Galium labradoricum

Labrador Marsh Bedstraw

Rubiaceae

Galium labradoricum by Katy Chayka, 2011

***Galium labradoricum* 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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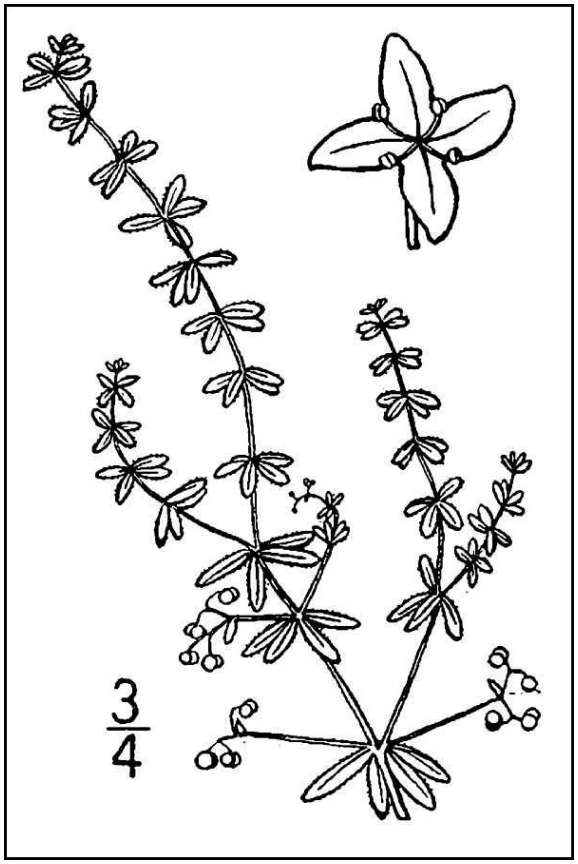
Life History

Galium labradoricum (Labrador Marsh Bedstraw) is a rhizomatous perennial herb in the Rubiaceae. The erect or loosely ascending stems are smooth, simply branched, and usually less than 40 cm in height. The blunt-tipped leaves are arranged in whorls of four: They are usually somewhat reflexed and are typically 8–12 mm long and 1.5–2.5 mm wide. Small clusters of flowers are located at the end of the branches. Each flower is 2–3.5 mm wide and has four bright white petals, four short stamens, and two styles. As *Galium* fruits develop they separate into two globular, indehiscent, one-seeded carpels—those of *G. labradoricum* are smooth and the fruiting pedicels are 1–2.5 mm long. (See Britton and Brown 1913, Leyendecker 1940, Fernald 1950, Puff 1977, Gleason and Cronquist 1991, Munroe et al. 2014).



Left: Britton and Brown 1913, courtesy USDA NRCS 2023a. Right: Peter M. Dziuk, 2011.

Throughout its range, *Galium labradoricum* produces flowers and fruits from May through August (Hauser 1964, Hough 1983, Redmond et al. 1993, Rhoads and Block 2007, Munroe et al. 2014, MENAP 2021). During two separate visits to one Pennsylvania population of *G. labradoricum*, botanists found the plants blooming on June 13, 1909 and past fruiting peak on August 6, 1911 (Long 1912). In 2017, New Jersey plants bearing both flowers and developing fruits were seen during the second week of June (personal observation). Labrador Marsh Bedstraw can also reproduce vegetatively via rhizomatous growth (Les 2017).

Galium is a large genus that has been divided into sections and *G. labradoricum* was placed in section Aparinoides, which includes a number of other species that occur in New Jersey. Puff (1977) further separated section Aparinoides into subgroups and *G. labradoricum* was placed with *G. obtusum* (ssp. *obtusum* and ssp. *filifolium*) due to their close structural similarity. *Galium obtusum* generally has larger leaves (10–25 mm long and 0.8–5 mm wide), longer fruiting pedicels (5–12 mm), and leaves that are not reflexed. In *G. obtusum* it is common for only one carpel per fruit to develop while both usually develop in *G. labradoricum*. It is advisable to examine multiple features because both species can exhibit variable morphology in response to environmental conditions. *Galium labradoricum* often co-occurs with another similar bedstraw, *G. trifidum* ssp. *trifidum*, but the latter species has rougher stems and flowers that are less than 1.5 mm wide (Puff 1977).

Pollinator Dynamics

In contrast with *Galium obtusum*, which often exhibits low pollen quality, approximately 90% of the pollen of *Galium labradoricum* is fertile (Puff 1977). The reproductive mechanisms of *G. labradoricum* have not been investigated but some inferences may be drawn from studies of other species. Rabinowitz et al. (1981) excluded *G. obtusum* from a pollination study because they thought the small, low, inconspicuous flowers would make pollinator visits unlikely, but Batra (1984) indicated that *Galium* flowers are visited by a profusion of insects including butterflies, moths, beetles, flies, ants, wasps, and bees. For many bedstraws, various types of flies are the most important pollinators but some small bees can also aid in cross-fertilization (Robertson 1929, Zomlefer 1994, DuPont and Olesen 2009, Lázaro et al. 2009, Bucharova et al. 2020, Hilty 2020). Lázaro et al. (2009) found that pollinators of *Galium mollugo* were influenced by plant community composition. For example, *G. mollugo* was most often pollinated by muscoid flies but in diverse floral neighborhoods the frequency of visits from alternative pollinators such as hover flies and solitary bees increased. Some *Galium* species are also capable of self-pollination (Les 2017), although it is not clear whether that applies to *G. labradoricum*.

Seed Dispersal and Establishment

No information was found regarding the specifics of seed dispersal in *Galium labradoricum*. Most *Galium* seeds are dispersed by gravity and/or water and all of the obligate wetland species have smooth, buoyant fruits that suggest water dispersal. The fruits of some bedstraws can also maintain viability after passing through an animal's digestive tract. Vegetative dispersal by rhizome or shoot fragments is also known in the genus (Les 2017).

Seed banking has been reported in *Galium labradoricum* (Bart and Davenport 2015). The germination rates of some *Galium* species may be enhanced by shallow burial of the seeds (Les 2017). Mycorrhizae have been found in a number of bedstraws although in some instances the associations appear to be facultative (Wang and Qiu 2006). One unidentified *Galium* species in a Connecticut wetland was mycorrhizal but had a low rate (10%) of fungal colonization (Cooke and Lefor 1994). Nutrient limitation research using *Galium mollugo* as a subject species found

arbuscular mycorrhizae in all of the three-week-old seedlings examined (Köhler et al. 2001). However some other studies have reported poor or absent mycorrhizae in *G. mollugo* (Harley and Harley 1987) so the associations may be more important while the plants are becoming established.

Habitat

Galium labradoricum is a plant of northern wetlands. Its habitats have been described as sphagnous bogs, fens, moors, sedge meadows, moist banks, marshy lake borders, floating mats, mossy thickets, and swamps (Arsène 1927, Iltis 1957, Fairbrothers and Hough 1973, Griffen 1975, Puff 1977, Thormann and Bayley 1997, Rhoads and Block 2007, Iverson et al. 2010). Characteristic woody species of the communities may include Arborvitae (*Thuja occidentalis*), Tamarack (*Larix laricina*), Black Spruce (*Picea mariana*), Bog Birch (*Betula pumila*), or Leatherleaf (*Chamaedaphne calyculata*) (Deam 1916, Hartley 1957, Puff 1977, Lynn and Karlin 1985, Bowles 1991, MENAP 2021). Fernald and Wiegand (1910) found *G. labradoricum* in a sphagnous marsh near the edge of a salt marsh and Miyanishi et al. (1991) observed the species growing on mounds in a salt pan just inland from the average daily high tide line. In one northern New Jersey shrub bog, *G. labradoricum* was growing only at the leading edge of the sphagnum mat where the peat was unconsolidated (Lynn and Karlin 1985). *G. labradoricum* is usually uncommon even in favorable habitats but it can occasionally become frequent in a particular community (Bowles 1991).

In New Jersey *Galium labradoricum* is typically found in limestone fens (Johnson and Walz 2013, NJNHP 2022), and the bedstraw has been associated with calcareous or alkaline substrates at many other places throughout its range (Long 1912, Coddington and Field 1978, Bowles 1991, Klymko et al. 2012, Munro et al. 2014). In western New England and northeastern New York, the fen communities where *G. labradoricum* occurred were dominated by *Betula pumila* or various *Carex* sedges (Motzkin 1994). However, the species is not restricted to calcareous sites. *G. labradoricum* has been said to "delight in mediacid to calcareous soils" (M. L. F. 1948). Puff (1977) indicated that the species preferred sites that were "only slightly acid to neutral and sometimes even slightly alkaline." Nekola (2004) noted that *G. labradoricum* could tolerate non-calcareous conditions and that the species' strongest affiliation was with sites which had moderate pH and cation levels.

A single observation from British Columbia provided a snapshot of the species' microsite in that location including elevation (980 meters) and slope gradient (4 percent) (Klinkenberg 2020). Klinkenberg also described the most favorable moisture regime for *G. labradoricum* as 6 (hygric) on a scale of 0 (very xeric) to 8 (hydric) and identified the nutrient regime as C (medium). A more comprehensive description of the soil and moisture regimes is provided by the B. C. Ministry of Forests (1998). In a hygric water regime, the primary water source is seepage and the water is removed slowly enough to keep the soil wet throughout most of the growing season. A medium nutrient regime has an average level of nutrient availability and is associated with sites where the water pH generally falls between 5.5 and 6.5.

Wetland Indicator Status

Galium labradoricum is an obligate wetland species, meaning that it almost always occurs in wetlands (U. S. Army Corps of Engineers 2020).

USDA Plants Code (USDA, NRCS 2023b)

GALA2

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

The global range of *Galium labradoricum* is restricted to Canada and the northern United States (POWO 2023). The map in Figure 1 depicts the extent of the species in North America.

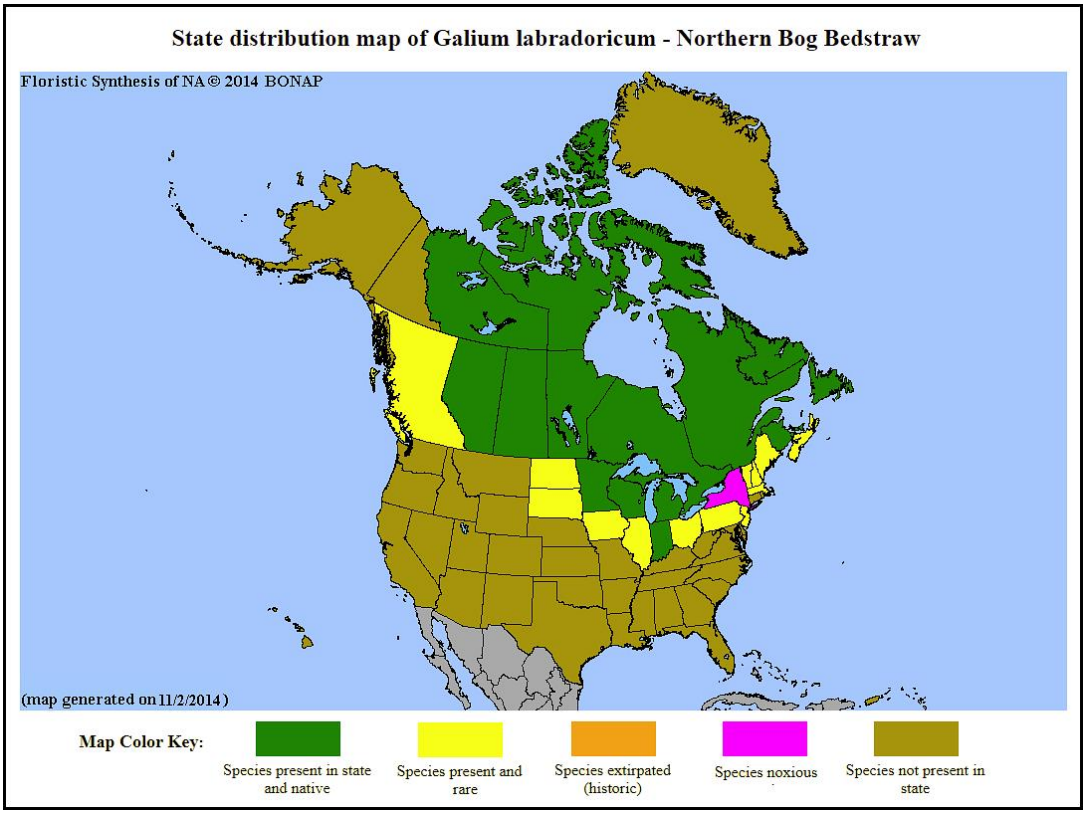


Figure 1. Distribution of G. labradoricum in North America, adapted from BONAP (Kartesz 2015).

The USDA PLANTS Database (2023b) shows records of *Galium labradoricum* in two New Jersey counties: Sussex and Warren (Figure 2). The map accurately reflects the current known distribution of the species.

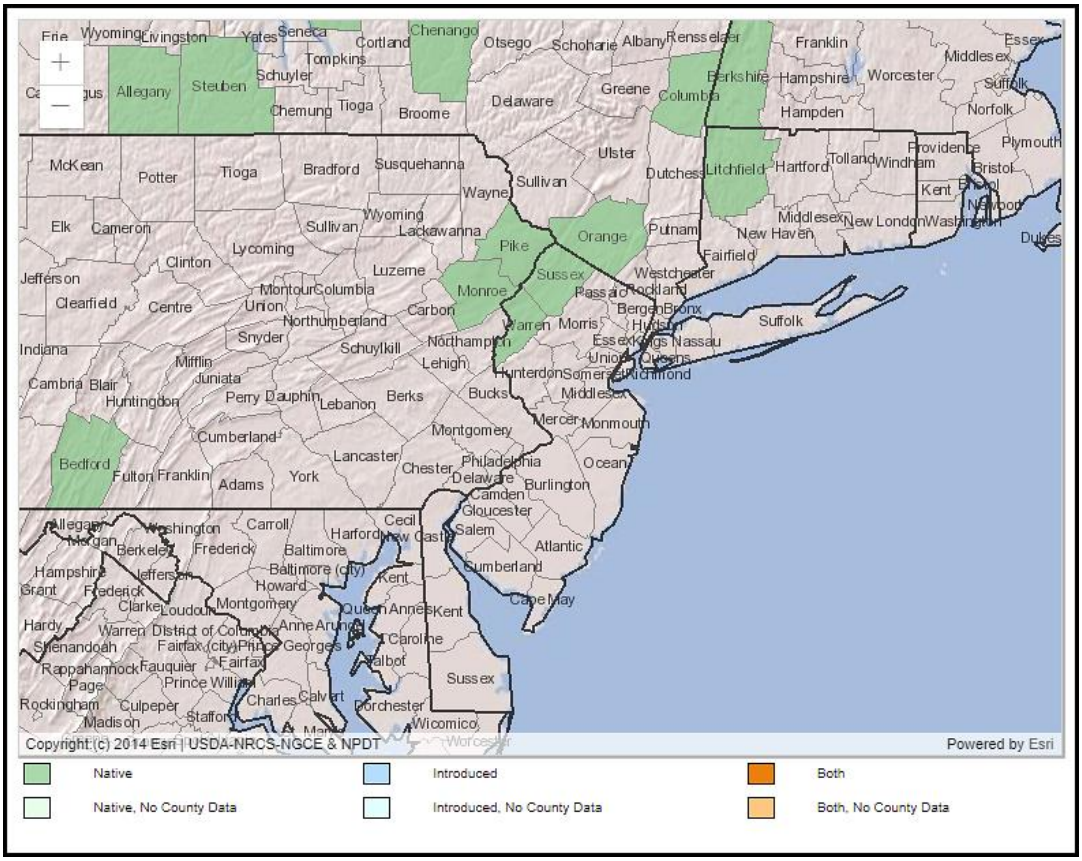


Figure 2. County records of G. labradoricum in New Jersey and vicinity (USDA NRCS 2023b).

Conservation Status

Galium labradoricum is considered globally secure. The G5 rank means the 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 3) illustrates the conservation status of *G. labradoricum* throughout its range. The species is secure or apparently secure throughout central and western Canada. Labrador Marsh Bedstraw is vulnerable in four provinces (including, sadly, Labrador) and one state, signifying a moderate risk of extinction. *G. labradoricum* is ranked as imperiled (high risk of extinction) in three states and critically imperiled (very high risk of extinction) in six states. Most of the districts where the species is especially vulnerable are located along the southern and eastern edges of its range.

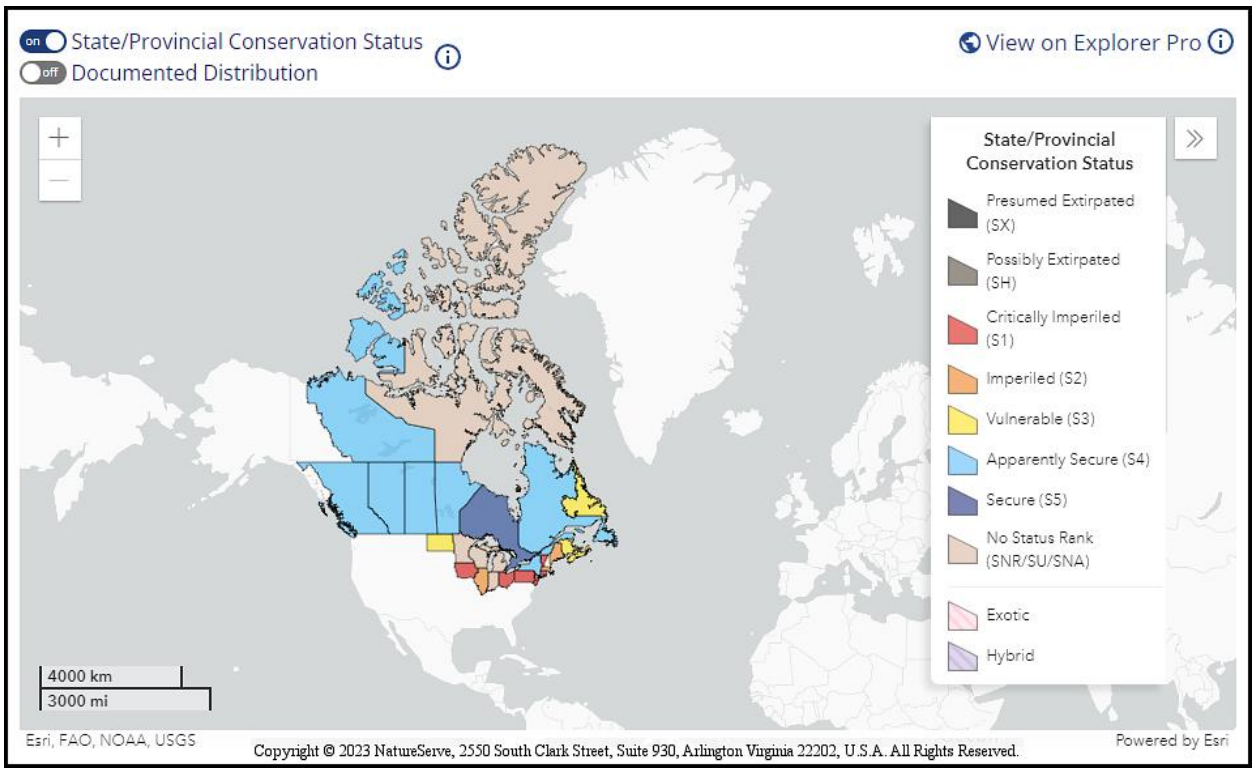


Figure 3. Conservation status of G. labradoricum in North America (NatureServe 2023).

New Jersey is one of the states where *Galium labradoricum* 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. *G. labradoricum* 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 the bedstraw 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).

Kenneth Mackenzie collected *Galium labradoricum* in Sussex County, New Jersey during 1922 (NJNHP 2022) but prior to that the bedstraw's range was thought to reach its southeastern limit in New York and Connecticut (Taylor 1915). About ten years after the first collection two more occurrences were documented in Sussex and Warren counties, and an additional population was located in Sussex County in 1962 (NJNHP 2022). The Warren occurrence may have been lost for a time because during the 1970s *G. labradoricum* was only thought to be extant in Sussex County, and it was one of the earliest species to be listed as endangered in the state due to its rarity and the fragility of its habitat (Fairbrothers and Hough 1973, Hough 1983). All of the Sussex County populations that were known when Fairbrothers and Hough classified *G. labradoricum* as endangered are now considered historical, but during the 1980s David Snyder relocated the original Warren County site and two additional occurrences were documented. Breden et al. (2006) reported three extant populations of *G. labradoricum*, two in Warren County

and one in Sussex, and that is still thought to be the case although the Sussex County population has not been revisited since it was first discovered in 1984 (NJNHP 2022).

Threats

Fairbrothers and Hough (1973) noted that *Galium labradoricum* was in a precarious position in New Jersey because the bogs where the bedstraw was growing could be so easily destroyed. Fen communities can be substantially altered by changes in hydrology or water quality, the presence of invasive species, or natural succession, all of which make the sites less hospitable for the native herbaceous species that utilize them (Johnson and Walz 2013). Invasive plants including *Phragmites australis* spp. *australis*, *Lythrum salicaria*, *Elaeagnus umbellata*, and *Rosa multiflora* have recently been noted as a threat to one extant *G. labradoricum* occurrence in the state.

Many of the hydrologic changes to sensitive *Galium labradoricum* habitats are caused by human endeavors but beaver activity can also be a threat. A lacustrine marsh where *G. labradoricum* was growing in Alberta was flooded by beavers while the site was under study, although specific impacts to the bedstraw were not discussed (Thormann and Bayley 1997). One New Jersey population of *G. labradoricum* was inundated for a lengthy period as a result of beaver activity. The mammals were subsequently removed and some of the plants survived but the bedstraw was noted to be much less abundant at the site. Searches of another New Jersey locality where the habitat had been flooded failed to turn up any surviving *G. labradoricum* plants (NJNHP 2022).

Herbivory does not appear to pose a significant threat to *Galium labradoricum*. *Galium* species on the whole have few insect herbivores, although some bedstraws are subject to gall-forming insects (Batra 1984). Browsing by mammals may actually have a positive effect. Many *Galium* species appear to benefit from grazing, possibly due to reduced competition from overstory vegetation (Les 2017). Pellerin et al. (2006) found that *G. labradoricum* was more abundant in fens with deer than it was in those where no deer were present.

Because *Galium labradoricum* is a northern plant that reaches its southern limit in New Jersey, existing threats to populations in the state are likely to be exacerbated by climate change. Changing precipitation patterns and rising temperatures are leading to more frequent and prolonged droughts in New Jersey, as well as unpredictable flooding events (Hill et al. 2020). Fen communities are highly vulnerable to climactic shifts because of the hydrologic impacts (Johnson and Walz 2013). An assessment of the potential effects of climate change on selected plants determined that *G. labradoricum* was moderately vulnerable in New Jersey (Ring et al. 2013), and a similar assessment in Pennsylvania concluded that the species was highly vulnerable in that state (Schuette 2020). Most of the places where *G. labradoricum* is already imperiled are located along the southern edge of its current range (Figure 3), so the global extent of the bedstraw is likely to be reduced as the climate continues to warm.

Management Summary and Recommendations

Occurrences of *Galium labradoricum* in New Jersey are of particular conservation importance because they are located along the southernmost boundary of the species' range. Populations situated along range edges can contain genotypes that have a higher tolerance for climactic extremes and are thus better adapted to survive during periods of rapid change (Rehm et al. 2015). Consequently, it would be advantageous to have a better understanding of *G. labradoricum*'s current status in the state. Updated assessments are needed for two of the populations that are considered extant, and surveys of several historical sites might also prove to be fruitful.

There are a number of areas where additional studies could help to fill gaps in knowledge about *Galium labradoricum*. Few specifics are available regarding Labrador Marsh Bedstraw's potential for self-pollination, strategies for dispersal of seeds and vegetative propagules, establishment requirements, or mycorrhizal relationships. An investment in research could aid in planning for conservation of *G. labradoricum* in the portions of its range where the bedstraw is imperiled.

Synonyms

The accepted botanical name of the species is *Galium labradoricum* (Wiegand) Wiegand. Orthographic variants, synonyms, and common names are listed below (ITIS 2021, POWO 2023, USDA NRCS 2023b). Wiegand initially described Labrador Marsh Bedstraw as a variety of *G. tinctorium* but later elevated it to species status at Fernald's urging (Wiegand 1897, 1904).

Botanical Synonyms	**Common Names**
Galium tinctorium var. *labradoricum* Wiegand	Labrador Marsh Bedstraw Northern Bog Bedstraw

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