Sporobolus neglectus

Small Rush-grass

Poaceae

Sporobolus neglectus courtesy John Hilty, Illinois Wildflowers

***Sporobolus neglectus* 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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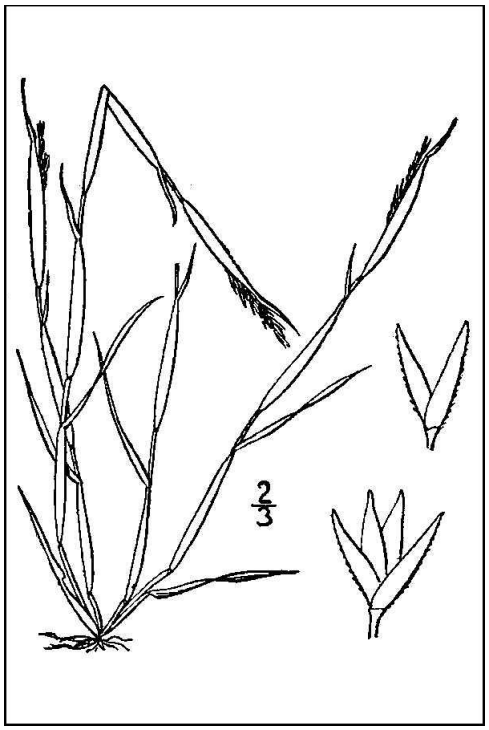
Life History

Sporobolus neglectus (Small Rush-grass) is an inconspicuous annual grass that grows in tufts. Fernald (1950) noted that the species name means overlooked or neglected. The stems are 10–45 cm tall but usually under 30 cm, and they may be either erect or reclining at the base and upturned at the end. The leaf sheaths are somewhat inflated and mostly smooth with small tufts of hair at the top, and the leaves are 1–12 cm long and no more than 2 mm wide. The inflorescence of *S. neglectus* is a spike-like panicle 2–5 cm long and 2–5 mm wide. The base of the terminal panicle is enclosed in the leaf sheath and lateral panicles may remain fully enclosed or become partially exserted. *Sporobolus* species have one fertile floret per spikelet. The spikelets of *S. neglectus* are 1.5–3 mm long and yellow to cream colored or sometimes tinged with purple, the two glumes are shorter than the florets, and the lemmas are smooth and awnless. (See Britton and Brown 1913, Fernald 1950, Hitchcock 1950, Gleason and Cronquist 1991, Mittelhauser et al. 2019, Peterson et al. 2021).



Left: Britton and Brown 1913, courtesy USDA NRCS 2023a. Right: Michael Oldham, 2021.

Sporobolus neglectus is a summer annual with a life cycle that includes a relatively long period of growth, a brief reproductive period, and senescence following seed set (Skokan 1983, Baskin and Baskin 2000). Germination takes place in the spring. Plants grown from seeds that germinated during late April were 5–10 cm tall by late June (Skokan 1983). Bennett (1987) found that *S. neglectus* plants took 147–158 days to reach flowering stage. Flowering and fruiting usually occur between August and October, but the process may extend into November in some locations (Rhoads and Block 2007, Weakley et al. 2022). In a Nebraska population studied by Skokan (1983) dispersal was completed by mid-November.

Mature fruit is required for identification of *Sporobolus neglectus*, as there are a number of closely related species with which it may be confused. *S. neglectus* is particularly similar to *Sporobolus vaginiflorus*, which is common throughout New Jersey, and *S. ozarkanus*, which does not occur in the state. *Sporobolus ozarkanus* has been treated as a variety of both *S. neglectus* and *S. vaginiflorus* at different times (Fernald 1933, Steyermark and Kucera 1961, Peterson et al. 2021), and Weakley et al. (2022) observed that the three species form a complex which is still poorly understood. The three species in the complex also have comparable life history characteristics and habitat preferences (McGregor 1990, Hilty 2020). Skokan (1983) noted that *S. neglectus* and *S. vaginiflorus* even flowered simultaneously. *Sporobolus neglectus* and *S. vaginiflorus* can be distinguished by their spikelets: Those of the latter species are usually longer (2.3–6 mm) and have pubescent lemmas (Fernald 1933, Colbry 1957, Peterson et al. 2021). Nash (1896) pointed out that the mature lemmas of *S. neglectus* usually appear pale and shining while those of *S. vaginiflorus* are typically dull and mottled, and Lamson-Scribner (1901) indicated that that culms of *S. neglectus* were more spreading.

Two other similar species, *Sporobolus clandestinus* and *S. compositus*, may also be encountered in New Jersey but they are somewhat rare (ranked S3 and S2 respectively) in the state (Kartesz 2015, NJNHP 2022). Molecular evidence indicated that both species are closely related to the *S. neglectus*/*S. vaginiflorus* complex (Peterson et al. 2014). *S. clandestinus* and *S. compositus* are perennials although first-year plants could be confused with one of the annual *Sporobolus* species. *S. compositus* has smooth lemmas but its glumes and lemma are three distinctly different lengths while those of *S. neglectus* are nearly equal in size; *S. clandestinus* has pubescent lemmas and terminal spikelets that are full exserted (Rhoads and Block 2007). Additional distinctions between the species can be detected at the microscopic level—details are available in Harms (2015) and Harms and Mendenhall (2015).

Pollinator Dynamics

A number of *Sporobolus* species have cleistogamous flowers that remain enclosed in the sheaths and are self-fertilized (Campbell et al. 1983). *Sporobolus neglectus* produces the majority of its seeds in that manner (Doyon and Dore 1967). Skokan (1983) estimated that 93.2% of reproduction in the species resulted from cleistogamy. All of the plants examined by Skokan had some cleistogamous florets, and some individuals were entirely cleistogamous. When chasmogamous (open-pollinated) florets were present they were restricted to the upper end of the terminal panicle. Exposed chasmogamous florets are likely to be pollinated by wind (Culley et al. 2002, Friedman and Barrett 2009). On *S. neglectus* plants with both types of flowers the cleistogamous florets usually mature earlier (Skokan 1983).

McGregor (1990) observed that florets on the exerted portions of *Sporobolus neglectus* panicles were rarely productive and most of the fruits developed on the short, lateral inflorescences which remained enclosed in the sheaths. A closer examination of the enclosed panicles revealed that each branch had a pair of pedicellate spikelets, one of which was larger than the other, and that the larger spikelets produced bigger fruits and seeds.

Seed Dispersal and Establishment

The fruit of a grass, known as a grain or caryopsis, is dry, indehiscent, and single-seeded. The caryopses of *Sporobolus neglectus* are gray-brown with purplish markings and shallow indentations. At maturity, the fruits from the larger spikelets are 1.5–2.0 mm long and those from the smaller spikelets are 0.8–1.4 mm long (McGregor 1990). At the end of the growing season the sheaths on *S. neglectus* plants spread backward, allowing the enclosed fruits to be released (Skokan 1983). In many other grasses, including *Sporobolus vaginiflorus* and *S. ozarkanus*, the seeds remain enclosed in the fruits until they germinate but when the fruit of *S. neglectus* is moistened the outer layer softens and slips from the seed (McGregor 1990).

Most *Sporobolus neglectus* seeds are dispersed by gravity and remain close to the parent plants. Hall (1955) noted that patches of the species remained in the same place from one year to the next although they fluctuated somewhat in size. Longer distance dispersal may be dependent on animals. Hilty (2020) suggested that the grass seeds could be an important winter food for sparrows and other resident songbirds but thought that the plants were likely to be overlooked by mammalian herbivores. In some locations *S. neglectus* seeds were thought to have been transported to new locations by attachment to livestock and farm equipment or other vehicles (Doyon and Dore 1967), and the species' establishment at a remote site in Hungary was attributed to the feeding of wild game by hunters (Király 2016).

The seeds of summer annuals are typically dormant at maturity and require a period of stratification at low winter temperatures (Baskin and Baskin 1988). The pattern was exemplified by *Sporobolus vaginiflorus*, which showed peak germination during the first spring after dispersal. However *S. vaginiflorus* did not continue to germinate after the first year (Baskin and Baskin 1988) whereas *Sporobolus neglectus* is known to maintain a seed bank (Lippert and Hopkins 1950). McGregor (1990) reported different dormancy requirements for the small and large seeds of *S. neglectus*: The large seeds ripen in a single winter but the smaller seeds require at least two winters before they can germinate. The strategy enables Small Rush-grass to persist in the soil when conditions are not favorable for establishment. Experimental studies by Skokan (1983) found that light availability had no effect on germination rates in *S. neglectus*.

Habitat

Sporobolus neglectus can occupy a wide variety of habitats at elevations of 0–1300 meters above sea level. The grass favors dry, open sites with sterile sandy or gravelly soils, but it is equally likely to occur in either natural communities or disturbed sites with those habitat characteristics (Rhoads and Block 2007, Hilty 2020, Peterson et al. 2021).

The natural communities where *Sporobolus neglectus* is most frequently reported are rocky barrens and glades over a calcareous substrate (Weakley et al. 2022). The habitats are sub-xeric and usually have only a thin layer of soil over the bedrock (Baskin et al. 2007, McClain et al. 2022). Hall (1955) noted that succession proceeded slowly at the sites, creating relatively stable communities. *S. neglectus* can become seasonally dominant in the glades during late summer and fall (Hall 1955, Baskin and Baskin 2000, McClain et al. 2022).

Sporobolus neglectus, *S. vaginiflorus*, and *S. ozarkanus* are all characteristic species of the *Sporobolus neglectus* - *Sporobolus vaginiflorus* Alkaline Bedrock Annual Grassland Alliance, a plant community that can develop on shale, limestone, dolomite, or diabase (Nordman 2014). *Sporobolus neglectus* has also been associated with dry, sandy, upland prairie remnants in the Midwest (Fay and Thorne 1953). In New England, the grass is rare and was historically associated with calcareous areas (Fernald 1933, Weatherby et al. 1936, Go Botany 2023). However, Bennett (1987) found that seeds collected from *S. neglectus* plants in a limestone habitat actually fared better when grown over granite than they did when grown over either limestone or sandstone.

Sporobolus neglectus is a C_4 grass, which means that it uses an alternate pathway for photosynthesis that enhances its water-use efficiency and makes it well adapted for subsistence in arid environments (Baskin and Baskin 2000, Osborne and Freckleton 2009). In fact, the species seems to be capable of tolerating an array of stressful circumstances. Doyon and Dore (1967) noted that *S. neglectus* appeared able to adjust to excessive wetness or dryness as well as to high and low soil temperature extremes. Engelhardt and Hawkins (2016) evaluated the suitability of grasses for use along highway right-of-ways in order to identify species that would establish readily, stabilize soils while enduring typical roadside conditions (eg. drought, low fertility, freezing, salinity, acidity, wear, competition), and require infrequent maintenance. *Sporobolus neglectus* was initially identified as a potentially suitable species but a full assessment was not conducted because its seeds were not commercially available.

Presumably it is that adaptability which has allowed *Sporobolus neglectus* to establish in such varied habitats. In New Jersey, populations of Small Rush-grass have been observed on stream banks, lake shores, and railroad right-of-ways, while historic locations included dry pine woods and fields (NJNHP 2022). Shinners (1941) observed that *S. neglectus* appeared to be spreading more in Wisconsin from introductions along rail corridors and roadways than it was from the natural occurrences on gravelly hillsides. Railroad bed occurrences have also been reported in Missouri, Virginia, and Quebec (Doyon and Dore 1967, Ramsey et al. 1993). The *S. neglectus* populations studied by Skokan (1983) were all located on frequently mowed roadsides, and the species has recently spread to heavily salted roadsides in New England (Mittelhauser et al. 2019, Go Botany 2023). Another reported habitat was pastures that were subject to frost heave (Doyon and Dore 1967), and a particularly high seed bank presence was reported in overgrazed short-grass prairie habitat (Lippert and Hopkins 1950). In Hungary the rapid spread of an introduced occurrence was credited to disturbances resulting from the activity of wild boars (Király 2016).

Wetland Indicator Status

The U. S. Army Corps of Engineers 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). *Sporobolus neglectus* has more than one wetland indicator status within the state. In the Atlantic and Gulf Coastal Plain region, *S. neglectus* is an upland species, meaning that it almost never occurs in wetlands. In the rest of the state it is a facultative upland species, meaning that it usually occurs in nonwetlands but may occur in wetlands (U. S. Army Corps of Engineers 2020).

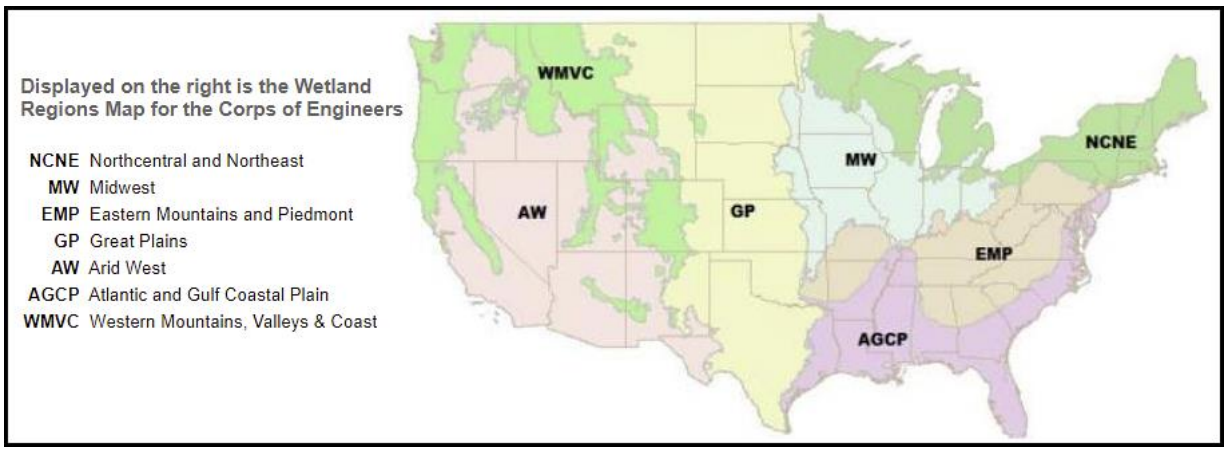


Figure 1. Mainland U. S. wetland regions, adapted from U. S. Army Corps of Engineers (2020).

USDA Plants Code (USDA, NRCS 2023b)

SPNE2

Coefficient of Conservancy (Walz et al. 2020)

CoC = 6. Criteria for a value of 6 to 8: Native with a narrow range of ecological tolerances and typically associated with a stable community (Faber-Langendoen 2018).

Distribution and Range

The native range of *Sporobolus neglectus* includes much of the United States and Canada, and the species is introduced in parts of Europe (POWO 2023). The map in Figure 2 depicts the extent of *S. neglectus* in North America.

The USDA PLANTS Database (2023b) shows records of *Sporobolus neglectus* in four New Jersey counties: Morris, Somerset, Sussex, and Warren (Figure 3). The data include historic observations and do not reflect the current distribution of the species.

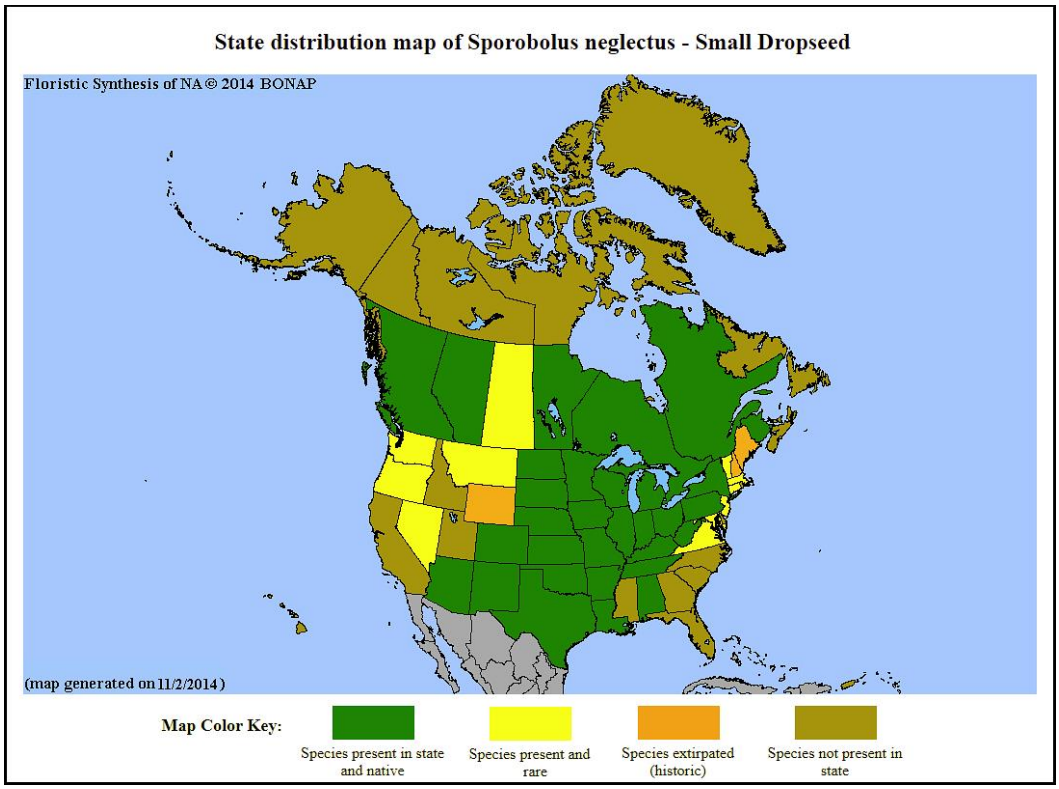


Figure 2. Distribution of S. neglectus in North America, adapted from BONAP (Kartesz 2015).

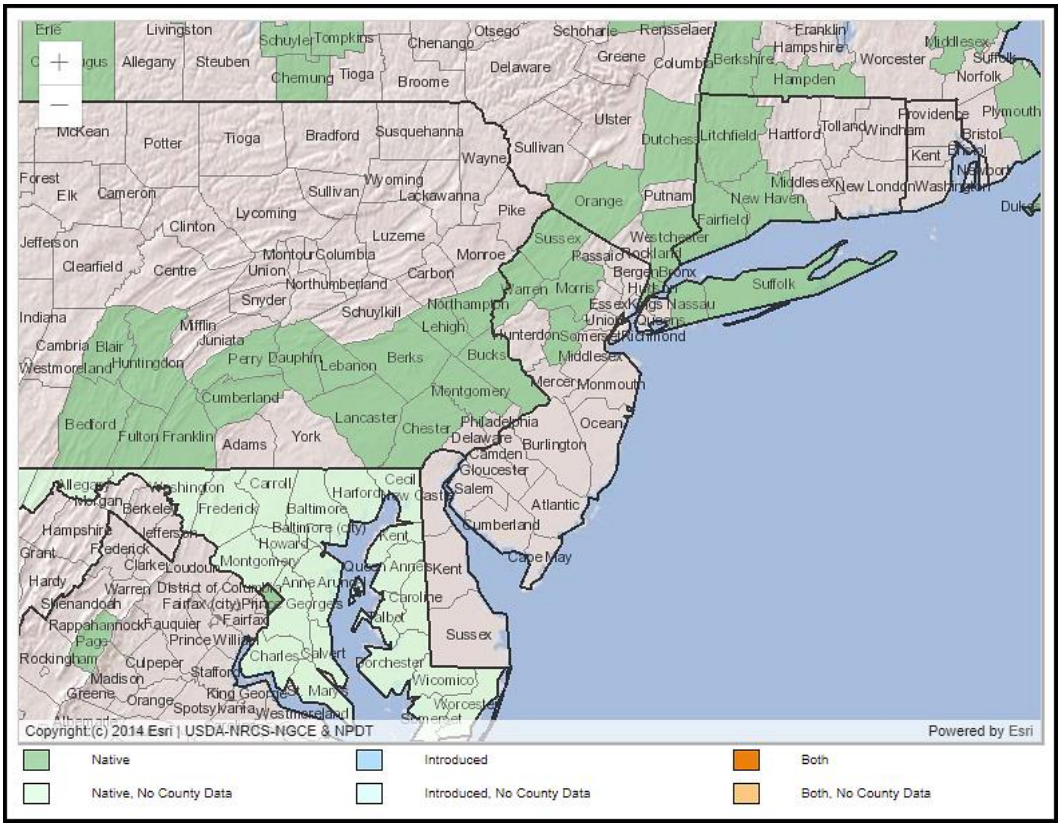


Figure 3. County records of S. neglectus in New Jersey and vicinity (USDA NRCS 2023b).

Conservation Status

Sporobolus neglectus 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 4) illustrates the conservation status of *S. neglectus* in North America. The species is vulnerable (moderate risk of extinction) in one state and one province, imperiled (high risk of extinction) in one state and three provinces, critically imperiled (very high risk of extinction) in five states, and possibly extirpated in Maine, New Hampshire, and the District of Columbia. In many districts where it occurs Small Rush-grass is secure, apparently secure, or unranked. In certain parts of the United States, the species has been regarded as somewhat weedy (Lippert and Hopkins 1950, Colbry 1957). *S. neglectus* is not accepted as native in British Columbia or New Brunswick.

The naturalization of *Sporobolus neglectus* and the similar *S. vaginiflorus* were first documented in Slovenia during the 1950s and the grasses slowly spread throughout that country and into adjacent nations including Austria, Croatia, and Italy. In recent years the expansion of the two species in central Europe has been characterized as explosive (Jogan 2017). *S. neglectus* was recently identified as a potentially invasive species in Hungary (Király 2016) and *S. vaginiflorus* is now considered invasive in Bosnia and Herzegovina (Maslo and Šarić 2021).

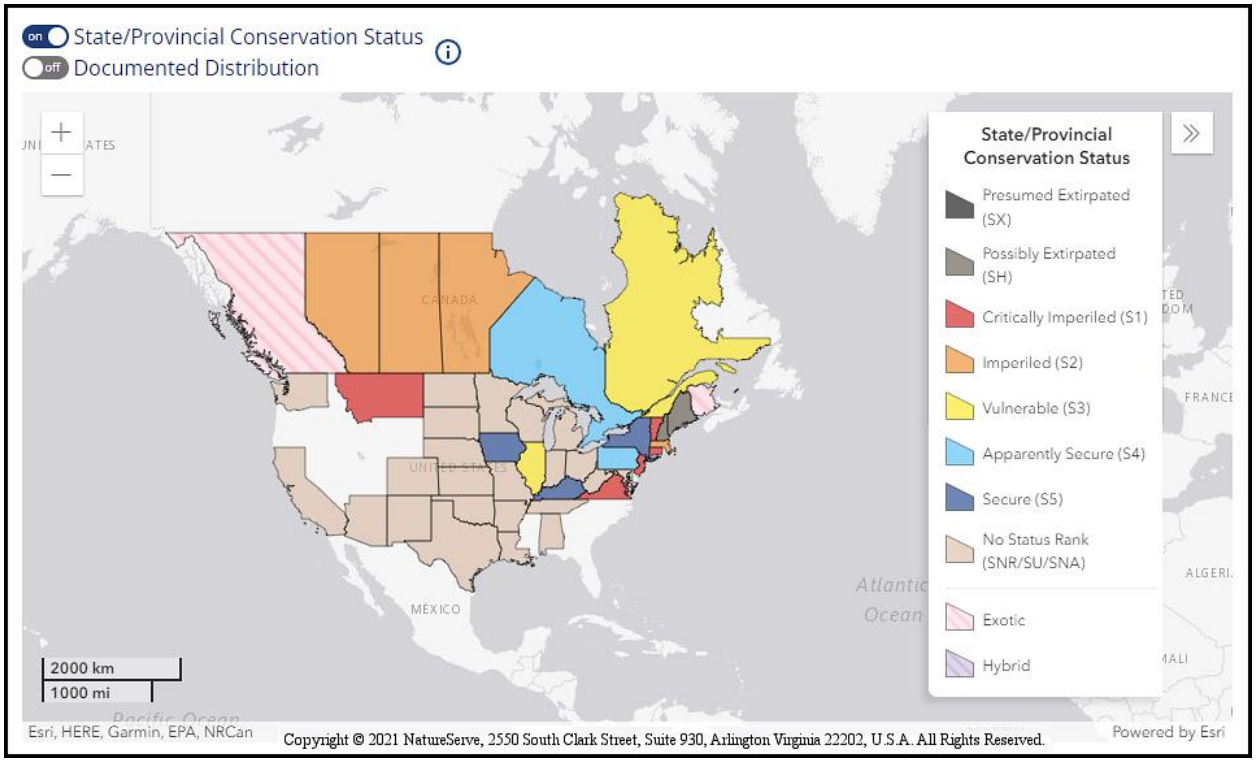


Figure 4. Conservation status of S. neglectus in North America (NatureServe 2023).

New Jersey is one of the states where *Sporobolus neglectus* 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. *S. neglectus* 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 being listed does not currently provide broad statewide protection for plants. Additional regional status codes assigned to the grass 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).

Taylor (1915) noted that *Sporobolus neglectus* was a rare and local species in the greater New York area, reporting a single record for New Jersey from a site in Sussex County. Several collections of *S. neglectus* were made in Morris and Somerset counties between 1914 and1927 but all of those occurrences are now ranked as historical or extirpated. Two other Sussex County populations known to local botanists were documented by David Snyder during the 1980s, and a small population was discovered in Warren County in 1992 (NJNHP 2022). Those three occurrences were cited as extant by Breden et al. (2006) but one of the Sussex populations could not be relocated in 2007. The other two occurrences from the northwestern counties are still thought to be extant (NJNHP 2022).

On one of New Jersey's early special plant lists, Small Rush-grass was categorized as a species that was rare statewide but generally more frequent in other locations (NJONLM 1984). Despite the historical scarcity of *Sporobolus neglectus* in New Jersey it appears that the grass was described from material that originated within the state. According to Hitchcock (1950), the type specimen for *S. neglectus* was collected by N. L. Britton (1887) at the Sussex County location referenced by Taylor (1915). Although Nash (1895) did not identify any source material in his description of the species, notations on the herbarium sheet indicate that Hitchcock subsequently designated Britton's specimen as the type based on Nash's handwritten correction to the original label.

Threats

Throughout its range, low-level threats to *Sporobolus neglectus* may occur as a result of land-use conversion, habitat fragmentation, competition, or predation (NatureServe 2023). No particular threats have been noted for New Jersey occurrences.

Sporobolus neglectus grows in open places and does not tolerate competition from taller plants (Hilty 2020). Some occurrences are likely to be threatened by succession, which often causes a decline in native herbaceous species in glade communities (Sutter et al. 2011). Although succession usually proceeds slowly in glades, patches of *S. neglectus* that are situated near the lower ends of slopes can trap the seeds of woody species, thus hastening the process in their immediate vicinity (Hall 1955). The ability of *S. neglectus* to establish in a variety of disturbed habitats indicates that it has some characteristics of a fugitive species, which are typically poor competitors that are restricted to early successional environments and rely on the colonization of new sites in order to survive (Hutchinson 1951). However, fugitive species usually produce numerous propagules that are widely dispersed and that does not seem to be the strategy utilized by *S. neglectus*. Nevertheless, the species has managed to spread widely, even becoming weedy

or invasive in some instances, while simultaneously declining in other areas. It appears that the current distribution of *Sporobolus neglectus* has been largely shaped by inadvertent human dispersal.

Sporobolus neglectus plants may be subject to herbivory by grasshoppers. A dozen different species of grasshopper were documented eating *S. neglectus* in cedar glades and one of them (*Trachyrhachis kiowa*) was a specialist, obtaining 92% of its food supply from the rush-grass. However, *T. kiowa* can switch to other grasses in different habitats, and the other eleven species were all generalists that proportionally consumed plant species according to their abundance in the vegetation (Bergmann and Chaplin 1992). In most cases, grasshopper herbivory is unlikely the pose a significant threat to *S. neglectus* populations.

A more serious risk may arise from disease. Fungal infections documented on *Sporobolus neglectus* have included a rust, a smut, and a downy mildew (Jackson 1918, Mankin 1969, Tiffany and Knaphus 1985 and 2004, Vánky 2003). Damage from the rust, *Uromyces sporoboli*, is likely to be limited to leaf discoloration although severe cases can cause an extensive loss of photosynthetic tissue and reduce overall plant performance (Gautam et al. 2022). The smut fungus, *Ustilago vilfae*, interferes with reproduction because it infects the grass inflorescence so that fungal spores are produced in place of seeds (Vánky 2003). Effects of the downy mildew, *Sclerophthora macrospora*, can vary depending on the host plant and environmental factors. Grasses are most susceptible to *S. macrospora* during the seedling stage when a fungal infection may result in developmental failure (Dernoeden and Jackson 1980). Symptoms in older plants can range from stunted growth to the replacement of floral parts (lemma, palea, ovary and/or glumes) with leaf-like structures (Raghavendra and Safeeulla 1979).

As the climate continues to warm, plant communities in New Jersey are being exposed to higher temperatures and shifting precipitation patterns that are increasing total annual rainfall as well as the frequency and intensity of droughts and floods (Hill et al. 2020). *Sporobolus neglectus* is tolerant of high temperatures and xeric conditions but occurrences that are situated on streambanks and lakeshores could be susceptible to floods. Although no information was found regarding the impacts of flooding on the species, prolonged periods of inundation are likely to be harmful and increasingly moist environments could make the plants more vulnerable to fungal infections. Because *Sporobolus neglectus* is able to establish in a variety of disturbed habitats it may be somewhat resilient to climate change but impacts on the species could vary considerably throughout the state based on local conditions.

Management Summary and Recommendations

One of New Jersey's three potentially extant populations of *Sporobolus neglectus* has not been monitored during the past 30 years and an updated site visit is recommended to assess the status of the occurrence and determine whether suitable habitat is still present. Periodic monitoring of the other two occurrences is also suggested. Although no *S. neglectus* plants were observed during the last visit to one of the sites, the species could be persisting in the seed bank and thus might reappear under favorable circumstances.

It is possible that additional occurrences are present in the state. Doyon and Dore (1967) suggested that *Sporobolus neglectus* was under-collected because it was so easily overlooked, particularly early in the season or when obscured by the presence of other grasses. *S. neglectus* could also become established at new locations in the future. There is no shortage of disturbed habitat in New Jersey but the species' ability to colonize new locations is probably dependent on opportunistic dispersal events.

Bennett (1987) noted that the significant positive response of *Sporobolus neglectus* to granite substrates was surprising because the species was more often found on calcareous sites. She hypothesized that the absence of *S. neglectus* on acidic substrates could be the result of competition with some other species which had pre-empted its establishment in those habitats and suggested that as a topic for future research. Long-distance dispersal of *S. neglectus* would also be a subject worthy of investigation. A better understanding of the role that both birds and humans play in the transport of Small Rush-grass seeds to new locations might shed light on some of the seeming contradictions in the species' behavior in different parts of its range.

Synonyms

The accepted botanical name of the species is *Sporobolus neglectus* Nash. Orthographic variants, synonyms, and common names are listed below (ITIS 2023, USDA NRCS 2023b).

Botanical Synonyms	Common Names
Sporobolus vaginiflorus var. *neglectus* (Nash) Scribn.	Small Rush-grass Small Dropseed Puffsheath Dropseed Annual Dropseed

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