

Scleria verticillata

Whorled Nut-rush

Cyperaceae



Scleria verticillata by Samuel Brinker, 2021

***Scleria verticillata* 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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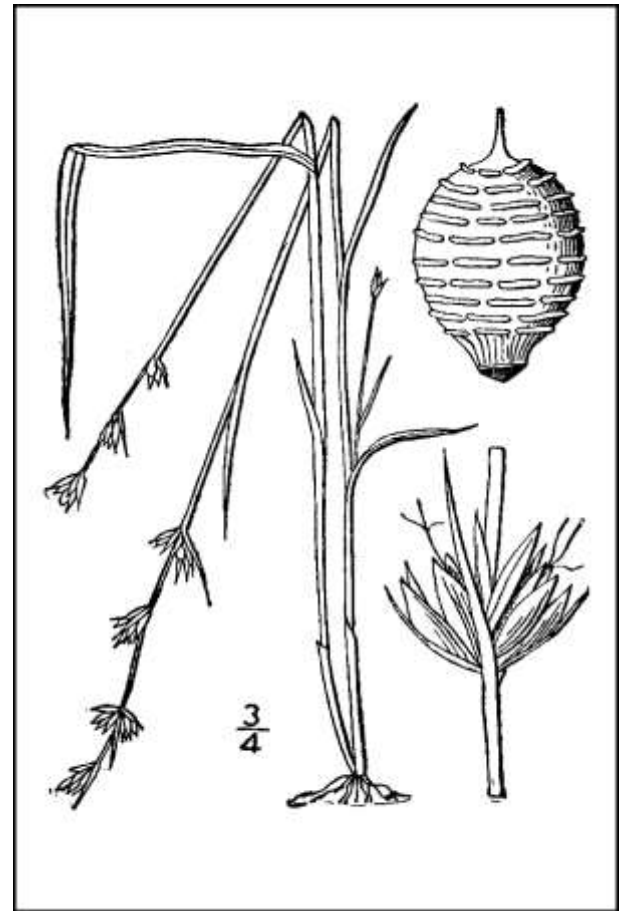
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Life History

Scleria verticillata (Whorled Nut-rush) is a slender annual sedge with reddish fibrous roots. Sedges in the genus *Scleria* have pale, bony achenes with a specialized structure at the base known as a hypogynium—a hardened disc that differs from the achene body in form and texture. *S. verticillata* differs from the other New Jersey species of *Scleria* in that the hypogynium is greatly reduced or absent. *S. verticillata* stems may be solitary or in tufts, and they are simple, three-sided, smooth, erect, and 10–60 cm tall. The leaves are 0.5–2 mm wide, shorter than the stems, and smooth, although some hair can be present on the sheaths. The inflorescence of Whorled Nut-rush is an interrupted spike of 2–8 sessile clusters of spikelets that are distributed in a somewhat spiral fashion along the stem. The spikelets are 2–3 mm long and may be subtended by bristle-like bracts up to 7 mm in length. The achenes are white, gray or brownish, 1–1.5 mm long, and have longitudinal ridges on the surface and distinctly pointed tips. It is often noted that the plants—and particularly the roots—are fragrant when drying, although that is not a handy feature for field identification. (See Britton and Brown 1913, Core 1936, Fernald 1950, Godfrey and Wooten 1981, Kessler 1987, Gleason and Cronquist 1991, Reznicek et al. 2020). In New Jersey flowering begins in July and fruit may be produced from early August to mid-September (Stone 1911, Hough 1983).



Left: Samuel Brinker, 2010. Right: Britton and Brown 1913, courtesy USDA NRCS 2022a.

Pollinator Dynamics

The majority of species in the Cyperaceae are pollinated by wind, and while there are a few notable exceptions in scattered genera no alternative pollination mechanisms have been reported for *Scleria* (Goetghebeur 1998). Adaptations to wind pollination in the family include large anthers, long filaments, and prominent stigmas (Zomlefer 1994). It seems likely that wind is the pollination mechanism for *Scleria verticillata*.

Cross-pollination is presumed for the majority of sedges (Bryson and Carter 2008). Most species in the Cyperaceae enhance the likelihood of cross-fertilization by developing female flowers in advance of male flowers and or by achieving floral maturity in a bottom-to-top sequence (Goetghebeur 1998). However, Ramirez and Seres (1994) found that *Scleria latifolia* was partially self-compatible and self-fertility has also been reported in *S. lacustris* (Jacono et al. 2011). Consequently, outcrossing cannot be assumed for *S. verticillata*.

Seed Dispersal

Scleria plants produce separate male and female flowers, and one-flowered pistillate spikelets are typically intermixed with clusters of several-flowered staminate spikelets (Fernald 1950). Each of *Scleria verticillata*'s 2–8 spikelet clusters is few-flowered and female flowers only produces a single achene, so the plants' reproductive efforts result in a few large propagules rather than numerous small seeds. The achenes have no specialized structures for wind dispersal, although some may be locally dispersed by gravity. Water dispersal is a common mechanism in the genus (Diaz 2019), and Jacono (2008) found that the seeds of *S. lacustris* can float for several days before sinking. Bird consumption of *Scleria* achenes has been reported and may result in some longer-distance dispersal. *Scleria verticillata* and other *Scleria spp.* are important winter food plants for northern bobwhite (*Colinus virginianus*) in Florida (Pittman 2019), and *Scleria* seeds comprise a small portion of the diet of Fulvous Whistling Ducks (*Dendrocygna bicolor*) in Louisiana (Hohman et al. 1996). Bird dispersal of *Scleria* seeds was also cited by Leck and Schutz (2005), although the authors noted that large seeds generally have longer gut retention times which may decrease viability.

Jacono (2008) studied the regeneration ecology of *Scleria lacustris* and found that the species had a large and persistent seed bank. However, *S. lacustris* is an invasive species in Florida and similar strategies cannot be assumed for a plant like *Scleria verticillata* that is rare throughout much of its range. No specific information regarding seed dispersal, persistence, or germination was found for *S. verticillata*.

Habitat

Scleria verticillata occurs in wet, sandy, marly or peaty soils at elevations of 0–400 meters (Reznicek et al. 2020). The communities where it has been found are usually open, and include bogs, fens, grasslands, interdunal swales, lakeshores, marshes, savannas, and moist pinelands (Fairey 1967, Rhoads and Block 2007, Tucker and Ebinger 2011, Weakley 2015, Reznicek et al.

2020). Inland sites are nearly always described as calcareous or alkaline (LeBlond 2001, Rhoads and Block 2007, Weakley 2015) and *S. verticillata* has often been described as an obligate calciphile (Bridges 1985, Orzell and Kurz 1986, MNDNR 2022) or as being restricted to calcium-rich habitats such as fens and marl flats (Pearson and Leoschke 1992, Stockmeier and Givnish 2019). In Tennessee, the sedge was a component of tallgrass prairie dominated by tall panic-grasses (*P. anceps*, *P. virgatum*), Little Bluestem (*Schizachyrium scoparium*), and Big Bluestem (*Andropogon gerardii*) and the prairie substrate was described as limestone with a loess cap of varying thicknesses (DeSelm 1990).

New Jersey's sole extant population of Whorled Nut-rush grows in Lakeshore Marl Fen habitat (*Dasiphora fruticosa* ssp. *floribunda* / *Rhynchospora capillacea*—*Scleria verticillata* shrub herbaceous vegetation) as described by Breden et al. (2001). The other inland occurrence, now extirpated, was located in a limestone sink but most of New Jersey's historic records of the species were from coastal sites (NJNHP 2022). Stone (1908) was familiar with a number of the former *Scleria verticillata* occurrences and described the habitat as a narrow strip of coastal vegetation between pinelands plants and maritime flora, where some representatives of both communities occurred but also a suite of species that were not found in either. At one of the sites he noted that *S. verticillata* was located "down in the grass just where the *Spartina* and *Juncus gerardi* of the marsh meet the upland species."

There may be a common element between the seemingly disparate inland and coastal habitats utilized by *Scleria verticillata* in New Jersey. Carpenter and Zedler (undated) noted that few species can tolerate the harsh alkaline conditions of highly calcareous soils, and some fen specialists are often also found in coastal areas or inland saline wetlands. *Triglochin maritima* is another state-endangered species that occurs in both fens and coastal areas (NJNHP 2022), and it was reported that both habitats have soils with the high electrolyte content that the plants require but the sources are calcium in fens and sodium or chloride in coastal communities (Havas and Vasari 1999). Another possibility is that the *S. verticillata* plants were occupying calcium-rich microsites in New Jersey's coastal marshes. At numerous sites along the Atlantic and Gulf coasts, unique vegetation communities characterized by calciphiles have developed on top of middens where piles of shells were placed by Native Americans thousands of years ago (Eleuterius and Otvos 1979, McAvoy and Harrison 2012). Radiocarbon dating of some middens indicated that they were created 3100–4900 years ago, and the calcium-enriched soils now support an array of plants that are not typical components of coastal flora (Stalter et al. 1999, Stalter et al. 2018).

Wetland Indicator Status

Scleria verticillata 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 2022b)

SCVE2

Coefficient of Conservatism (Walz et al. 2018)

CoC = 9. 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

Scleria verticillata is native to North America, and has been reported from parts of Central America, and the Caribbean (POWO 2022). However, recent molecular studies indicate that Caribbean and Central American specimens are actually *S. tenella*, and that *S. verticillata* is restricted to North America (Bauters 2018). The map in Figure 1 shows the extent of Whorled Nut-rush in the United States and Canada.

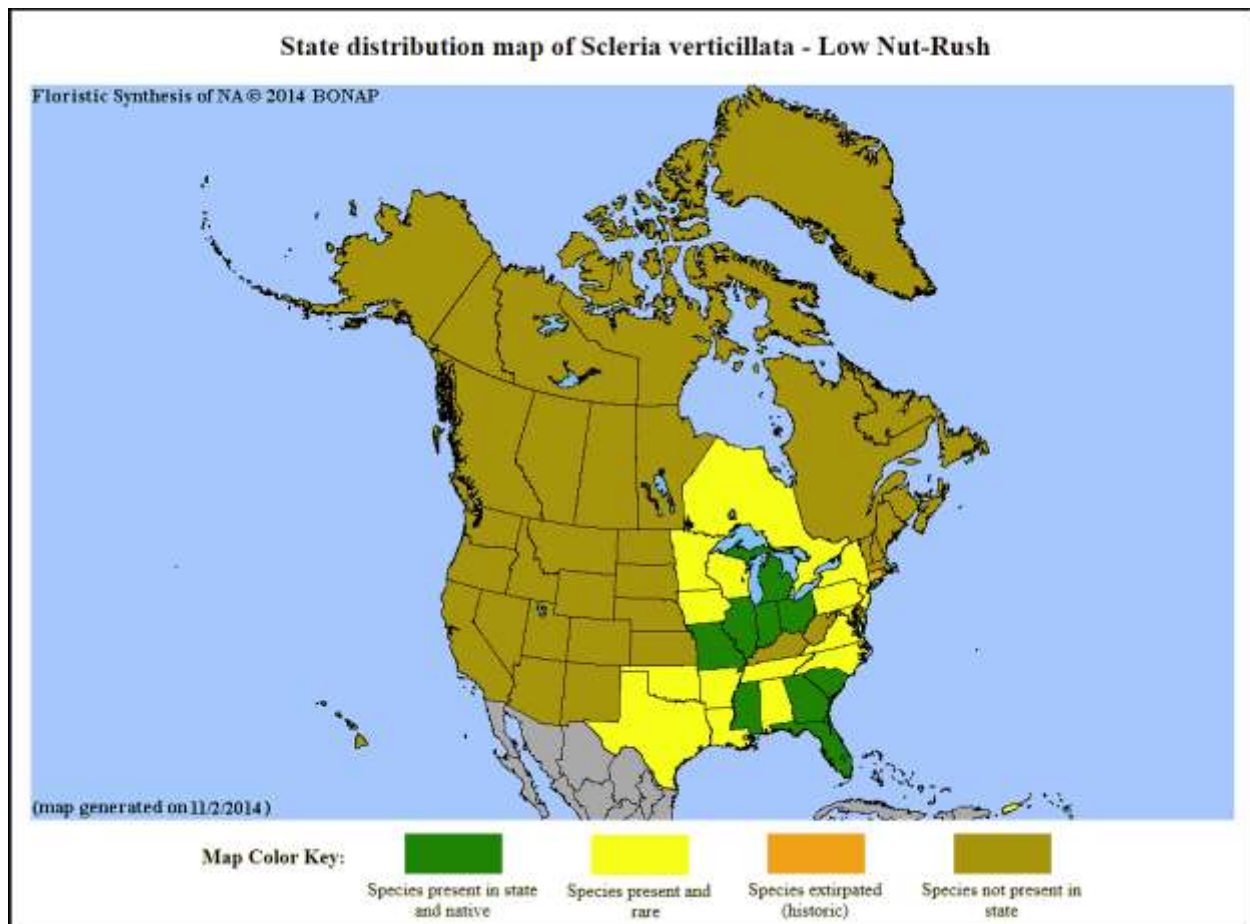


Figure 1. Distribution of *S. verticillata* in North America, adapted from BONAP (Kartesz 2015).

The USDA PLANTS Database (2022b) shows records of *Scleria verticillata* in five New Jersey counties: Atlantic, Bergen, Cape May, Sussex, and Warren (Figure 2 below). The data include historic observations and do not reflect the current distribution of the species.

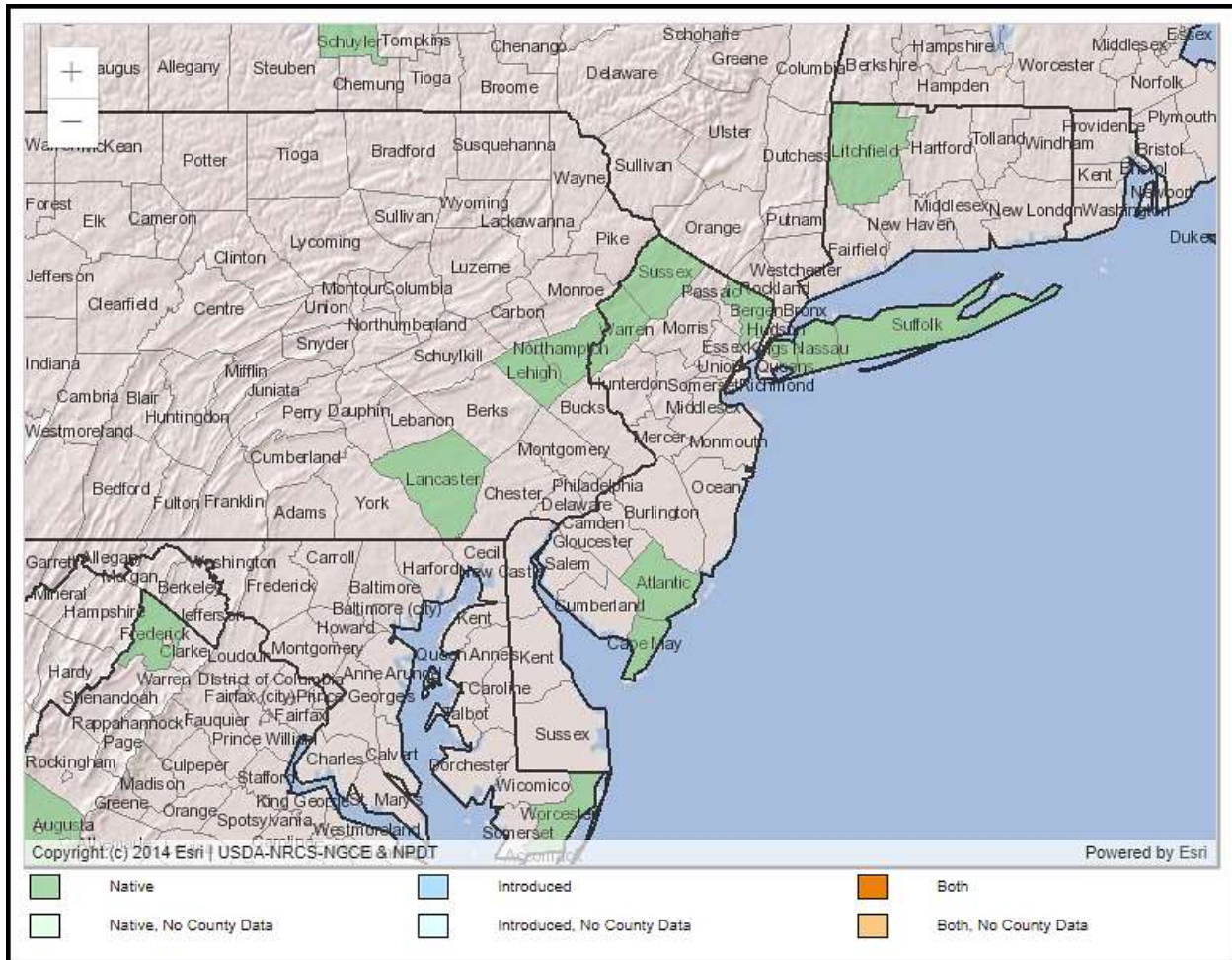


Figure 2. County records of *S. verticillata* in New Jersey and vicinity (USDA NRCS 2022b).

Conservation Status

Scleria verticillata 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 2022). The map below (Figure 3) illustrates the conservation status of Whorled Nut-rush throughout its range. *S. verticillata* is critically imperiled (very high risk of extinction) in eleven states, imperiled (high risk of extinction) in seven states, vulnerable (moderate risk of extinction) in two states and one province, and possibly extirpated in Connecticut. The species has not been ranked in four other states where it is known to occur. In North America, *Scleria verticillata* 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).

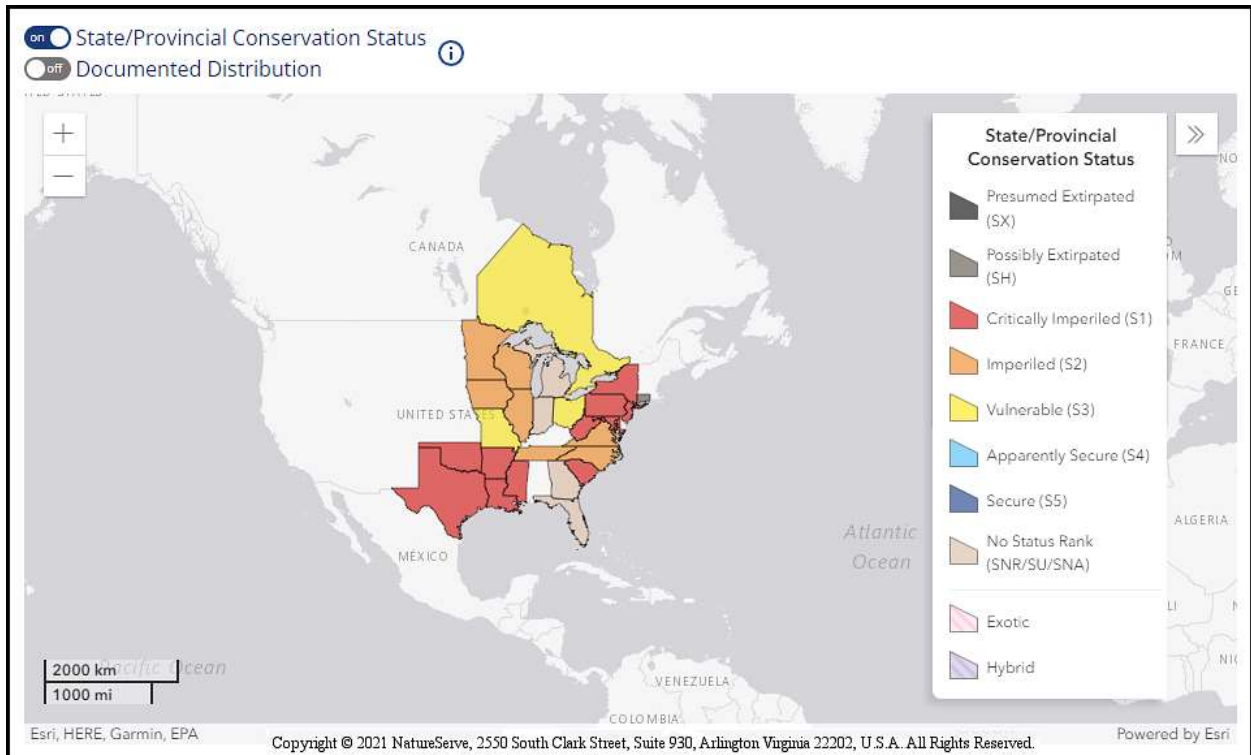


Figure 3. Conservation status of *S. verticillata* in North America (NatureServe 2022).

New Jersey is one of the states where *Scleria verticillata* is critically imperiled (NJNHP 2022). 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. *S. verticillata* 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 plant 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).

Stone (1911) said that *Scleria verticillata* was common along the edges of coastal marshes in southern New Jersey, and numerous collections of the species were made in that area between 1907 and 1916. Around the same time, *S. verticillata* was known from single occurrences in three northern counties and Taylor (1915) remarked that it was rare and scattered in the region. Unfortunately, all of New Jersey's coastal sites are now ranked as historic or extirpated and *S. verticillata* is only known from a single population in Warren County (NJNHP 2022).

Threats

The most significant threat to *Scleria verticillata* is habitat loss. At sites where the species is successful it may be locally common and persist for at least a century (NJNHP 2022) but its range-wide abundance is limited by a lack of suitable habitat. The Lakeshore Marl Fen

association utilized by Whorled Nut-rush is critically imperiled in the state (Breden et al. 2001), and other calcareous habitats in New Jersey such as fens and limestone sinks are also rare (Johnson and Walz 2013). Small plants that thrive in harsh habitats can be eliminated by competition when changes in hydrology or water quality make the sites more accessible to plant species that could not otherwise establish there (Moore et al. 1989). In Minnesota, the fen communities utilized by *S. verticillata* are unique, rare, and fragile and the sedge has declined as the habitat has been lost or degraded (MNDNR 2022). Pearson and Leoschke (1992) reported that nearly 40% of Iowa's fens had been destroyed by cultivation or drainage, and others had been impacted by grazing, edge effects from agricultural fields, nearby resource extraction, or establishment of woody plant species. The sensitive habitats can also be damaged by impacts from all-terrain vehicles or foot traffic (Moore et al. 1989, Johnson and Walz 2013).

Some habitat management methodologies utilized for the benefit of other species may pose a threat to *Scleria verticillata*. Impacts from mowing have been observed at the New Jersey site (NJNHP 2022). An evaluation of management techniques for the production of bobwhite food compared prescribed burns and roller chopping, and *Scleria spp.* (including *S. verticillata*) produced more stems and seeds when the latter method was used (Pittman 2019). Because the study was focused on bird forage, the techniques were compared to a traditional management tool (food plots) and not to unmanipulated habitat so conclusions about the actual cost or benefit to the sedge cannot be drawn.

New Jersey's calcareous habitats are also highly vulnerable to climate change. Shifts in natural hydrologic regimes resulting from altered weather patterns are likely to make the sites less suitable for specialist species and more susceptible to generalist or invasive species (Johnson and Walz 2013).

Management Summary and Recommendations

Protection of the sole extant occurrence is the obvious management priority for *Scleria verticillata* in New Jersey, and conservation efforts might include the development of a mowing plan that is compatible with the life history of the species. Unfortunately, there is insufficient information about critical aspects of the sedge's reproduction and establishment to serve as a foundation for such planning. Bryson and Carter (2008) observed that there is a paucity of information about fertilization in sedges, and information is particularly lacking regarding pollination and dispersal mechanisms in the genus *Scleria* (Diaz et al. 2019). Research concerning pollination strategies, seed dispersal and longevity, and requirements for germination and establishment in *Scleria verticillata* is essential in order to understand what is needed for the preservation of the species in states and provinces where it is imperiled.

Nine former *S. verticillata* occurrences along the New Jersey coast have been ranked as historical due to the presence of unsearched but potentially appropriate habitat, frequently because little detail was available regarding the location of the original observations (NJNHP 2022). Searches of suitable habitat in the transitional zone along the southern coast could prove fruitful, particularly in the vicinity of old shell middens that may have created favorable habitat for Whorled Nut-rush. Although many of the historic deposits have already been destroyed by

flooding, land-filling, and development, a number may still exist in the southernmost parts of the state (Kraft and Mounier 1972).

Synonyms

The accepted botanical name of the species is *Scleria verticillata* Muhl. ex Willd. Orthographic variants, synonyms, and common names are listed below (ITIS 2021, USDA NRCS 2022b, POWO 2022, Weakley 2015). While *Scleria tenella* has been reported as a synonym (USDA NRCS 2022b), recent molecular studies indicate that it is a distinct species occurring in Central and South America (Bauters 2018).

Botanical Synonyms

Scleria tenella Kunth
Scleria diffusa Michx. ex Kunth
Scleria kunthiana Steud.
Hypoporum diffusum Nees
Hypoporum verticillatum (Muhl. ex Willd.) Nees

Common Names

Whorled Nut-rush
Low Nutrush
Savanna Nutrush

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