Honckenya peploides var. *robusta*

Seabeach Sandwort

Caryophyllaceae

Honckenya peploides var. *robusta* by Bob Cunningham, 2014

***Honckenya peploides* var. *robusta* Rare Plant Profile**

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

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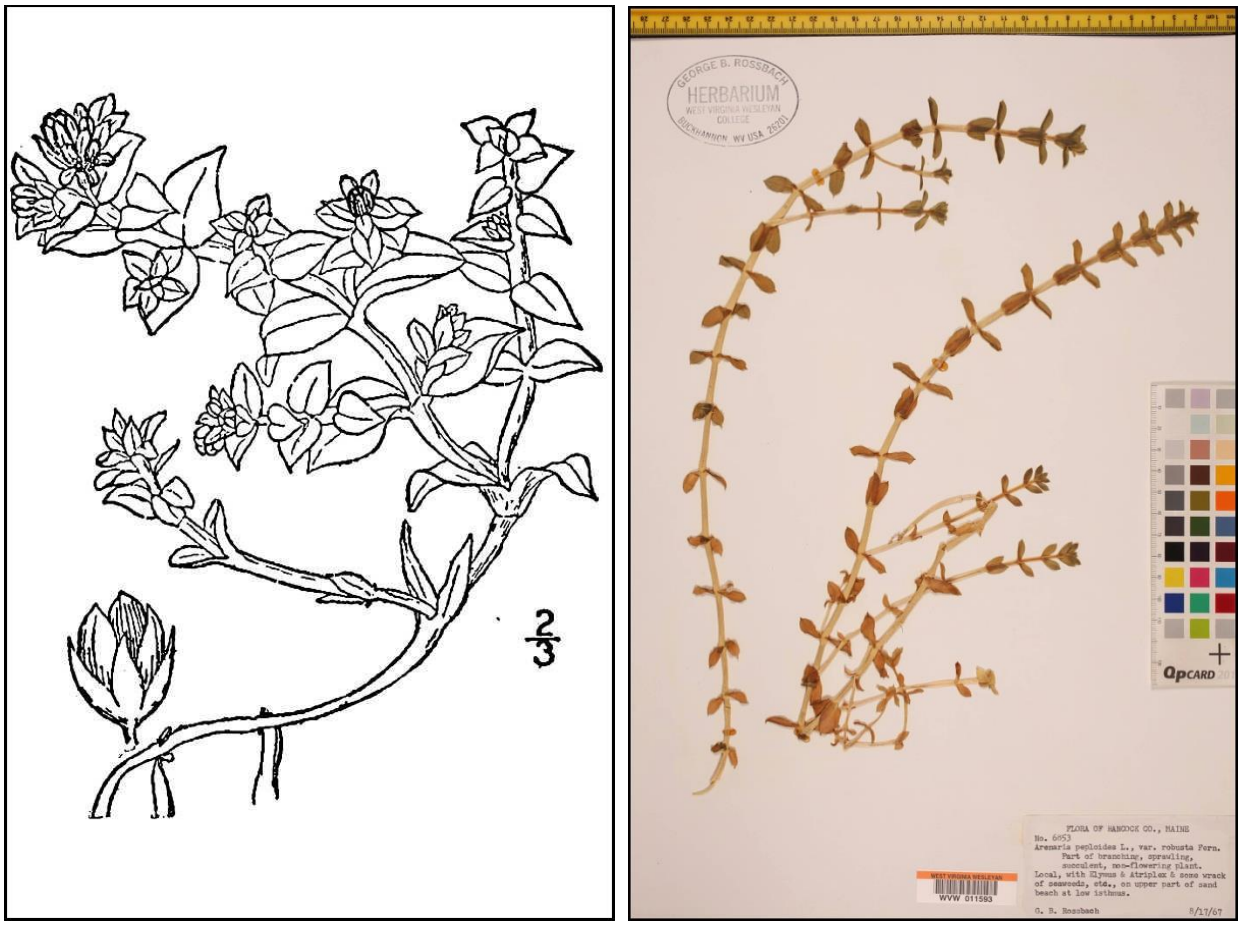
Life History

Honckenya peploides var. *robusta* (Seabeach Sandwort) is a rhizomatous perennial herb in the Caryophyllaceae. *Honckenya* is a monophyletic genus but *H. peploides* includes four recognized varieties—var. *robusta* is the only one that occurs in the northeastern United States (Wagner 2020). *Honckenya peploides* has been characterized as a trioecious species, meaning that individual plants within a population may produce flowers that are exclusively female, exclusively male, or bisexual (Godin 2022). Early observers reported a certain amount of gender fluidity in *H. peploides*; with some populations containing only male or female plants, some also including bisexual plants, and some having more than one kind of flower present on the same plant (Warming 1886, Knuth 1898). Malling (1957) examined sex determination in *Honckenya peploides* and concluded that plants with abortive anthers were female and plants with fully developed anthers were male but the male plants were also sometimes capable of producing functional pistillate organs in some or all of their flowers.



Left: *Honckenya peploides* (no variety) Britton and Brown 1913, courtesy USDA NRCS 2024a. Right: Scan of *H. peploides* var. *robusta* specimen collected by George B. Rossbach (1967), courtesy of the George B. Rossbach Herbarium at West Virginia Wesleyan College.

Honckenya peploides spreads vegetatively, often forming large clumps or mats. Pairs of somewhat fleshy leaves are present along the simple or branched stems. The flowers are terminal or axillary and have 5(–6) ovate sepals and the same number of petals. Female flowers

have tiny (< 2 mm) white petals and 3–5 well-developed styles, and a few rudimentary stamens may be present. Male flowers typically have 10 well-developed stamens, larger (2.5–6 mm) petals, and reduced styles. Bisexual flowers resemble male flowers but also have functioning pistils with longer styles. As suggested by the varietal name, *H. peploides* var. *robusta* is stouter than other forms of the plant. The stems are usually 3–6 mm in diameter, erect or ascending, and 1.5–5 dm in length. The lanceolate-ovate leaves are 12–28 mm long, 7–15 mm wide, and evenly spaced along the stems. The floral pedicels are short (2–3 mm) compared to those of other North American varieties and the fruiting capsules are ovoid to round and fleshy. (See Fernald 1909 & 1950, Britton and Brown 1913, Gleason and Cronquist 1991, Tiner 2009, Wagner 2020).

Baillie (2012) prepared a detailed account of the seasonal changes in *Honckenya peploides* var. *robusta* following a two-year study of several Connecticut populations. Buds appeared on old branches or rhizomes during late March. New shoots emerged during April and continued to expand through May, reaching their maximum size around the end of that month. Flowering began at the end of April and peaked during early May, although some plants continued to bloom until late May. Fruiting capsules developed in June and were gone by the end of July. Early signs of senescence were detected during late summer, most plants had collapsed by October and were desiccated by November. Few signs of the plants could be seen on the surface during the winter. In other places, flowering can sometimes begin later or continue longer and fruits may still be present in August or September (Hough 1983, Tiner 2009, Wagner 2020, Weakley et al. 2024).

Pollinator Dynamics

The flowers of *Honckenya peploides* are strongly honey-scented and secrete copious amounts of nectar, both of which are likely to attract insects (Knuth 1898, Sánchez-Vilas and Retuerto 2012, Wagner 2020). The Pacific *H. peploides* var. *major*, which Fernald (1909) noted to be larger than other varieties, is generally pollinated by small bees, flies, or ants (Tsukui and Sugawara 1992) and also by bumblebees (Lelej et al. 2012). Knuth (1898) indicated that various flies had been observed on *H. peploides* flowers in northern Europe but remarked that insect visits seemed rare considering the abundant nectar produced by the plants. Only one species of marine midge was seen visiting *H. peploides* var. *diffusa* at a site in Iceland despite the presence of numerous other potential pollinators (Philipp and Adsersen 2014). Baillie (2012) noted that small ants and gnats were attracted to *H. peploides* var. *robusta* flowers in Connecticut.

Knuth (1898) observed that *H. peploides* pollen often fell from the anthers onto the flowers and suggested that it might then be carried by wind to the stigmas of nearby blooms. He also thought that self-fertilization was probable, and Warming (1886) had earlier indicated that self-pollination was likely in *Honckenya*. *H. peploides* var. *diffusa* was one of the first vascular plants to colonize Surtsey, a volcanic island that formed off the coast of Iceland during the 1960s and was set aside as a reserve for scientific research. Within a relatively short period the *Honckenya* population had grown to include millions of plants. An unusually high proportion of bisexual plants had been recorded during the early years and the rapid spread of *H. peploides* around the island was attributed to their production of seeds via self-pollination (Árnason 2014,

Philipp and Adsersen 2014). However, no studies of self-compatibility or self-fertilization in *H. peploides* var. *robusta* were found.

Seed Dispersal and Establishment

The seeds of *Honckenya peploides* var. *robusta* are 2–4 mm in diameter and dull red-brown in color (Wagner 2020). *Honckenya* seeds are unique within the Caryophyllaceae because they have soft, white endosperm and there is a layer of endosperm present between the embryo and the seed coat (Martin 1946). *Honckenya* capsules may contain 3–15 seeds (Wagner 2020). The capsules of flowers that are strictly pistillate usually contain a higher number of seeds than those of bisexual flowers—means from a study of *H. peploides* var. *diffusa* populations were 8.8 for pistillate plants and 4.9 for bisexual plants (Philipp and Adsersen 2014).

When *Honckenya peploides* seeds are released from the capsules they initially fall to the ground beneath the parent plants. They are locally dispersed by wind, moving across the surface of the sand until they become trapped by vegetation or debris. *H. peploides* seeds are dispersed over long distances by water (Houle 1996, Sánchez-Vilas et al. 2010, Árnason 2014). Maun (2008) cited *Honckenya* as an example of a genus that was well suited for water dispersal because both its seeds and rhizome fragments could remain afloat and viable for long periods of time. Transport by ocean currents can result in the deposition of more than one propagule at the same location; for example, Philipp and Adsersen (2014) observed that multiple dispersal events had taken place at their study site in Iceland. The colonization of novel sites may be initiated by strong storms and floods (Nathan 2006).

Honckenya can maintain a persistent seed bank (Houle 1996), although a germination study that included *H. peploides* var. *peploides* found that seed viability declined with age over the seven-year project period (Walmsley and Davy 1997). Walmsley and Davy reported that the germination of *Honckenya* seeds was improved by stratification at low temperatures and by light, but was inhibited by high levels of salinity. Houle (1996) observed that seedlings mainly emerged during June, but noted that recruitment from seed might be limited by high rates of seedling mortality. Mortality rates approaching 100% were documented at a Quebec site for two consecutive years, primarily because the seedlings were buried by shifting sands. The observed effects of burial were replicated in an experimental greenhouse study: Seedling survival rates declined with just 0.5 cm of added sand and no seedlings survived the addition of 1.5 cm or more (Gagné and Houle 2002).

Habitat

In New Jersey, *Honckenya peploides* var. *robusta* is typically found above the high tide line on coastal beaches (Stone 1911, Fairbrothers and Hough 1973). Harshberger (1900, 1902) described typical *Honckenya* habitat as the middle beach zone, consisting of sand flats that were always damp. Kelly (2013) noted that the species sometimes became established on the lower beaches but such populations were often short-lived due to storm surges or erosion while populations situated on the broad overwash flats of the upper beaches were more likely to persist.

Honckenya peploides var. *robusta* occurs in similar settings throughout its range. In addition to sandy flats, the plants may also grow on dunes although they are generally located within 10 meters of sea level (Hill 1996, Tiner 2009, Angelo and Boufford 2011, Lamont and Stalter 2013, Wagner 2020). During a study of dune vegetation by Sims et al. (1987) the sandwort was encountered on ridges but not in swales. Stalter et al. (1996) noted that *H. peploides* var. *robusta* plants were frequently positioned directly in front of or adjacent to ocean-facing dunes. In some places, *H. peploides* var. *robusta* grows on pebble or cobble substrates rather than sand (Puryear 2005, Young 2021). In Connecticut *H. peploides* has also been observed growing in stony crevices among large rip-rap boulders along a railroad embankment and next to support pilings under a boardwalk (Baillie 2012).

H. peploides is nearly always found in full sun (Weakley et al. 2024). High temperatures, low moisture and nutrient availability, shifting substrates, and salt spray create a very stressful environment for the plants (Sánchez-Vilas 2007). Studies of other varieties of *Honckenya peploides* have suggested that female and male plants may utilize different strategies to cope with water stress, raising the possibility that they might preferentially colonize different microsites within their habitats as a result (Sánchez-Vilas 2007, Sánchez-Vilas et al. 2012, Philipp and Adsersen 2014).

H. peploides var. *robusta* growth on different substrates in Rhode Island, Doug McGrady (2022).

Because the environment utilized by *Honckenya peploides* var. *robusta* is so challenging the sites where it occurs are usually sparsely vegetated. Seabeach Sandwort is most often found sharing a habitat with American Searocket, *Cakile edulenta* ssp. *edulenta*. Other associates may include *Ammophila breviligulata*, *Atriplex* spp., *Cenchrus tribuloides*, *Euphorbia polygonifolia*, *Polygonum glaucum*, *Salsola* spp., or *Solidago sempervirens* (Harshberger 1900, 1902 & 1909, Sorrie and Dunwiddie 1996, Breden et al. 2001, Cartier et al. 2022). In the Nova Scotia coastal communities examined by Catling et al. (1984), *H. peploides* var. *robusta* was often the dominant (or sole) species growing in exposed locations on open sand and it was also present to a lesser extent in grassy areas dominated by *Ammophila breviligulata*.

Honckenya peploides often functions as a pioneer species in coastal habitats, and as it becomes established the sandwort can modify the environment in ways that make the site more accessible to other plants and animals. *Honckenya* plants in relatively undisturbed microsites can form

large tufts or clumps that trap windblown sand, creating low mounds known as embryo dunes (Harshberger 1900, Stone 1911, Catling et al. 1984, Maun 2008, Philipp and Adsersen 2014). The wind-dispersed seeds of other plants can become trapped against the mounds, which then serve as safe sites for their germination and growth (Sims et al. 1987, Gagné and Houle 2001). *H. peploides* was also thought to have aided the colonization of a young volcanic island by seabirds by providing them with nesting material (Árnason 2014).

Wetland Indicator Status

Honckenya peploides is a facultative upland species, meaning that it usually occurs in nonwetlands but may occur in wetlands (U. S. Army Corps of Engineers 2020).

USDA Plants Code (USDA, NRCS 2024b)

The USDA code for *Honckenya peploides* var. *robusta* is HOPER4. The USDA treats the taxon as a subspecies rather than a variety, using the code HOPER2.

Coefficient of Conservancy (Walz et al. 2020)

CoC = 10. Criteria for a value of 9 to 10: Native with a narrow range of ecological tolerances, high fidelity to particular habitat conditions, and sensitive to anthropogenic disturbance (Faber-Langendoen 2018).

Distribution and Range

Honckenya peploides can be found throughout the northern hemisphere but var. *robusta* is confined to the northeastern United States and eastern Canada (POWO 2024). The map in Figure 1 depicts the extent of the variety in North America.

The USDA PLANTS Database (2024b) shows records of *Honckenya peploides* var. *robusta* in four New Jersey counties: Atlantic, Cape May, Monmouth, and Ocean (Figure 2). The data accurately reflect the currently understood distribution of the species.

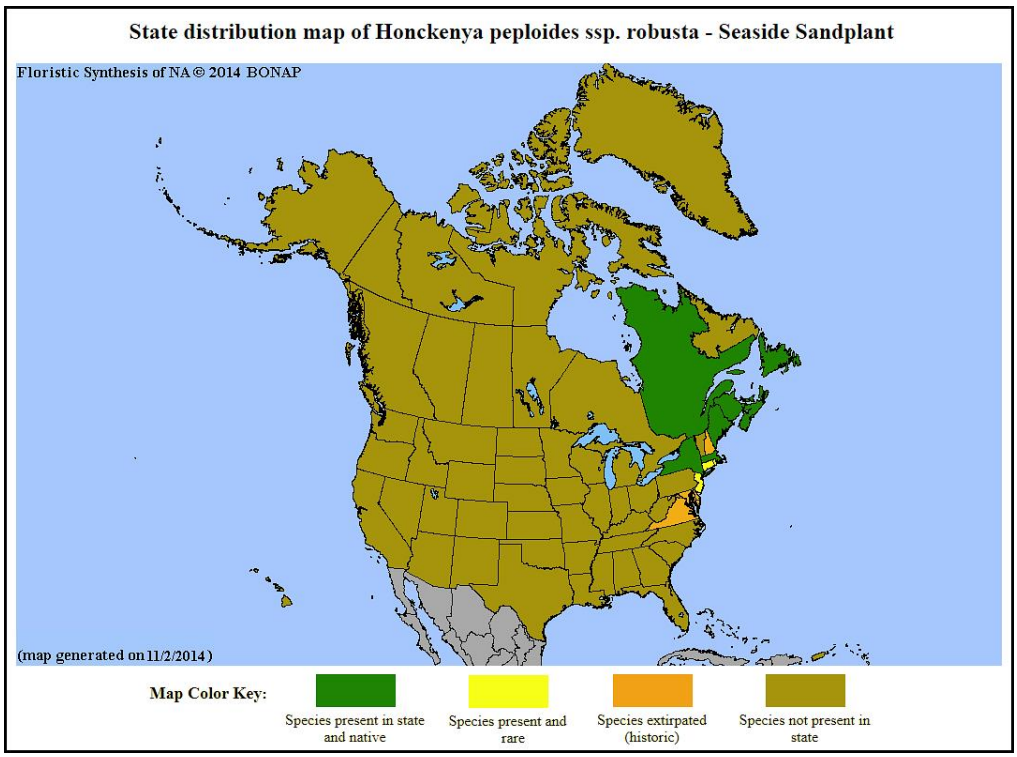


Figure 1. Distribution of H. peploides var. robusta in North America, adapted from BONAP (Kartesz 2015).

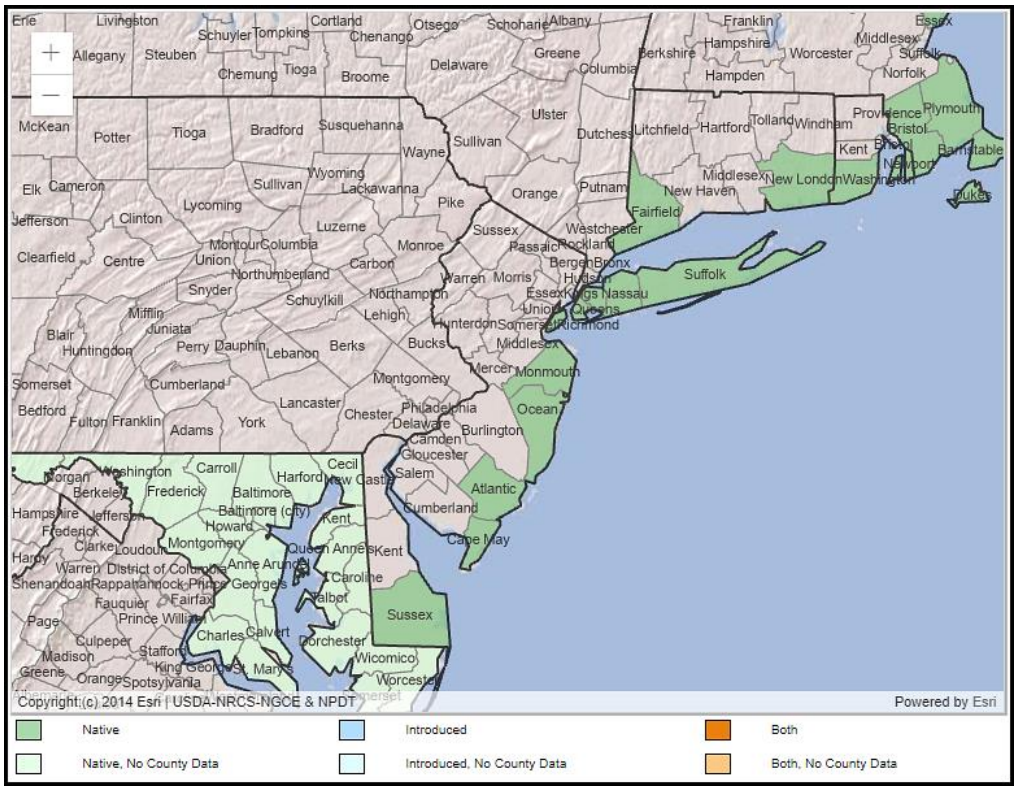


Figure 2. County records of H. peploides var. robusta in New Jersey and vicinity (USDA NRCS 2024b).

Conservation Status

Honckenya peploides var. *robusta* is considered globally secure. The G5T5 rank means that the variety 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 2024). The map below (Figure 3) illustrates the conservation status of *H. peploides* var. *robusta* throughout its range. The sandwort is vulnerable (moderate risk of extinction) in three provinces and one state, critically imperiled (very high risk of extinction) in one state, possibly extirpated in Delaware and Virginia, and likely extirpated in New Hampshire. Although not shown on the map, *H. peploides* is also critically imperiled in Maryland (MDNHP 2021). Hill (1996) noted that Seabeach Sandwort was declining in Connecticut, and it appears to be decreasing in frequency on some of Maine's coastal islands (Greene et al. 2005).

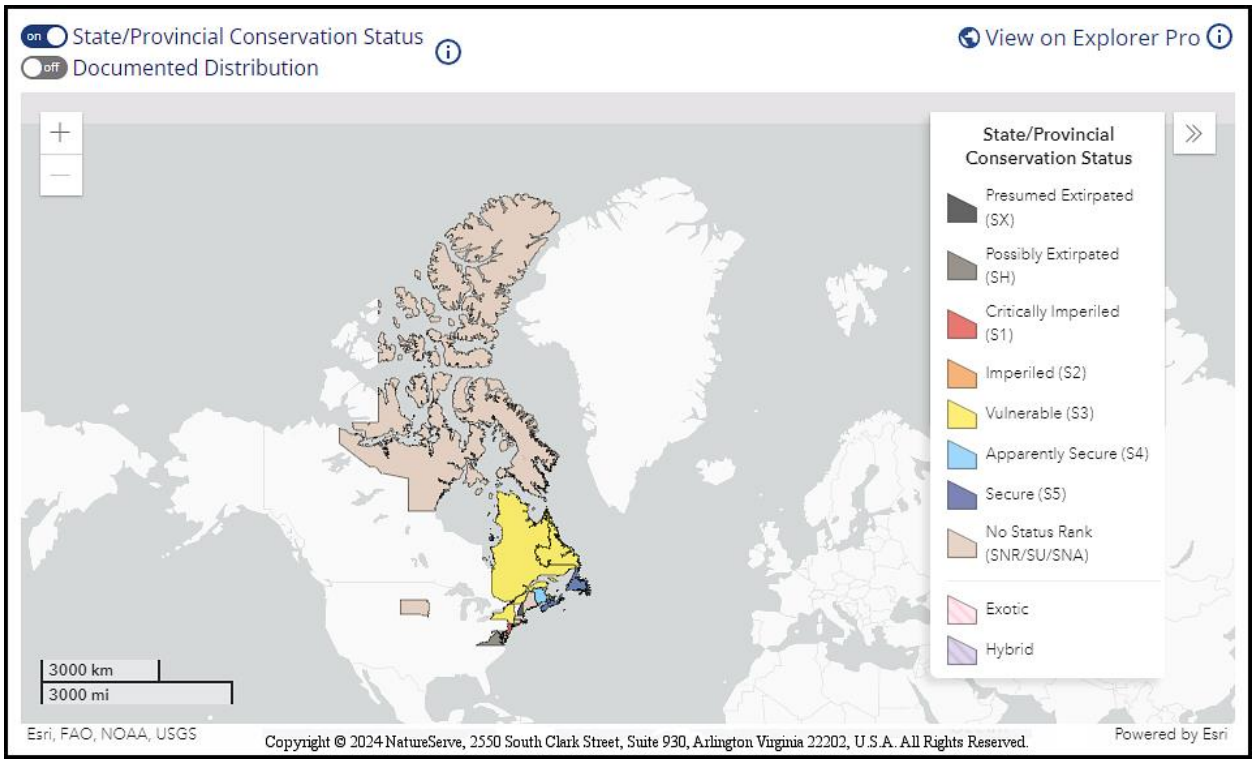


Figure 3. Conservation status of H. peploides var. robusta in North America (NatureServe 2024).

Honckenya peploides var. *robusta* is critically imperiled (S1) in New Jersey (NJNHP 2024). The 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. Seabeach Sandwort 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 such as wetlands or coastal habitats, being listed does not currently provide broad statewide protection for the plants. Additional regional status codes assigned to *H. peploides var. robusta* signify that the sandwort is eligible for protection under the jurisdictions of the Highlands Preservation Area (HL) and the New Jersey Pinelands (LP) (NJNHP 2010).

Honckenya peploides var. *robusta* was once fairly common on New Jersey's beaches. During the 1800s and the early part of the 1900s the species was described as "not rare" (Knieskern 1857) or "frequent" (Britton 1889) and numerous collections were made at locations all along the state's coast (Harshberger 1900 & 1902, Stone 1911, Mid-Atlantic Herbaria 2023). However, Stone (1911) observed that the sandwort appeared to be much less common that it had been in the past, noting that it had disappeared from some heavily used parts of the Jersey shore. Fairbrothers and Hough (1973) listed *Honckenya peploides* as a state endangered species because it had been rapidly disappearing, but five new occurrences were documented by David Snyder between 1980 and 2000 and other botanists relocated the species at some historical sites during the same period (Stalter and Lamont 2000, NJNHP 2024). At the turn of the century the species was listed as imperiled in New Jersey but its status was revised to critically imperiled within a decade (NJNHP 2001, 2010). A series of coastal flora surveys conducted from 2001–2011 documented a dramatic decline in *H. peploides*. Every previously reported location along the New Jersey coast was revisited and the species was seen at less than a third of the sites where it had once occurred. No new populations were found, and both the numbers and sizes of extant populations decreased notably during the course of the decade-long study (Kelly 2013).

Threats

As previously discussed, *Honckenya peploides* grows in a highly stressful environment where few other vascular plants are able to survive. However, populations can persist for a long time when habitat conditions remain suitable. *H. peploides* var. *robusta* was consistently found at the same site in Massachusetts from 1954–2012 and at one in Nova Scotia from 1899–2002 (Stalter and Lamont 2006, 2016). Some individual *H. peploides* var. *diffusa* plants that had established on an Icelandic island during the 1970s were still present and reproducing in 2010 (Philipp and Adsersen 2014). Lucas and Freedman (1989) investigated the potential impacts of oil spills on several coastal plant communities in Nova Scotia. Aboveground parts of *Honckenya peploides* var. *robusta* were damaged or destroyed by exposure to oil but the plants readily regenerated from their rhizomes. *H. peploides* is most vulnerable during the seedling stage when the plants are small and lack a well-developed root system (Houle 1996, Gagné and Houle 2002). Nevertheless, even established populations can face an assortment of serious threats, as evidenced by the drastic decline of the species in New Jersey.

Early reported losses of *Honckenya peploides* var. *robusta* in New Jersey were mainly attributable to extensive development in the coastal region (Stone 1911, Fairbrothers and Hough 1973). Habitat degradation remains the primary threat to *H. peploides* and other rare beach plants in the state. In some cases plants have been destroyed by off-road vehicles (ORVs), beach raking, or other local maintenance activities. In other cases population losses and declines have resulted from storms that eroded beaches, shifted substrate, or deposited wrack on top of plants (Kelly 2013, 2014). Additional concerns noted for individual occurrences in the state included herbivory by rabbits and competition with *Carex kobomugi*, an introduced sedge (NJNHP 2024).

Some comparable problems have been noted in other states. One New York population of *Honckenya peploides* var. *robusta* was lost after the site where it grew was bulldozed to create habitat for nesting terns (Coulter 1981, Stalter and Lamont 2005). *H. peploides* var. *robusta* is

also susceptible to trampling and may be eliminated by heavy foot traffic (Puryear 2005). Although an experimental study by Seer et al. (2015) reported no significant impacts on *H. peploides*, their research was conducted on a prostrate variety of the species so the results may not apply to the more upright var. *robusta*.

During the course of her life cycle study on *Honckenya peploides* var. *robusta*, Baillie (2012) encountered a population that was infected with a rust fungus. Although the rust, identified as *Uromyces acuminatus*, had not previously been documented on *Honckenya* the infection was severe and almost the entire occurrence was affected (Yun et al. 2012). Like many rust fungi, *U. acuminatus* utilizes alternate hosts during different life phases. One stage is generally restricted to *Spartina* spp. but the other can occur on an assortment of hosts in multiple plant families. The fungus causes the formation of small rust-colored pustules that become surrounded by yellow rings as cells in the adjacent tissue die. Severe infections can result in a reduction of the host's photosynthetic capacity and a consequent decrease in overall plant performance (Gautam et al. 2022).

Climate Change Vulnerability

Information from the references cited in this profile was used to evaluate the vulnerability of New Jersey's *Honckenya peploides* var. *robusta* populations to climate change. The species was assigned a rank from NatureServe's Climate Change Vulnerability Index using the associated tool (Version 3.02) to estimate its exposure, sensitivity, and adaptive capacity to changing climactic conditions in accordance with the guidelines described by Young et al. (2016) and the state climactic computations by Ring et al. (2013). Based on available data Seabeach Sandwort was assessed as Highly Vulnerable, meaning that it is likely to experience a significant decrease in abundance or range extent throughout New Jersey by 2050.

As the global climate becomes warmer both temperatures and sea levels are rising faster in New Jersey than in many other parts of the world and there is a 50% chance that sea-level rise along the state's coast will reach or exceed 0.4 meter by 2050. The higher seas are causing adjacent inland areas to flood more often and to experience elevated soil salinity. At the same time, shifting precipitation patterns are resulting in more frequent and intense storm events (Hill et al. 2020). As a beach plant, *Honckenya peploides* var. *robusta* has a high exposure to the direct impacts of sea level rise. Losses and declines due to storms and flooding have already been observed in the state (Kelly 2013, NJNHP 2024). Further damage to extant plants or potential habitat could result from strategies that are being used to prevent or mitigate the impacts of climate change such as beach fortification or replenishment. The likelihood of establishing new colonies in New Jersey is reduced by the scarcity of suitable habitat and a low probability of seedling survival. Increases in soil salinity or more frequent exposure to salt spray can inhibit seed germination, decrease seedling vigor or survival, and lower the reproductive capacity of mature plants (Walmsley and Davy 1997, Gagné and Houle 2002, Sánchez-Vilas 2007). *H. peploides* var. *robusta* is presently ranked as either critically imperiled or historical throughout the southern portion of its range so it is possible that higher temperatures have contributed to its decline.

Management Summary and Recommendations

Threats to *Honckenya peploides* var. *robusta* that arise from human activities are relatively easy to remedy by protecting the habitat. Populations of rare beach plants have been known to recover or reestablish following closure to ORV traffic or the discontinuation of raking, and some New Jersey occurrences of *H. peploides* have benefitted from fences that were erected to protect the nesting sites of rare birds or to facilitate vegetative regeneration (Kelly 2014, NJNHP 2024).

As the threats from climate change continue to mount, proactive intervention may be required in order to maintain the presence of *H. peploides* var. *robusta* in New Jersey. Kelly (2013) observed that sandwort populations were more likely to persist when they were situated in places that experienced lower levels of disturbance. Consideration should be given to focusing resources on extant occurrences in well-protected habitats or to promoting the establishment of subpopulations in sites that are sheltered from the direct impacts of storm surge and erosion.

Long-term conservation planning for Seabeach Sandwort could be aided by research. It would be useful to know whether climate has played a role in defining the southern limit of the species range. The potential for bisexual *Honckenya* flowers to develop fruit without the assistance of insects has long been inferred but no substantiating studies were found. Although some insects have been recorded visiting *H. peploides* flowers their effectiveness as pollinators has not been evaluated, and the relative importance of cross-pollination vs. self-fertilization in the production of viable seeds is unknown.

Synonyms

The accepted botanical name of the species is *Honckenya peploides* var. *robusta* (Fernald) House. The genus name has occasionally been written as *Honkenya*. Some orthographic variants, synonyms, and common names are listed below. The name *Ammodenia peploides* (L.) Rupr. was also applied to this variety by some early authors in reference to New Jersey occurrences (eg. Harshberger 1900, Stone 1911). A comprehensive review of the somewhat convoluted early taxonomic history of *H. peploides* var. *robusta* was undertaken by Moore (2002). Most contemporary taxonomists classify the plant as a subspecies rather than a variety (Kartesz 2015, Wagner 2020, ITIS 2024, POWO 2024, USDA NRCS 2024b, Weakley et al. 2024).

Botanical Synonyms	**Common Names**
Honckenya peploides ssp. *robusta* (Fernald) Hultén	Seabeach Sandwort
Arenaria peploides var. *robusta* Fernald	Seaside Sandplant
Minuartia peploides ssp. *robusta* (Fernald) Mattf.	Eastern Sea Sandwort

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