

Rhynchospora capillacea

Capillary Beaked-rush

Cyperaceae



Rhynchospora capillacea by Pat Deacon, 2022

***Rhynchospora capillacea* 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

501 E. State St.
PO Box 420
Trenton, NJ 08625-0420

Prepared by:
Jill S. Dodds
jsdodds@biostarassociates.com

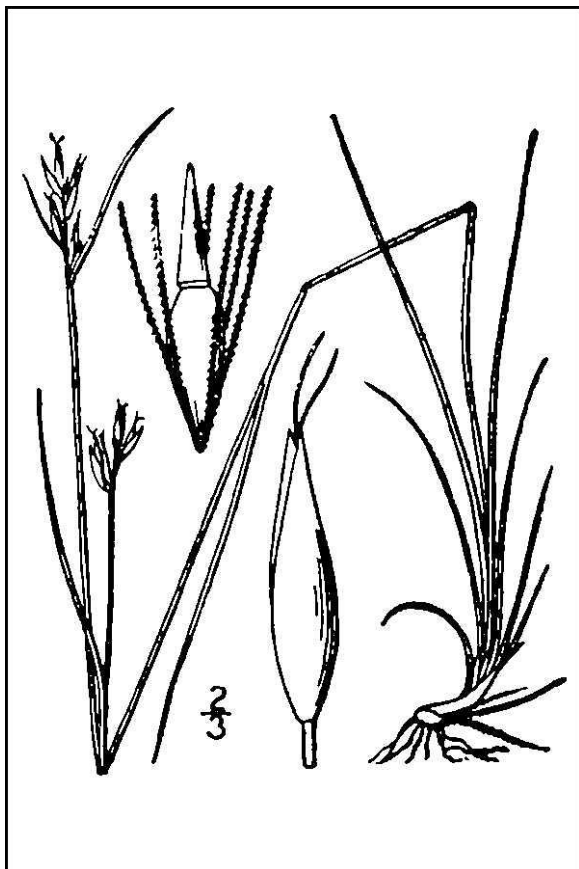
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For:
New Jersey Department of Environmental Protection
Office of Natural Lands Management
New Jersey Natural Heritage Program
natlands@dep.nj.gov

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Life History

Rhynchospora capillacea (Capillary Beaked-rush) is a tuft-forming sedge with thin (1.5 mm diameter) stoloniferous rhizomes. The wiry stems may be 10–40 cm tall. The leaves are bristle-like and less than 0.5 mm wide, rolling inward along the edges. The inflorescence consists of one or two (occasionally three) small clusters of spikelets at the top of the stem. The spikelets point upward so each cluster is less than 1 cm wide, and small bracts are present at the base of the clusters. The spindle-shaped spikelets of *R. capillacea* are brown and 6–7 mm in length. One or more of the lowest scales is empty, and only five or fewer scales per spikelet are fertile. The achenes are 1.5–2 mm long and half as wide, narrowing to stalk-like bases, and they are topped with slender, triangular tubercles 0.8–1.7 mm long. Six bristles surround the base of each achene, nearly reaching the top of the tubercle. In most plants the bristles have backward-pointing barbs but a smooth-bristled form can occur throughout the range of the species. (See Britton and Brown 1913, Gale 1944, Fernald 1950, Fassett 1957, Godfrey and Wooten 1981, Gleason and Cronquist 1991, Arsenault et al. 2013, Kral 2020). The blooming period of *Rhynchospora capillacea* begins in July and fruits may be present until late September or October (Hough 1983, Weakley et al. 2022).



Left: Illustration from Britton and Brown 1913, courtesy USDA NRCS 2023a. Right: Carl-Adam Wegenschimmel, 2020.

Rhynchospora capitellata is very similar to *R. capillacea* and it can sometimes grow in the same habitat. Unlike *Rhynchospora capillacea*, *R. capitellata* has flat leaves that are 1.5–3.5 mm

wide, denser more widely-spreading spikelet clusters, and achenes that are broader than half their length (Arsenault et al. 2013, Kral 2020, Weakley et al. 2022).

Pollinator Dynamics

Most species in the Cyperaceae are wind-pollinated but insect pollination has also been documented in several sedge genera, including *Rhynchospora*. Nearly all of the insect-pollinated sedges are also pollinated by wind (Goetghebeur 1998). Wind is the prevailing pollination mechanism for the majority of *Rhynchospora* species except for those in section *Dichromena*: The flowers of plants in that group have pale, leafy involucre bracts, white glumes, and sticky pollen and use insects as their primary means of cross-fertilization (Lucero et al. 2014). Some New Jersey *Rhynchospora* species, including *R. alba* and *R. pallida*, utilize a combination of insect and wind pollination. However, the floral morphology of *Rhynchospora capillacea*, exemplified by inconspicuous brown spikelets in small clusters, is indicative of wind pollination (da Costa et al. 2021).

Seed Dispersal and Establishment

Potential vectors of *Rhynchospora* seeds include both wind and water, and species with barbed bristles are also likely to be transported by animals via attachment to feathers or fur (Leck and Schütz 2005). Farnsworth and Ogurcak (2008) characterized *R. capillacea* as a wind-dispersed plant but Ferren et al. (2013) emphasized the role of the bristles in dispersing the species' achenes. *R. capillacea* seeds might sometimes be dispersed following consumption by birds or small mammals, as *Rhynchospora* achenes are known to occasionally be eaten by waterfowl (McAtee 1918, Mabbott 1920, Fassett 1957), and the small propagules could also be relocated by adherence to animals' muddy feet (Bryson and Carter 2008). The longevity of *R. capillacea* seeds has not been evaluated, but many other species in the genus are known to maintain seed banks (Leck and Schütz 2005).

Initial results from *Rhynchospora capillacea* seed germination trials conducted by the New England Wild Flower Society indicated that the seeds require a period of stratification before they can germinate (Cullina 2002). The sedge appears to establish most successfully on bare soil and it is generally an early successional species in the communities where it occurs (Seischab and Bernard 1985, Cullina 2002, Farnsworth and Ogurcak 2008). Many sedges are known to form mycorrhizal associations, including some species of *Rhynchospora* (Wang and Qiu 2006), although it is not clear whether that is the case for *R. capillacea*.

Habitat

Rhynchospora capillacea is a calciphile, growing almost exclusively over limestone or other calcareous substrates. Habitats where pH was measured were found to be slightly basic, with reported averages of 7.4 and 7.66 (Heibert et al. 1986, Altricher et al. 2018). Capillary Beaked-rush occurs at elevations ranging from 1–1000 meters above sea level in wet habitats such as

bogs, fens, marshes, meadows, springs, and seeps. Some seepage areas are situated alongside rivers or streams, while others may be on dripping cliffs or wet ledges (Hough 1983, Orzell et al. 1985, Ogle 1989a, Jones and Jones 1990, Allison and Stevens 2001, Cullina 2002, Rhoads and Block 2007, Arsenault et al. 2013, Kral 2020, Weakley et al. 2022). In a North Dakota fen complex, *R. capillacea* was growing in floating mat communities that were characterized by short, fine-textured vegetation and standing water for most of the growing season (Altricher et al. 2018). One Virginia population was found in a site that had been heavily pastured (Ogle 1989b). All of New Jersey's extant populations are located in calcareous fens (Johnson and Walz 2013, NJNHP 2022).

Throughout its range there are a variety of communities where *Rhynchospora capillacea* has been noted as a characteristic or dominant species. At one spring-fed elevated bog in Indiana, *R. capillacea* was described as sod-forming due to its extremely dense growth around the springs, stream beds, and shallow pools (Starcs 1961). *R. capillacea* was also cited as a typical species of Indiana's interdunal pannes, which are ponded depressions in wet, calcareous sand situated on the lee side of lakeshore dunes (Homoya et al. 1985, Heibert et al. 1986). Lundholm and Larson (2003) identified *R. capillacea* as one of the dominant species in a limestone pavement alvar (a plant community on shallow soils over limestone bedrock) in southern Ontario, while a Texas community where the sedge was prevalent was labeled as a Sawgrass—Spikesedge—Beakrush/Whitetop—Black Bogrush—Aparejogress Herbaceous Vegetation Association (Singhurst et al. 2010).

In New Jersey, Capillary Beaked-rush is a significant component of Lakeshore Marl Fen (*Dasiphora fruticosa* ssp. *floribunda* / *Rhynchospora capillacea*—*Scleria verticillata* Shrub Herbaceous Vegetation Association), a community that is critically imperiled (S1) in the state. The sedge may also be found in the imperiled (S2) Northern Piedmont Rich Fen (*Morella pensylvanica*—*Dasiphora fruticosa* ssp. *floribunda* / *Carex sterilis*—*Carex flava* Shrub Herbaceous Vegetation Association), or in certain communities dominated by *Cladium mariscoides* such as the Twig-rush Seasonally Flooded Herbaceous Alliance (Breden et al. 2001).

Within the communities where *Rhynchospora capillacea* occurs, the sedge favors particular positions that suggest a high requirement for light and little tolerance for competition. The plants usually establish on open substrate or areas of microdisturbance, persisting only in sites with low-growing vegetation (Sorrie 1987, Nekola 1994, MANHESP 2019). At one Ohio site, Choesin and Boerner (2000) observed that *R. capillacea* was abundant on the open marl and had a lesser presence in the sedge meadow. In an Iowa fen, *R. capillacea* dominated the sedge mat, where the majority of plants were between 25–35 cm in height, but was a minor species in the outer border zone where most plants were considerably taller (Van Der Valk 1975).

Hydrologic gradient probably has a strong influence on microsite suitability. Heibert et al. (1986) noted that the *Rhynchospora capillacea* plants in the Indiana pannes grew in the zone between seasonal high and low water levels where they had to survive periodic inundation. A study by Janssens and Johnson (2001) documented the expansion of Capillary Beaked-rush in two communities following relatively minor changes in water levels. In a short sedge-*Triglochin* patterned fen where *R. capillacea* was already well established, the species expanded its range

when a lower water table opened up microsites that had previously been pools or pool margins covered by bryophytes. In a nearby *Scirpus pungens* fen, *R. capillacea* appeared after the site conditions became wetter. At the latter location, the authors were not certain whether the sedge had already been present in the seed bank or whether it had established from seeds that originated in the patterned fen.

Wetland Indicator Status

Rhynchospora capillacea 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)

RHCA11

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 *Rhynchospora capillacea* includes portions of the United States and Canada (POWO 2023). The map in Figure 1 depicts the extent of *R. capillacea* in North America.

The USDA PLANTS Database (2023b) shows records of *Rhynchospora capillacea* in two New Jersey counties: Sussex and Warren (Figure 2). Records from Mid-Atlantic Herbaria (2023) indicated that specimens have also been collected in Atlantic, Burlington, Camden, Middlesex, and Monmouth counties. The data include historic observations and do not reflect the current distribution of the species.

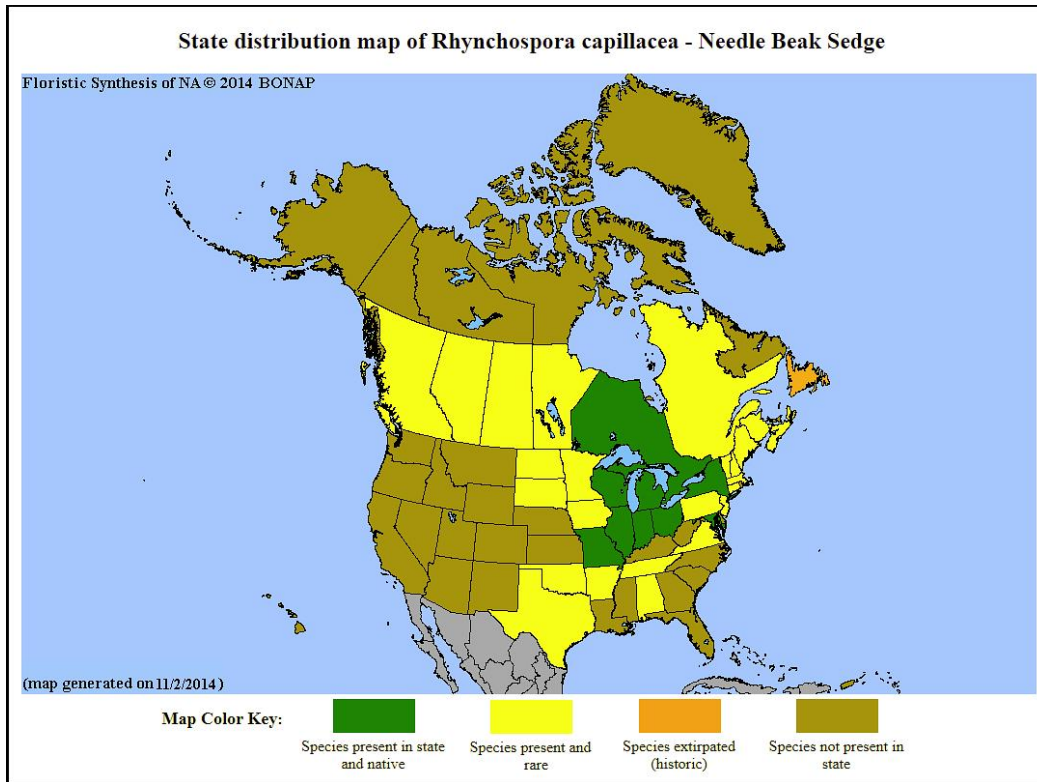


Figure 1. Distribution of *R. capillacea* in North America, adapted from BONAP (Kartesz 2015).

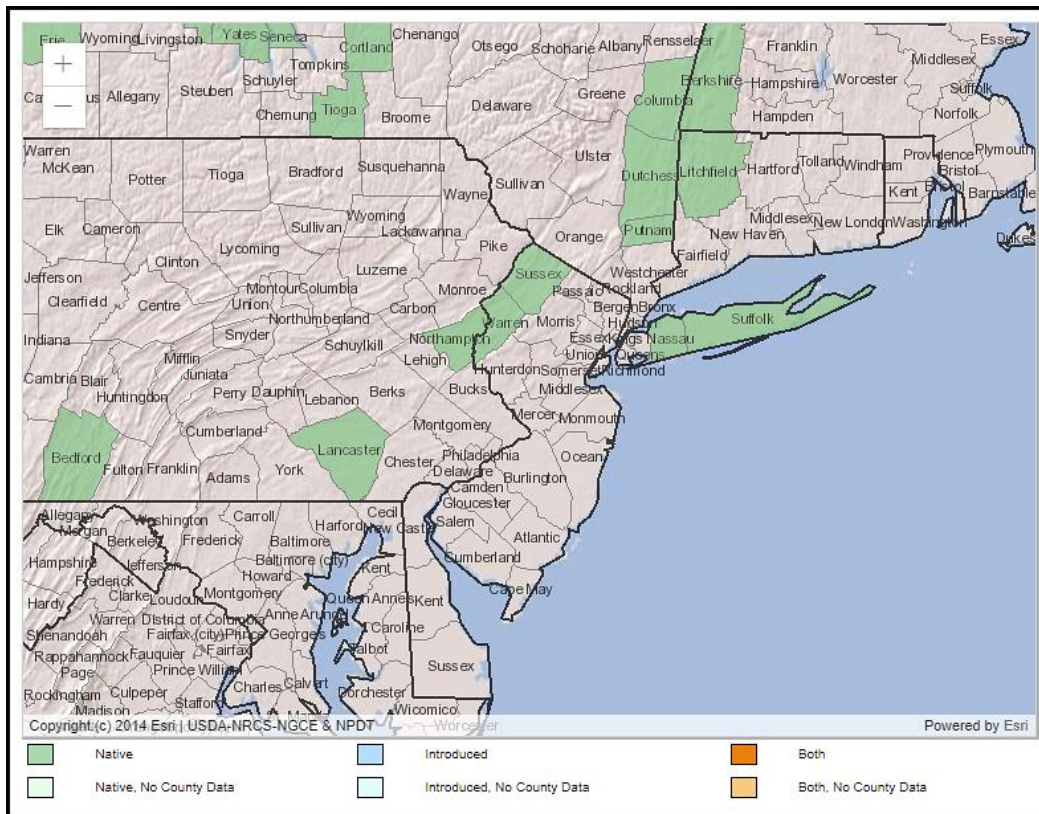


Figure 2. County records of *R. capillacea* in New Jersey and vicinity (USDA NRCS 2023b).

Conservation Status

Rhynchospora capillacea 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 local recent 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 3) illustrates the conservation status of *R. capillacea* throughout its range. The sedge is vulnerable (moderate risk of extinction) in two provinces, imperiled (high risk of extinction) in three provinces and five states, critically imperiled (very high risk of extinction) in twelve states and two provinces, and possibly extirpated in Newfoundland. *R. capillacea* is apparently secure in New York and Ontario, and it has not been ranked in six states.

In North America, *Rhynchospora capillacea* has also been 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 R2 (imperiled), signifying a high risk of extinction (Frances 2017).

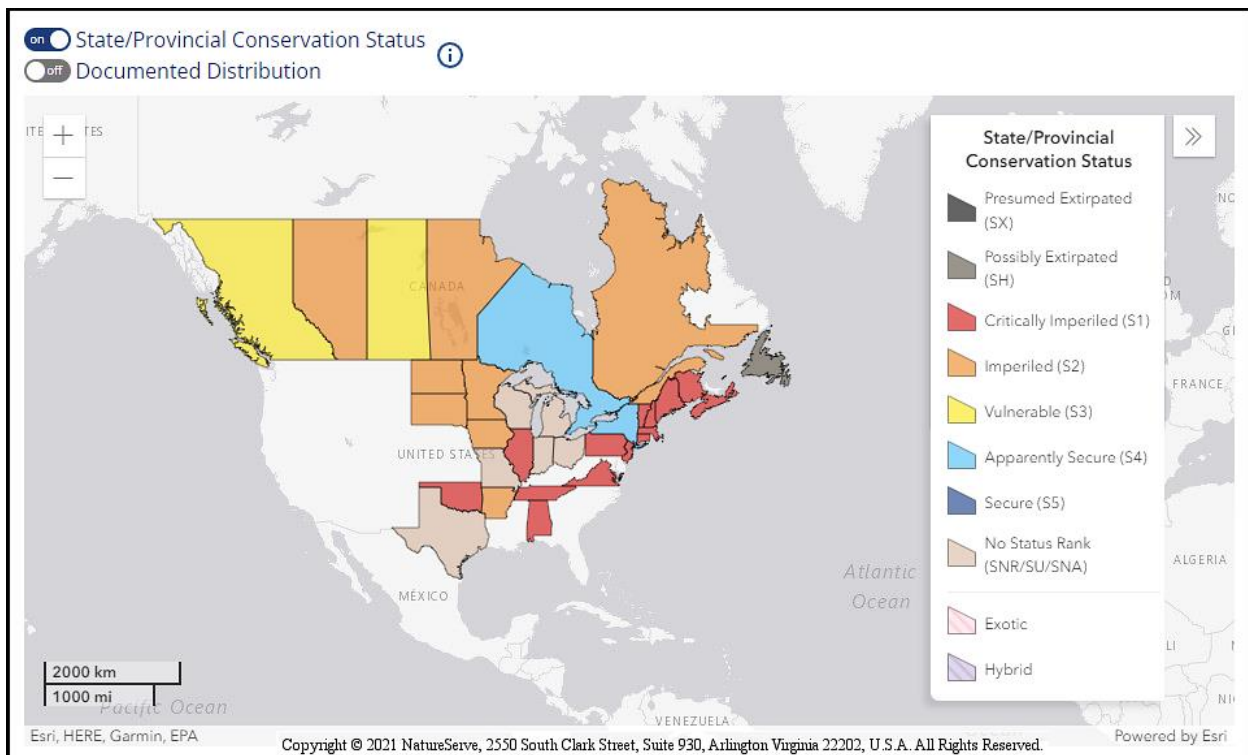


Figure 3. Conservation status of *R. capillacea* in North America (NatureServe 2023).

Rhynchospora capillacea is critically imperiled (S1) in New Jersey (NJNHP 2022). The rank usually 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. *R. capillacea* 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 sedge 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).

Britton (1889) reported a single occurrence of *Rhynchospora capillacea* in New Jersey, and that population is still extant (NJNHP 2022). Nine additional occurrences are presently tracked in the Natural Heritage Database: Six extant or possibly so, one historical, and two extirpated. All of the tracked populations are located in either Sussex or Warren County. Both Taylor (1915) and Hough (1983) indicated that those were the only two counties where *R. capillacea* occurred, but sites in Burlington and Camden County were reported by Stone (1911). Stone's record, along with other reports of the species from central and southern counties (Mid-Atlantic Herbaria 2023), raises a question as to whether *R. capillacea* could establish in parts of New Jersey outside of the limestone district, which is mainly restricted to the northwestern counties (NJGWS 2016). A Cretaceous-era band of sand, silt and clay that stretches across the lower part of the state contains significant deposits of lime marl (Tedrow 2002), and in some places the soils are slightly alkaline (Wherry 1920). Calciphilic plants have also been known to establish on calcium-rich anthropogenic habitats such as coastal shell middens (Eleuterius and Otvos 1979, McAvoy and Harrison 2012). It is equally possible that some of the old reports of *R. capillacea* in New Jersey were based on misidentified specimens.

Threats

Loss of habitat and curtailment of the natural disturbance regimes that deter succession are the primary threats to *Rhynchospora capillacea* throughout its range (Cullina 2002, MANHESP 2019). The fen communities favored by Capillary Beaked-rush are relatively rare in New Jersey and they face an assortment of threats as a result of regional development, overbrowsing, and natural succession. Activities on adjacent land, or even at other locations in the watershed, can result in changes to hydrology or water quality that make the sites more accessible to native and non-native plant species that would not otherwise be able to establish there. The sensitive habitats can also be damaged by impacts from all-terrain vehicles or foot traffic (Moore et al. 1989, Johnson and Walz 2013).

A former New Jersey population of *Rhynchospora capillacea* was eradicated by the construction of a dam that left the site permanently flooded (Breden et al. 2006), and two other populations currently face possible impacts from offsite activities—one due a nearby housing development and one because of an agricultural field (NJNHP 2022). At two locations direct damage from deer trails and/or foot traffic was noted as a concern (NJNHP 2022). However, while trampling may harm individual plants, such small-scale disturbances could benefit the population as a whole by creating bare soil where *R. capillacea* can regenerate (Seischab and Bernard 1985).

Because *Rhynchospora capillacea* requires open space to establish and is seldom found growing amongst taller plants it is thought to be a poor competitor. During a study of an Iowa fen complex, Van Der Valk (1976) observed a difference in the height of *R. capillacea* plants growing in two different vegetation zones. The beaked-rush was dominant on a sedge mat where growing conditions appeared to be harsh in comparison to other zones in the complex, but had a reduced presence in the border zone where growing conditions seemed to be more favorable. However, *R. capillacea* plants growing in the border zone had an average height of 30 cm while those on the sedge mat had an average height of 17cm. The author attributed the greater abundance of *R. capillacea* in the less favorable habitat to the presence of fewer competitors. In New Jersey fens, *R. capillacea* can face competition from both native and non-indigenous species. Loss of habitat due to the encroachment of woody plants was noted at two sites. The spread of invasives, particularly *Lythrum salicaria*, *Carlina vulgaris*, and *Phragmites australis* ssp. *australis*, has been identified as a threat to multiple occurrences (NJNHP 2022).

Heavy deer browsing has been reported in two New Jersey fens supporting *Rhynchospora capillacea* (NJHP 2022), although the extent of its impact on the sedge was not clear. The rhizomatous plants might be able to recover from occasional browsing but frequent incidents could deplete their belowground resources, and at certain times of year herbivory could prevent completion of the reproductive cycle.

More than two dozen kinds of smut fungi are known to occur on *Rhynchospora* species and infections can prevent the development of flowers or fruits (Vánky 2010). There does not appear to be any documentation of a smut fungus on *R. capillacea*, and no other reports of disease in the species were found.

Some New Jersey populations of *Rhynchospora capillacea* are already facing multiple threats, and the problem could be exacerbated by climate change. Shifting climactic conditions in New Jersey are resulting in higher temperatures, more frequent and intense precipitation events, and increasing periods of drought (Hill et al. 2020). An assessment of the potential effects of climate change on *R. capillacea* concluded that the species was moderately vulnerable in the state (Ring et al. 2013). New Jersey's fens are highly vulnerable to climate change at the community level because changing weather patterns can alter natural hydrologic regimes, making the habitats become less suitable for specialist species and more susceptible to generalist or invasive species (Johnson and Walz 2013).

Management Summary and Recommendations

Calcareous fens are fragile communities in need of protection, particularly in New Jersey's highly urbanized landscape. Conservation of fen habitats in the state would benefit *Rhynchospora capillacea* as well as a number of other rare plant species. Efforts might include land preservation, the establishment of buffers to maintain stable hydrology and water quality, and site-specific management planning for the control of succession and invasive species.

Seven presumably extant populations of *Rhynchospora capillacea* are tracked in New Jersey but several of the occurrences have not been observed for many years, including one where close

monitoring of succession was recommended more than three decades ago. At three sites that were visited more recently an urgent need for the control of invasive plants was identified. Although *R. capillacea* has been characterized as an early successional species, established populations can persist for a long time when habitat conditions remain favorable—as evidenced by the fact that hundreds of plants were observed just a short time ago at a location where the beaked-rush was first collected in 1884 (NJNHP 2022). It might be prudent to select a few of the more exemplary occurrences for an investment of limited management resources.

Much of the current understanding regarding the sedge's habitat requirements and community interactions is based on anecdotal evidence rather than formal studies. There are several areas where additional data could inform more effective planning for long-term management of *Rhynchospora capillacea* populations: Some examples include seed banking capacity, mycorrhizal relationships, or herbivory impacts. It would also be interesting to know whether *R. capillacea* can colonize other calcium-rich environments in New Jersey outside of the northwestern counties.

Synonyms

The accepted botanical name of the species is *Rhynchospora capillacea* Torr. Orthographic variants, synonyms, and common names are listed below (ITIS 2021, POWO 2023, USDA NRCS 2023b).

Botanical Synonyms

Rhynchospora capillacea var. *leviseta* E. J. Hill ex A. Gray
Rhynchospora capillacea f. *leviseta* (E. J. Hill ex A. Gray) Fernald
Rhynchospora setacea MacMill.
Rhynchospora smallii Britton
Phaeocephalum capillaceum (Torr.) Farw.
Phaeocephalum capillaceum var. *levisetum* Farw.

Common Names

Capillary Beaked-rush
Horned Beakrush
Needle Beak Sedge

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