

Bidens eatonii

Eaton's Beggar-ticks

Asteraceae



Bidens eatonii by Sean Blaney, 2012

***Bidens eatonii* 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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Life History

Bidens eatonii (Eaton's Beggar-ticks) is a rare annual herb in the Asteraceae. The smooth, purple or greenish stems may be straight or branched and typically range between 25–75 cm in height although occasionally plants may be as tall as 1.5 meters. The opposite leaves are toothed and simple or sometimes lobed near the base with narrow, lanceolate blades that taper into slender or wing-margined petioles. *B. eatonii* plants bloom during September and October. Although members of the aster family usually have composite flower heads comprised of both ray and disc florets, ray florets are lacking or greatly reduced in *Bidens eatonii*. Typical heads contain 7–30 yellowish disc florets, and when ray florets are present there are usually three or fewer short (2–5 mm) yellow-orange petals. The achenes may be blackish, purplish, or red-brown and are linear or narrowly triangular with strong midribs, few hairs, and 2–4 barbed awns nearly half the length of the fruit body. (See Fernald 1950, Gleason and Cronquist 1991, Tiner 2009, Strother and Weedon 2020).

B. eatonii is most likely to be confused with other *Bidens* species that have simple, petiolate leaves and discoid flowers. In New Jersey there are three similar species that can occur in comparable habitat. *Bidens tripartita* and *B. connata* have broad flower heads while those of *B. eatonii* are narrow. *Bidens bidentoides* also has narrow flower heads, but its flowers and fruits are longer than those of *B. eatonii* and its achenes have indistinct midribs and copious hair (Fernald 1903, Gleason and Cronquist 1991).



B. eatonii growth habit, Sean Blaney, 2012.



Leslie J. Mehrhoff, 1990.

Pollinator Dynamics

No pollination studies were found for *Bidens eatonii*, but related plants are fertilized by a variety of bees and flies. *Bidens* species with predominantly discoid flowers generally attract fewer pollinators than those with showy ray florets (Sun and Ganders 1988, Hilty 2020, Jacobsen

2021). Nevertheless, insects have been observed pollinating *Bidens* plants with flowers like those of *B. eatonii*. Bumblebees (*Bombus* sp.) were reported as pollinators of *B. tripartita*, *B. connata*, and *B. frondosa* while Halictid bees have been found on *B. discoidea* and *B. frondosa* (Ish-Am 2009, Hilty 2020). An assortment of Bombyliid, Syrphid, and Tachinid flies have also been seen on *B. discoidea* and *B. frondosa* (Hilty 2020, Jacobsen 2021). A number of bees that are specialist pollinators on flowers in the aster family have been reported on *Bidens* spp., but it was not clear whether the insects visited species with discoid flowers or only those having ray florets (Fowler 2016, Fowler and Droege 2020). Some species of *Bidens* are self-compatible while others are not (Budumajji and Solomon Raju 2018): No information was available regarding the ability of *B. eatonii* to produce viable seed by means of self-fertilization.

Seed Dispersal

Because *Bidens eatonii* flowers during the fall its fruits develop late in the growing season. In many *Bidens* species, achenes may be found on the dried flower stalks well into the winter months (Levine 1995). Leck et al. (1994) noted that it can take several months for the seeds of *B. laevis* to reach the wetland surface. Once released, *Bidens* seeds may fall close to the parent plants or be relocated by water. Average water dispersal distances of 14–16 meters have been reported for *B. frondosa* and *B. discoidea* (Middleton 1999), and experimental work with *B. cernua* and *B. elata* showed that the seeds of both species were able to float for at least 30 days Frye (1920). The primary long-distance dispersal mechanism for the genus is animals. The long, barbed awns on *Bidens* achenes allow them to adhere to fur, feathers, or clothing—a trait which gave rise to the common name of beggar-ticks (Crowe and Parker 1981, Venable and Levin 1983). *Bidens* spp. seeds have been found in the digestive tracts of dabbling ducks (Green et al. 2016), so post-consumption dispersal is another possibility.

As with many other aspects of *Biden eatonii*, little information is available regarding its seed longevity and germination prerequisites. *Bidens laevis* is a more common species with a primarily annual habit that can also be found in freshwater tidal marshes. Studies have shown that *B. laevis* can form persistent seed banks, although it exhibits considerable year-to-year variation in seed bank density, germination, and total vegetative cover at a given site (Leck et al. 1994, Leck and Simpson 1995). Some species, including *B. cernua* and *B. laevis*, require a period of cold stratification for embryos to mature prior to germination (Hogue 1976, Leck et al. 1994). Sprouting in *B. tripartita* and *B. pilosa* was found to be highest for seeds positioned at or within 1 cm of the surface; that may be due to a light requirement as the germination of many *Bidens* seeds is precluded or inhibited by darkness (Benvenuti and Macchia 1997, Chauhan et al. 2019, Yu et al. 2020, Leck et al. 1994, Hogue 1976). Many of the better-studied *Bidens* species are weedy or somewhat abundant where they occur, so the attributes of a rare plant like *B. eatonii* cannot be reliably inferred from their behavior.

Habitat

Bidens eatonii grows on tidal river mudflats at elevations below 10 meters. It typically occurs in the upper portion of the intertidal zone where the influence of salt water reaches its inland limits.

The wet, muddy substrate upon which it occurs may be alternately exposed to the sun and submerged by fresh or brackish water, and its estuarine habitats may be limited to narrow shorelines or include extensive areas of marsh. (See Fassett 1925, Coddington and Field 1978, Sorrie 1987, MANHESP 2015, Strother and Weedon 2020, MENAP 2021). Québec populations of Eaton's Beggar-ticks occur both within and above the zone of tidal influence. Plante (2001) reported that *B. eatonii* plants that were submerged on a daily basis averaged 10–15 cm in height and produced 10–20 fruits per flower head, while those growing above the tide line averaged 25–40 cm in height and produced 20–40 fruits per flower head. The author also observed that plants growing within the tidal zone were often coated with a fine layer of silt or filamentous algae, and that shoreline populations were distributed in discontinuous bands or scattered clusters of 5–10 individuals.

The plant community described for *Bidens eatonii* in New Jersey is a *Eriocaulon parkeri*–*Polygonatum punctatum* Herbaceous Vegetation Association, also known as an Estuary Pipewort Brackish Intertidal Flat. Characteristics include low (< 1 meter) vegetation growing on sandy or gravelly substrate with a low proportion of organic material. The association type has been ranked as S2? in the state, signifying that it was considered imperiled but there was some uncertainty regarding the status (Breden et al. 2001). In Connecticut *B. eatonii* has been reported from gravelly, elevated portions of a river marsh community dominated by *Acorus calamus*, where it was noted that the irregular surface created by the partially exposed *Acorus* rhizomes provided a microhabitat that protected the seeds of Eaton's Beggar-ticks and other annual plants from the action of winter ice floes (Caldwell and Crow 1992).

Wetland Indicator Status

The U. S. Army Corps of Engineers (2020) 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). *Bidens eatonii* has more than one wetland indicator status within the state. In the Northcentral and Northeast region, *B. eatonii* is an obligate wetland species, meaning that it almost always occurs in wetlands. In other regions of the state it is listed as a facultative wetland species, meaning that it usually occurs in wetlands but may occur in nonwetlands (U. S. Army Corps of Engineers 2020).

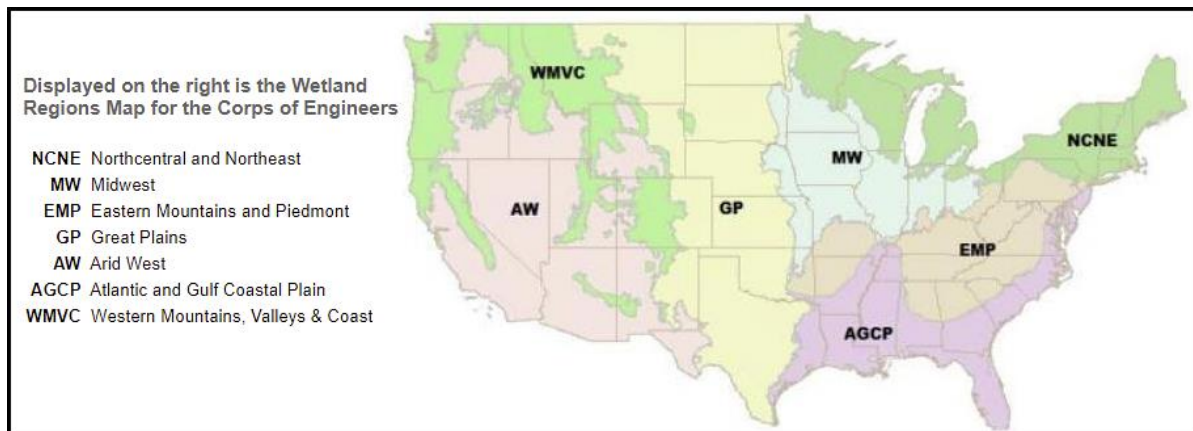


Figure 1. Mainland U. S. wetland regions, adapted from U. S. Army Corps of Engineers (2020).

USDA Plants Code (USDA, NRCS 2022)

BIEA

Coefficient of Conservatism (Walz et al. 2018)

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

The global range of *Bidens eatonii* is restricted to the United States and Canada (POWO 2022). The map in Figure 2 depicts the worldwide extent of the species.

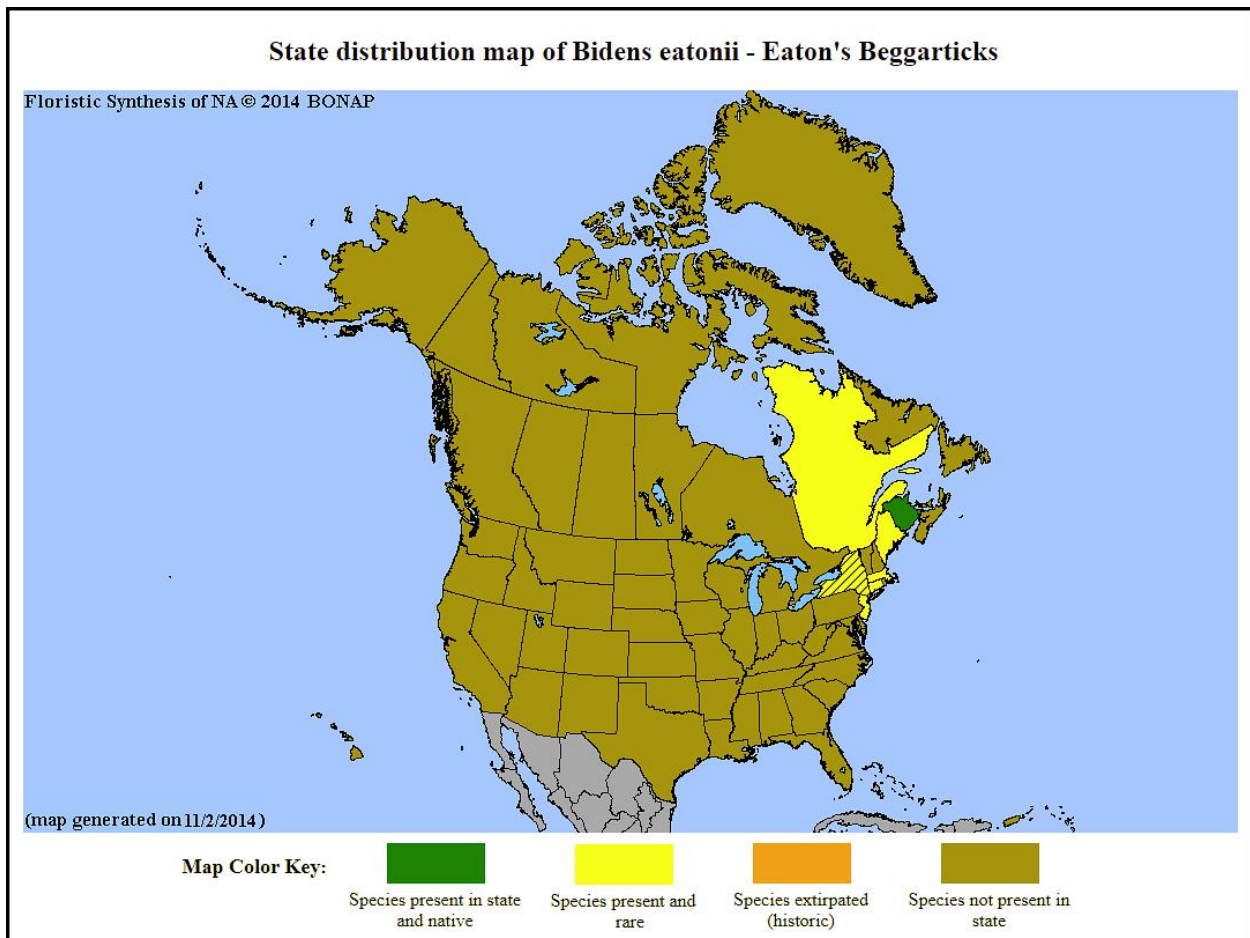


Figure 2. Distribution of *B. eatonii* in North America, adapted from BONAP. Cross hatching /// indicates a questionable presence. (Kartesz 2015).

The USDA PLANTS Database (2022) shows New Jersey records of *Bidens eatonii* only in Middlesex County (Figure 3). The data reflects the species' known distribution in the state.

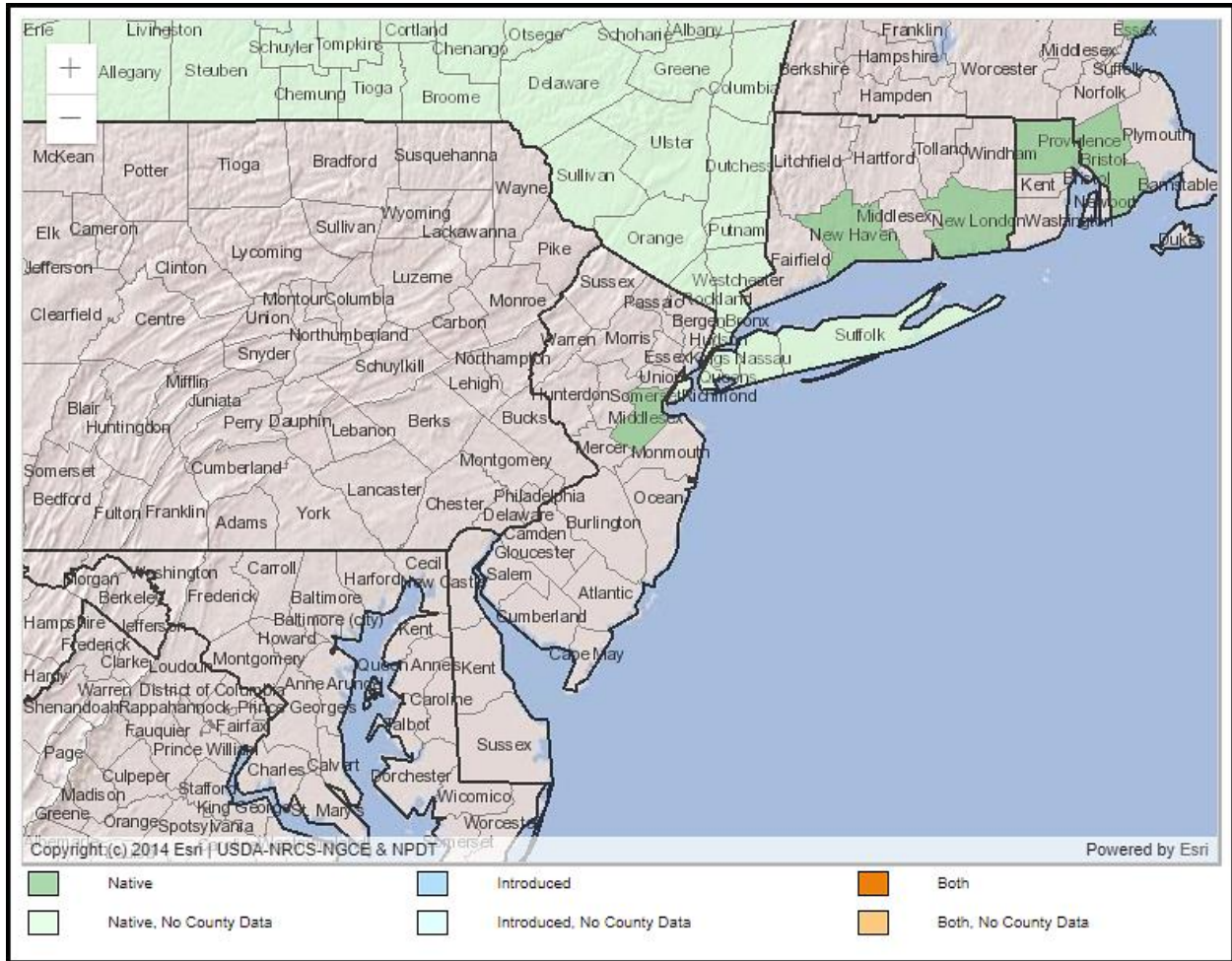


Figure 3. County records of *B. eatonii* in New Jersey and vicinity (USDA NRCS 2022).

Conservation Status

Bidens eatonii is globally vulnerable. The G3 rank means the species has a moderate risk of extinction or collapse due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors (NatureServe 2022). *Bidens eatonii* has also been classified as vulnerable on the IUCN Red List of Threatened Species (IUCN 2021). In North America, *B. eatonii* was identified as a plant species of highest conservation priority for the North Atlantic region, which includes four Canadian provinces and twelve U. S. states. The species has a regional rank of R3 (vulnerable), signifying a moderate risk of extinction (Frances 2017). The map below (Figure 4) illustrates the conservation status of *B. eatonii* throughout its range. Eaton's Beggar-ticks is critically imperiled (very high risk of extinction) in four states and one province, imperiled (high risk of extinction) in one state, and vulnerable (moderate risk of extinction) in one province. The majority of documented populations are located in Québec, where the species only occurs at scattered sites along a 125 kilometer stretch in the intertidal

zone of the St. Lawrence River (Plante 2001). *Bidens eatonii* is not considered secure anywhere in its range. Despite the paucity of occurrences, some authors have subdivided *B. eatonii* into a number of varieties (see Synonyms and Taxonomy section). Standley (1992) pointed out that since the status of the varieties was questionable, simply listing the species would provide protection for all of its populations.

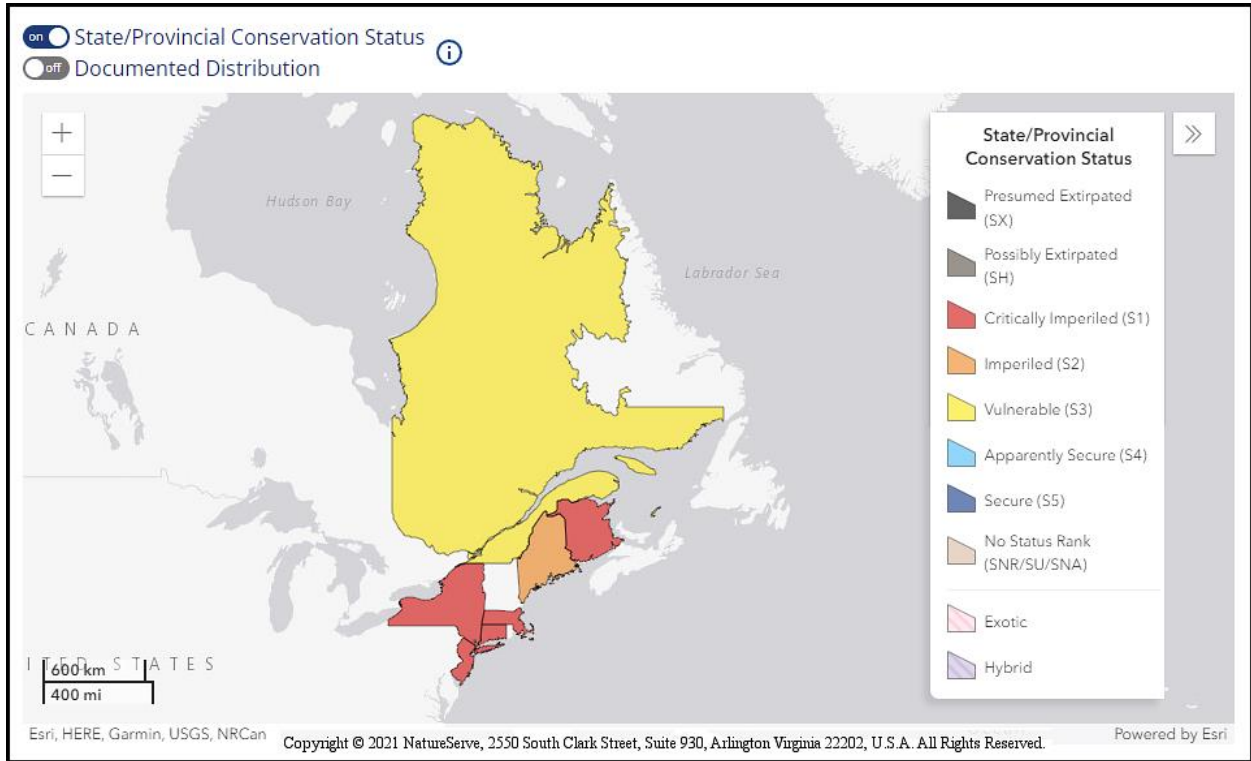


Figure 4. Conservation status of *B. eatonii* in North America (NatureServe 2022).

Bidens eatonii is ranked S1.1 in New Jersey (NJNHP 2022), meaning that it is critically imperiled due to extreme rarity. A species with an S1.1 rank has only ever been documented at a single location in the state. *B. eatonii* 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 Eaton's Beggar-ticks 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). New Jersey's sole occurrence of *Bidens eatonii* was documented by a single collector during the 1930s. The population was relocated nearly 60 years later (Snyder 2000) and is presently reported as extant (NJNHP 2022).

Threats

Factors that influence the rarity of a plant species include its geographic range, habitat specificity, and local population size (Rabinowitz 1981), and *Bidens eatonii* faces constraints in all three categories. Its worldwide distribution is limited to the coastal regions of a few states

and provinces in eastern North America, where it has been associated with one tidal river in Québec, a single river in New Brunswick, and no more than 10 waterways in the United States—including several from which it may already be extirpated (Plante 2001, Smith 2016). Within those watersheds, *B. eatonii* is restricted to the upper intertidal zones of the rivers (see Habitat section), and Labrecque et al. (2012) noted that the species is never locally abundant. Extensive distances between habitats that are suitable for *B. eatonii* probably limit the species' ability to disperse to new locations (Ouellette 2022). Isolated occurrences are likely to have minimal gene exchange with other populations, and small colony sizes can also diminish genetic variability (Ellstrand and Elam 1993, Lande 1988). Limited genetic variation may result in reduced fruit set, lower survival of offspring, and less adaptability to new conditions (Frye and Neel 2017, Charlesworth and Charlesworth 1987, Jump and Peñuelas 2005).

Of the roughly 70 occurrences of *Bidens eatonii* throughout its range, only 17 were reported to have good viability and many of those were facing multiple potential threats (Smith 2016). It has been noted that just one major oil or chemical spill on the St. Lawrence River could eradicate every *B. eatonii* population in Québec (Labrecque et al. 2012), while industrial scale forestry operations in the New Brunswick watershed where Eaton's Beggar-ticks was documented often have significant detrimental impacts on aquatic habitats (MREAC 2018). Industrial pollution and shoreline development for residential, agricultural, or recreational use have also been cited as threats to *B. eatonii* in both Canada and the U. S. (Tognelli et al. 2017, Labrecque et al. 2012, Smith 2016).

At the site of New Jersey's *B. eatonii* occurrence the proliferation of Common Reed (*Phragmites australis*) was identified as a developing problem (NJNHP 2022). *P. australis* has been noted as a threat to *Bidens eatonii* at additional locations along with other invasive plants such as Purple Loosestrife (*Lythrum salicaria*) and Japanese Knotweed (*Reynoutria japonica*) (Labrecque et al. 2012, Smith 2016, Tognelli et al. 2017). All three of the exotic species are capable of forming dense, nearly monospecific stands to the detriment of many native plants.

Bidens eatonii is particularly vulnerable to climate change as a result of its habitat restrictions. Even based on conservative estimates of sea level rise, coastal wetland losses in the northeast are likely to be extensive (Reid and Trexler 1992), and the intersection of multiple geologic and climactic factors is causing New Jersey to experience rising seas at a higher rate than other parts of the world (Hill et al. 2020). *B. eatonii* faces a heightened chance of extinction if it cannot disperse or adapt rapidly enough to keep up with community-level changes triggered by shifting climactic conditions.

Management Summary and Recommendations

In New Jersey, the most pressing management need identified for *Bidens eatonii* is invasive species control (NJNHP 2022). Established stands of *Phragmites australis* are difficult to eradicate, particularly without collateral damage to nearby sensitive species. However, some level of intervention may limit the spread of the exotic grass and allow *B. eatonii* to persevere at the site. The pros and cons of potential management techniques for *P. australis* have been reviewed by OMNR (2011) and Hazelton et al. (2014).

Regular monitoring of Eaton's Beggar-ticks in New Jersey and other places where it is imperiled is recommended in order to identify and address developing threats. Focused searches for additional occurrences of the species throughout its range could also prove to be worthwhile. Labrecque et al. (2012) suggested that the abundance of *Bidens eatonii* may have been underestimated because the species is somewhat unobtrusive, and they surmised that there is good potential for the discovery of additional populations. Their optimism appears to be warranted. A total of 16 new occurrences were located in three New England States between 1996 and 2012 (Gerke et al. 2014). Although the original New York record of *B. eatonii* may have been based on a misidentification (Snyder 2000), the species was reportedly collected from a new location in that state during 2011 (Mid-Atlantic Herbaria 2022).

Bidens eatonii could benefit from an investment in research on many aspects of its life history, particularly focusing on reproduction, dispersal, and establishment. The development of effectual protective measures requires a more comprehensive understanding of the species' basic requirements. Due to its global rarity and the likelihood of increasing extirpations as a result of changing climactic conditions, the possibilities for ex-situ propagation of *Bidens eatonii* should be thoroughly explored. Some work has already taken place. Seeds of *B. eatonii* have been preserved in long-term storage in the Millennium Seed Bank, Royal Botanic Gardens, Kew, United Kingdom, and positive results were reported when the stored propagules were evaluated for viability and germination potential (Liu et al. 2020).

Synonyms and Taxonomy

The accepted botanical name of the species is *Bidens eatonii* Fernald. Orthographic variants, synonyms, and common names are listed below (ITIS 2021, USDA NRCS 2022, POWO 2022). *Bidens eatonii* was once identified as a discrete species with multiple varieties (Fassett 1925), but more recent thinking is that it may be part of an undescribed complex (Crowe and Parker 1981, Caldwell and Crowe 1992) or might better be included in *B. tripartita* along with several other closely related taxa (*B. comosa*, *B. connata*, and *B. heterodoxa*) (Strother and Weedon 2020). More work is needed to clarify the relationships within the genus but—regardless of the outcome—the plant currently identified as *Bidens eatonii* is likely to remain a unique species or subtaxon that is worthy of preservation.

Botanical Synonyms

Bidens eatonii var. *fallax* Fernald
Bidens eatonii var. *illicita* S. F. Blake
Bidens eatonii var. *interstes* Fassett
Bidens eatonii var. *kennebecensis* Fernald
Bidens eatonii var. *major* Fassett
Bidens eatonii var. *mutabilis* Fassett
Bidens eatonii var. *simulans* Fassett
Bidens eatonii var. *typica* Fassett
Bidens heterodoxa var. *interstes* Fassett

Common Names

Eaton's Beggar-ticks
New England Estuarine Beggar-ticks
Bident d'Eaton

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