a small area of the state, or significantly reduced in number from its previous status. *P. pusilla* is also listed as an endangered species (E) in New Jersey, meaning that without intervention it has a high likelihood of extinction in the state. Although the presence of endangered flora may restrict development in certain communities, being listed does not currently provide broad statewide protection for plants. Additional regional status codes assigned to the plantain signify that the species is eligible for protection under the jurisdictions of the Highlands Preservation Area (HL) and the New Jersey Pinelands (LP) (NJNHP 2010).

Plantago pusilla has often been described as native to the central United States but adventive in the eastern part of the country (eg. Bassett 1966, Primack 1980, Rosatti 1984). Given that the species has a high potential for long-distance dispersal and an affinity for disturbance there is currently no reason to question its natural occurrence in New Jersey. Dwarf Plantain has been present in the northeast for a considerable period of time. Morris (1909) indicated that *P. pusilla* had "long been known" in several eastern states, and some specimens that were collected in New Jersey, New York, and Delaware date back to the mid-1800s (NJNHP 2022, Mid-Atlantic Herbaria 2023).

Willis (1874) said *P. pusilla* was not rare in New Jersey, although according to Britton (1881, 1889) it was rare in most of the state but not along the central coast. Taylor (1915) characterized *P. pusilla* as "a very localized species, whose distribution is not yet understood." Hough (1983) indicated that the last known collection had been made in Camden County in 1968 and that other records from the state were over 50 years old, and the Camden occurrence was subsequently reported as extirpated (Breden et al. 2006). However, *Plantago pusilla* can still be found in New Jersey. Three extant occurrences are known, all of which were discovered within the past decade (NJNHP 2022). It is interesting to note that the extant populations are situated in the central coastal counties of Monmouth and Ocean where the species was reportedly most abundant during the 1800s.

Threats

The sites where New Jersey's *Plantago pusilla* populations are located experience a lot of human and vehicular traffic which could damage the plants, although observers indicated that the activities did not appear to be having any notable effect on the occurrences (NJNHP 2022). Nordman (2023) remarked that range-wide threats to *P. pusilla* seem to be low.

Plantago pusilla has the characteristics of a ruderal species that is well-suited to disturbance (Grime 1977). Such species are generally poor competitors so individual occurrences might be threatened by natural succession or invasive non-native plants. However, *P. pusilla* is likely to persist by colonizing new sites as old ones become less favorable. Any plants that become established have a high probability of reproducing: As Torrey (1843) noted even the tiniest *P. pusilla* plants can bloom, and Baskin and Baskin (1974) reported 100% flowering rates for the plants in their study. Since Dwarf Plantain is self-pollinated fertilization is guaranteed, and the species appears to have effective mechanisms for local and long-distance dispersal. Lamont and Young (2005) cited *P. pusilla* as an example of a species that has migrated aggressively into new territories during the past century.

Rapid or extensive habitat changes such as those resulting from development could eliminate a population of *Plantago pusilla*. Individual occurrences could also be threatened by the application of herbicides, particularly prior to seed set and dispersal. For example, DeVaney (1968) reported that *P. pusilla* is susceptible to 2,4 -D (Dimethylamine salt).

As the global climate becomes warmer, the consequences in New Jersey include mounting temperatures, shifting precipitation patterns that increase the frequency and intensity of both droughts and floods, rising sea levels, and higher salinity in coastal wetlands (Hill et al. 2020). Available information regarding *Plantago pusilla* suggests that the species is likely to be fairly resilient to climate change, particularly because it can reproduce rapidly, disperse to new sites effectively, and persist in the soil for at least two years. Lamont and Stalter (1991) found *P. pusilla* in a coastal park that was periodically subjected to severe storms and had occasionally been completely submerged in salt water. Some tolerance for high soil salinity can be inferred from its presence in saline habitats (Nuttall 1818, Reid et al. 2010). However, no explicit studies of its tolerance to extreme conditions (eg. inundation, desiccation, salinity) were found.

Management Summary and Recommendations

No immediate management needs have been identified for the New Jersey colonies of *Plantago pusilla*. Although the sites where it occurs are routinely subjected to disturbances that are likely to harm some of the plants the species appears to be doing reasonably well at the population level.

It is possible that *Plantago pusilla* has a presence in the state beyond the populations that are currently known. Although most of the sites where historic occurrences were located have been searched, the ruderal strategy of *P. pusilla* could allow the species to persist as a fugitive in a series of temporary habitats. The small plants are far from showy and without careful inspection they could easily be overlooked or mistaken for stunted graminoids growing in harsh conditions.

It would be advantageous to have a better understanding of the manner in which *Plantago pusilla* has spread throughout the United States. However, because of the plantain's long history of occurrence in the northeastern part of the country some of the questions regarding its distribution may remain unresolved. More practical avenues of research might include evaluating the extent of the species' tolerance for salinity, flooding, and drought or determining whether climactic factors play any role in defining the limits of its range.

Synonyms

The accepted botanical name of the species is *Plantago pusilla* Nutt. Orthographic variants, synonyms, and common names are listed below (ITIS 2023, POWO 2023, USDA NRCS 2023b). For a time during the late 1800s and early 1900s *Plantago pusilla* and *P. elongata* were lumped together—first under the former name and then under the latter (Engelmann 1883, Britton 1889, Bissell 1900, Morris 1909). Since Morris (1909) separated the two species based on features of their bracts and seeds most sources have recognized both species, although Kartesz (2015) treats *Plantago pusilla* as a synonym of *P. elongata*.

Botanical Synonyms	**Common Names**
Plantago hybrida W. P. C. Barton	Dwarf Plantain

Plantago maritima W. P. C. Barton	Slender Plantain
Plantago bigelovii S. Watson	Woolly Indianwheat
Plantago pusilla var. *macrosperma* Engelm.	
Plantago pusilla var. *major* Engelm.	
Plantago pusilla f. *major* (Engelm.) Bassett	

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