# *Xyris caroliniana*

**Sand Yellow-eyed-grass**

**Xyridaceae**

*Xyris caroliniana* by Aiden Campos, 2022

***Xyris caroliniana* Rare Plant Profile**

New Jersey Department of Environmental Protection
State Parks, Forests & Historic Sites
Forests & Natural Lands
Office of Natural Lands Management
New Jersey Natural Heritage Program

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## Life History

*Xyris caroliniana* (Sand Yellow-eyed-grass) is a perennial herb with a bulbous base that often forms small tufts. The bases of the plants are chestnut brown and set deeply into the substrate. The leaves are basal, 2–5 dm long, 2–5 mm wide, and spirally twisted (see image in Diaz-Toribio and Putz 2021). The linear stems are 1.2–1.5 mm wide and 3–8$^{+}$ dm in height. The flowering spikes of *Xyris* plants are dense and somewhat conelike with a number of overlapping brownish bracts; those of *X. caroliniana* are narrowly elliptic or lance-shaped and 1–3 cm long. The Sand Yellow-eyed-grass plants that occur on the Atlantic coastal plain tend toward the smaller end of the spectrum in both height and spike length. The flowers are three-petaled and they are solitary in the axils of the bracts. *Xyris* flowers have three unequal sepals which are partially or completely concealed behind the bracts: The innermost one is membranous but the features of the two lateral sepals are often helpful in distinguishing species. Both the petals and the innermost sepal are deciduous, while the lateral sepals remain attached to the fruit. In *X. caroliniana*, the sepals are fringed and their tips extend beyond the bracts. The petals are obovate and 8–10 mm long: They are typically yellow, but there are some white-flowered forms that occur with greater frequency toward the southern end of the species' range. The narrow seeds are longitudinally ribbed and less than a millimeter long. (See Britton and Brown 1913*, Fernald 1950*, Kral 1960, 1966a, & 2020; Gleason and Cronquist 1991, Ward 2007).

* Descriptions used from Britton and Brown and Fernald were for *X. arenicola* and *X. flexuosa*, respectively, as both sources applied the name *X. caroliniana* to another species (see discussion in Synonyms and Taxonomy section).

Left: Britton and Brown 1913, courtesy USDA NRCS 2025a. Center: T. Muise, 2021. Right: Nate Harley, 2019.

It is easiest to identify yellow-eyed-grasses from fresh material, and flowering time may also be helpful. *Xyris caroliniana* can be distinguished by its narrow floral spikes, twisted leaves and stems, and deep-set chestnut-colored bulbs. Its afternoon flowering period helps to separate it from some similar species, although the white-flowered form generally blooms earlier in the day than the yellow-flowered form. *X. caroliniana* also occurs in drier habitats than most other

members of the genus (Fernald 1937, Kral 1966a, LeGrand et al. 2022, Weakley et al. 2024). Flowering and fruiting takes place continuously throughout the growing season from late June onward (Kral 1966a, Ward 2007, LeGrand et al. 2022).

## Pollinator Dynamics

*Xyris* flowers are ephemeral, typically lasting for only a few hours. The North American species do not have nectaries or a scent, and they produce relatively small amounts of pollen. Kral (1983) noted that, due to the limited attractiveness and short life of the flowers, wind had sometimes been proposed as the primary pollination mechanism for the genus. Torres-Cruz et al. (2023) suggested that cross-fertilization by insects was probably more prevalent than previously thought based on their studies of South American *Xyris* species, which were visited by a wide variety of invertebrates. In North America, both bees and flies have been observed visiting *Xyris* flowers, with bees being the primary pollinators (Kral 1983, 1998, Les 2020). A pollination study of *X. tennesseensis* showed that the flowers received a number of insect visitors during the brief time that they were open (Boyd et al. 2011). In fact, one bee species (*Lasioglossum zephyrum*) did not wait for the flowers of *X. tennesseensis* to open but removed the sheathing lower sepal as the flower bud emerged in order to gain early access to the pollen (Wall et al. 2002).

No specific pollinators have been identified for *Xyris caroliniana* and it is not clear whether the species is self-compatible. The research conducted on *X. tennesseensis* by Boyd et al. (2011) indicated that both halictid bees and syrphid flies visited the flowers to obtain pollen but only the bees transported a significant amount of pollen to other flowers. However, the authors concluded that the role of insects was not critical because they found no significant difference in seed set between insect-pollinated flowers and those from which insects had been excluded. Self-compatibility reportedly varies within the genus (Les 2020), and some yellow-eyed-grasses are thought to be capable of developing seeds without fertilization (Kral 1983).

While certain insects exploit *Xyris* flowers for their pollen, there is another organism that exploits the insect visitors of some yellow-eyed-grasses. *Fusarium xyrophilum* is a fungus that infects *Xyris* plants, inhibits their floral development, and produces showy yellow pseudoflowers on the spikes. Insects are attracted to the pseudoflowers and disperse the spores of the fungus to other *Xyris* plants. To date, the fungus has only been reported on *Xyris* species in South America (Slot and Kasson 2021, Torres-Cruz et al. 2024).

## Seed Dispersal and Establishment

*Xyris* fruits are many-seeded capsules with thin walls that rupture at maturity (Fernald 1950, Kral 1966a). The seeds fall or are shaken from the capsules by the spreading of bracts and sepals or the reclining of old scapes. *Xyris* seeds are often buoyant so they may drift if they land on water (Kral 1998), and both wind and post-consumption mammalian dispersal have been reported in the genus (Les 2020). Kral (1960) noted that the fruiting spikes of yellow-eyed-grasses can also

be an important seasonal food source for Wild Turkeys (*Meleagris gallopavo*) so some bird-mediated dispersal might also occur.

*Xyris* seeds can germinate within two weeks if they land on a moist substrate but in dry conditions they are often able remain dormant for years (Kral 1998). During a seed bank study in North Carolina *X. caroliniana* did not emerge from soil collected at two sites where it was present in the vegetation (Cohen et al. 2004); however, Baskin and Baskin (2003) found that *X. tennesseensis* maintained a small but persistent seed bank. Germination may occur regardless of the season as long as there is adequate moisture, warmth, and sunlight (Kral 1966a). An absolute light requirement was reported for *X. tennesseensis* (Baskin and Baskin 2003).

Following germination, *Xyris* seed husks often remain attached to the linear cotyledons for several weeks. After about a month, the seedlings form small, usually fan-shaped rosettes of five or more leaves. Most species flower within a year, so seeds released during the fall may develop into blooming plants by the following summer (Kral 1966a). Seeds of *X. scabrifolia* that were planted in March flowered during the summer of the same year (Les 2020). The little information that was found regarding mycorrhizal relationships in *Xyris* suggests that they could be important during early development. Baskin and Baskin (2003) noted the difficulty of establishing *X. tennesseensis* in non-native soil, and Tamura et al. (2008) found that the presence of certain fungi stimulated germination and promoted seedling growth in *X. complanata*, a species native to Australia and southeastern Asia.

## Habitat

*Xyris caroliniana* utilizes a variety of coastal plain habitats at elevations of 0–300 meters above sea level (Kral 2020). Sand Yellow-eyed-grass is more tolerant of dry growing conditions than any other *Xyris* in the continental United States (Kral 1960, Moffett and Boyd 2013, U. S. Army Corps of Engineers 2022). It can also be found in moist or seasonally moist habitats but not in sites that are permanently wet (Kral 1966a, Orzell and Bridges 2006, LeGrand et al. 2022). *X. caroliniana* requires abundant sunlight and does best in open places (Weakley et al. 2024). The species does not have any particular soil requirements (Kral 1966a), although it is frequently found on sandy substrates. Typical habitats throughout its range include pine savannas, flatwoods, mesic to dry prairies, sandhills, embankments, and dune swales (Urquiola Cruz et al. 1990, Sorrie et al. 2006, Ward 2007, Franck and Wunderlin 2009, Carr et al. 2010, Korosy et al. 2013, Gallardo Cruz and Acosta Ramos 2019, Kral 2020, Weakley et al. 2024).

Many of the habitats utilized by *Xyris caroliniana*, including those in New Jersey, are subject to periodic fires (Amoroso and Judd 1995, McMillan et al. 2002, Carr et al. 2010, NJNHP 2024). Depending on the location, reported fire intervals varied from 1–3 years to 10–20 years. The species has also been recorded in a number of habitats created by human disturbance such as abandoned roads, ditch edges, borrow ponds and scrapes, utility corridors, and pine plantations (Snyder 2000, Cohen et al. 2004, Shelingoski et al. 2005, Sorrie et al. 2006).

## Wetland Indicator Status

*Xyris caroliniana* is a facultative wetland species, meaning that it usually occurs in wetlands but may occur in nonwetlands (U. S. Army Corps of Engineers 2022).

## USDA Plants Code (USDA, NRCS 2025b)

XYCA

## 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

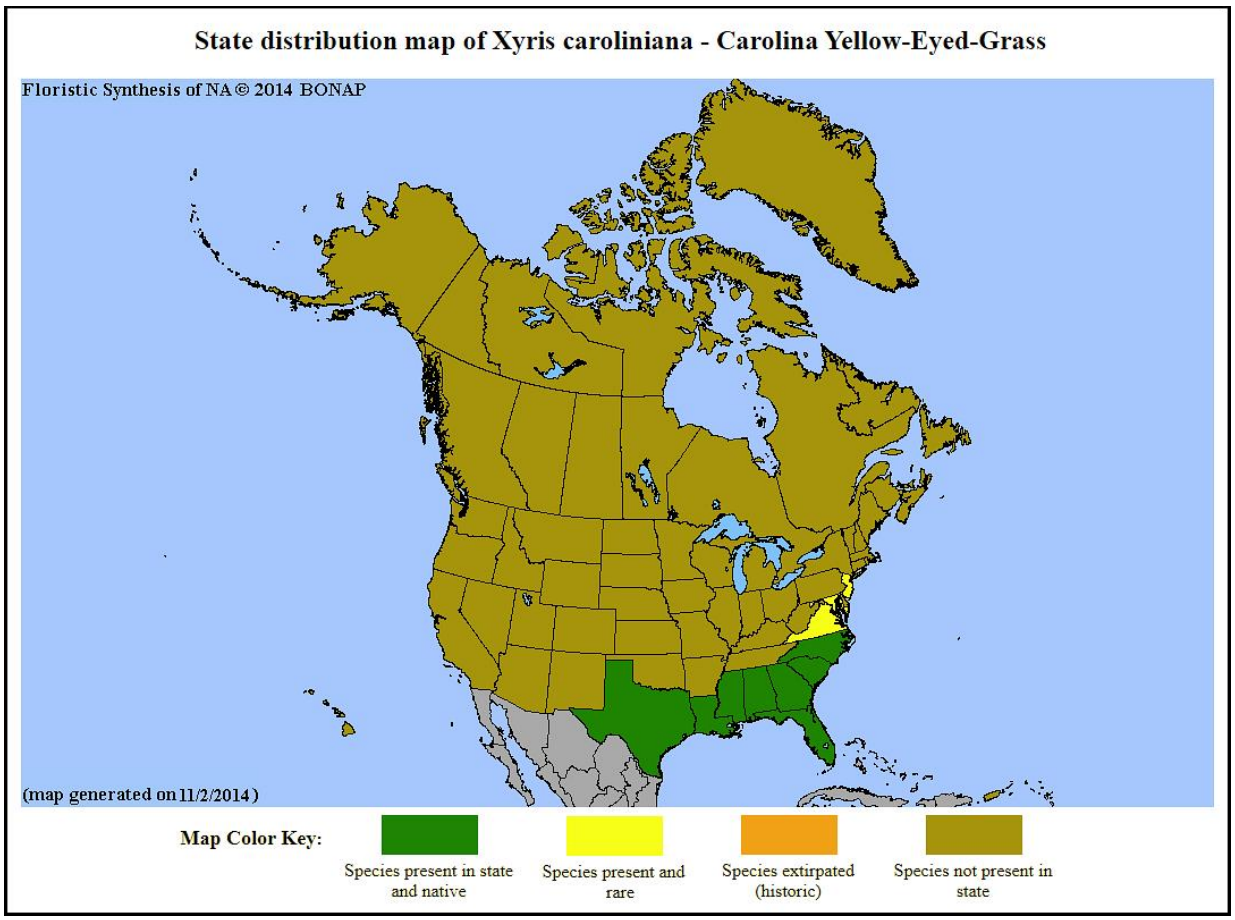


*Figure 1. Distribution of X. caroliniana in North America, adapted from BONAP (Kartesz 2015).*

*Xyris caroliniana* is native in the southeastern United States and Cuba (POWO 2025). Sorrie and Weakley (2001) listed more than 40 other coastal plain plants with a similar distribution pattern. The map in Figure 1 (above) depicts the extent of the species in North America.

The USDA PLANTS Database (2025b) shows records of *Xyris caroliniana* in twelve New Jersey counties: Atlantic, Bergen, Burlington, Camden, Cape May, Gloucester, Mercer, Middlesex, Monmouth, Ocean, Salem, and Warren (Figure 2). The data include historic reports and do not reflect the current distribution of the species. Some plant specimens collected in Cumberland County were also labeled as *X. caroliniana* (Mid-Atlantic Herbaria 2025), although Moore et al. (2016) indicated that reports of the species from that county were probably based on misidentifications.

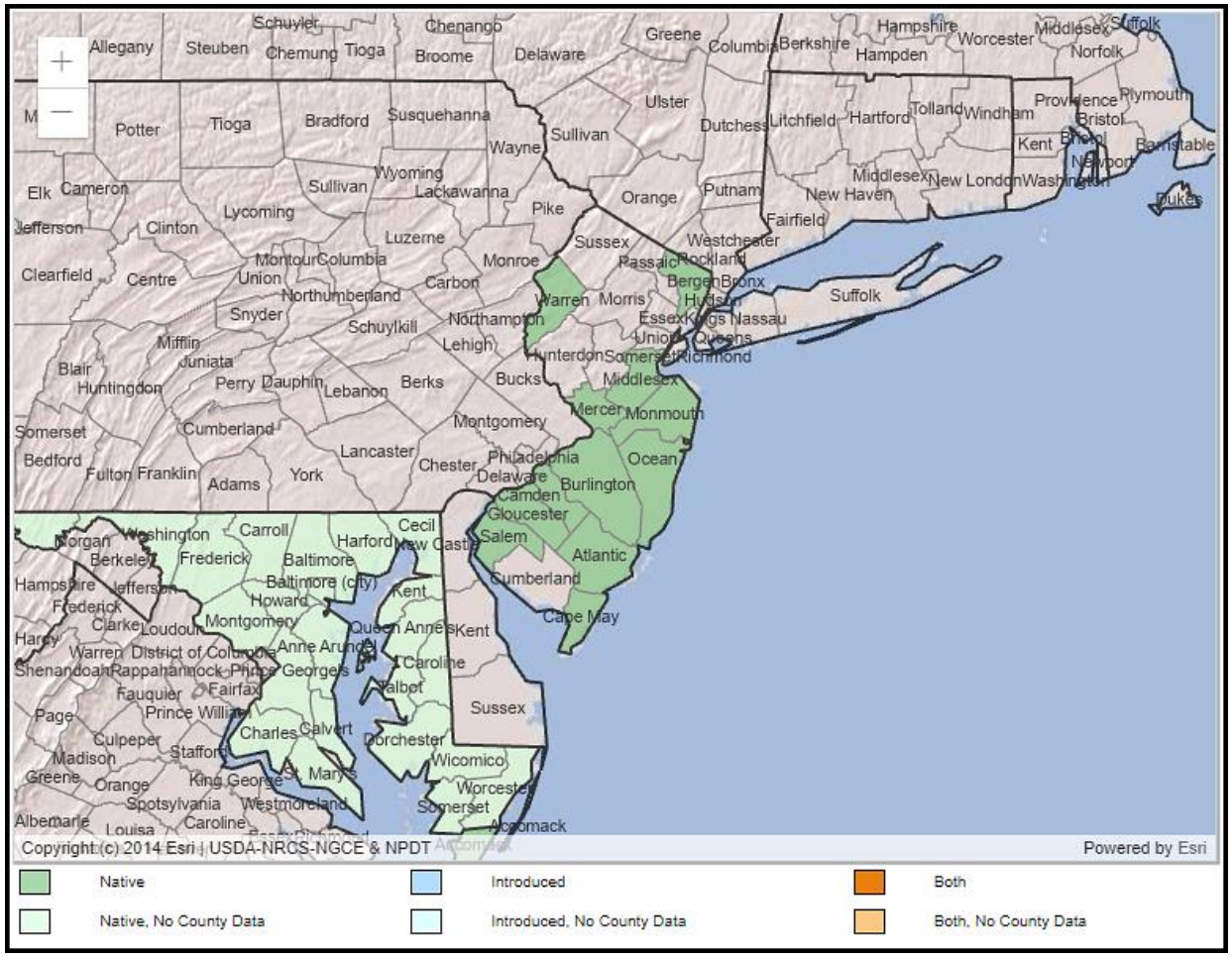


*Figure 2. County records of X. caroliniana in New Jersey and vicinity (USDA NRCS 2025b).*

## Conservation Status

*Xyris caroliniana* 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 recent local 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 2025). The map below (Figure 3) illustrates the conservation status of *X. caroliniana* in North America. The yellow-eyed-grass is critically imperiled (very high risk of extinction) in two states but it is secure, apparently secure, or unranked in the other states where it occurs. It is also listed as a critically endangered species in Cuba (Berazaín Iturralde et al. 2005, Gallardo Cruz et al. 2019).

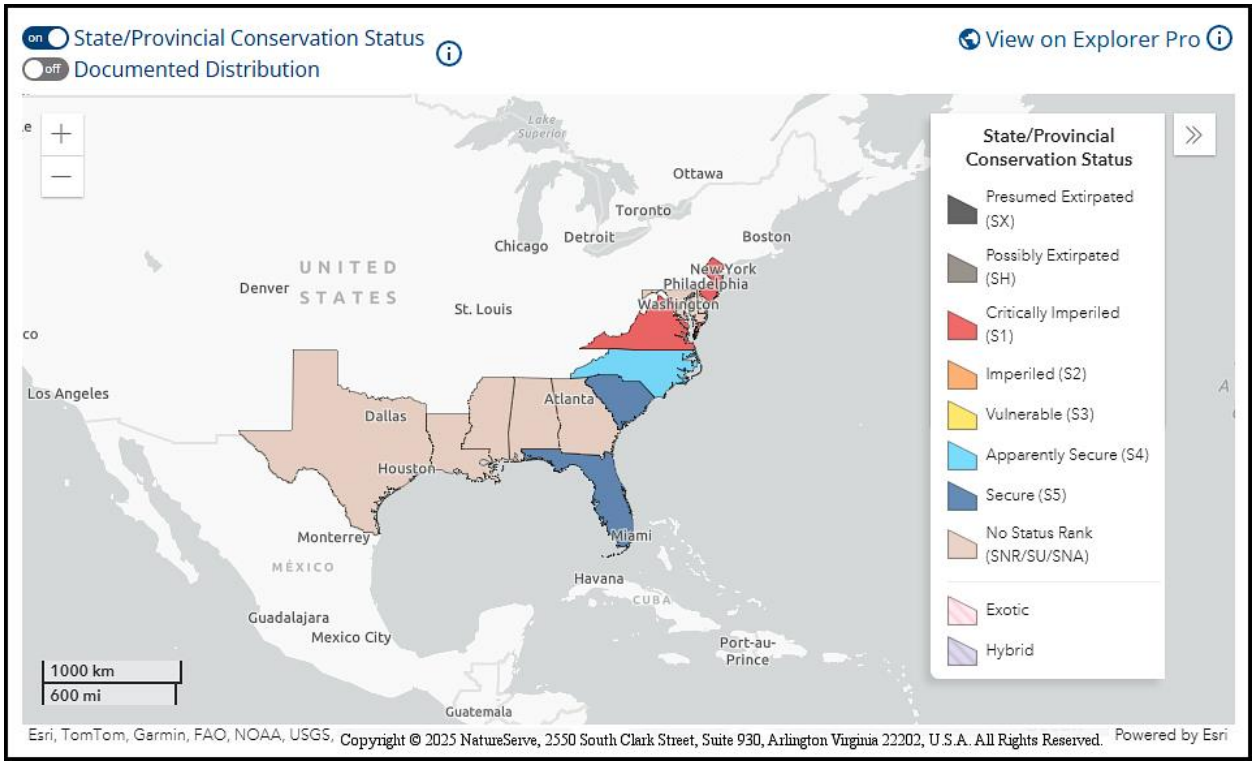


*Figure 3. Conservation status of X. caroliniana in North America (NatureServe 2025).*

New Jersey is one of the states where *Xyris caroliniana* is critically imperiled (NJNHP 2024). 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. Sand Yellow-eyed-grass 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 *X. caroliniana* 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).

*Xyris caroliniana* was over-reported in early New Jersey floras due to widespread confusion regarding nomenclature, so many of the records shown on the map in Figure 2 were probably based on observations of other more common species (see Synonyms and Taxonomy Section). At least one of the herbarium sheets labeled as *X. caroliniana* turned out to be *X. chapmanii*

(Moyer and Bridges 2015). Habitat notes included by Stone (1911) and Taylor (1915) suggest that the species they identified as *X. arenicola* was the one we now call *X. caroliniana*, and it was only known from two sites in Burlington County. Burlington remained the sole New Jersey county of record for most of the twentieth century, during which time the species was generally identified as *X. flexuosa* (Hough 1983). Snyder and Vivian (1981) characterized it as endangered and it was included on New Jersey's first official list of endangered plants, although the use of the name *X. caroliniana* was not adopted by the state until 1992 (NJONLM 1990, 1992). Sand Yellow-eyed Grass could still be found at one Burlington County site during the 1990s and additional occurrences were documented in Atlantic County during that period (Snyder 2000). Breden et al. (2006) reported three extant populations in the state and an additional one was discovered in 2014. Four other occurrences are ranked as historical or extirpated (NJNHP 2024).

## Threats

The most immediate threat identified for populations of *Xyris caroliniana* is habitat loss or degradation. In New Jersey habitat losses have mainly been attributable to natural succession, which seems to have eliminated more than one occurrence (Snyder 2000, NJNHP 2024). The populations that appear to be faring best in the state are those that have burned. Although the *X. caroliniana* plants at one site were damaged by a hot fire, the population recovered and increased in size. Another population—in a location that was apparently maintained by fire in the past—was damaged after heavy equipment that was employed for fire control inadvertently made the site accessible to off-road trucks, and recreational vehicles have continued to utilize and destroy the habitat. Ongoing habitat degradation was also cited as a threat to the remaining populations of *Xyris caroliniana* in Cuba (Gallardo Cruz and Acosta Ramos 2019). In Florida, an evaluation of depression wetland habitat quality identified *X. caroliniana* as a sensitive species, indicating that it was intolerant of development in the surrounding landscape (Reiss 2006).

*Fusarium xyrophilum*, the fungus that sterilizes *Xyris* plants and forms pseudoflowers on them to spread its own spores, was only recently discovered and described (Laraba et al. 2020). It has already been documented on three *Xyris* species (Torres-Cruz 2024) so it seems likely that the fungus could spread to other yellow-eyed-grasses. As more information becomes available it will be easier to assess whether the organism might become a threat to *Xyris* in North America.

## Climate Change Vulnerability

Information from the references cited in this profile was used to evaluate the vulnerability of New Jersey's *Xyris caroliniana* populations to climate change. An attempt was made to assign the species a rank from NatureServe's Climate Change Vulnerability Index using the associated tool (Version 3.02) to estimate its exposure, sensitivity, and adaptive capacity to changing climactic conditions in accordance with the guidelines described by Young et al. (2016). However, there was not sufficient data available about the species to conduct a meaningful assessment of vulnerability. Information clearly attributable to *Xyris caroliniana* was limited by historical inconsistencies in nomenclature so many aspects of the species' life history had to be inferred from studies of other members of the genus.

As a result of global climate change the plant communities in New Jersey are increasingly exposed to higher temperatures, while altered precipitation patterns in the region are bringing about more frequent floods and lengthier droughts (Hill et al. 2020). Generally speaking, the more southerly distribution of *Xyris caroliniana* suggests that the species will be able to adapt to warming conditions in the northern part of its range. However, there is little specific information about its reproduction, dispersal, or establishment requirements, and no studies of its responses to competition or extreme weather conditions were found. Because *X. caroliniana* prefers an open canopy and is sensitive to natural succession the populations in New Jersey are likely to be threatened by an increasing number of invasive plant species, which are expected to become more problematic in the region as the climate continues to change (Bellard et al. 2013, Salva and Bradley 2023).

## Management Summary and Recommendations

An investment in research is needed for *Xyris caroliniana*, both to clear up some of the confusion around historical records and to answer some basic questions about the species itself. Important topics for study include pollination mechanisms, key dispersal strategies, seed longevity, germination requirements, and mycorrhizal relationships. While fire appears to be an appropriate tool for the management of *X. caroliniana* habitat, it would be useful to have more detailed information regarding the burn intensity, frequency, and timing that are most beneficial for the species.

In New Jersey, an updated statewide assessment is needed for Sand Yellow-eyed-grass. None of the four 'extant' occurrences have been monitored for a decade or more, and some were in very poor condition when they were last seen. Monitoring visits for this species should evaluate current population status and habitat conditions. Site-specific management planning is likely to be needed for any remaining occurrences, with a focus on maintaining an open canopy and preventing direct damage to extant plants. Suitable habitat might still be present in the vicinity of some sites where the species was listed as historical or extirpated (NJNHP 2024), and since *Xyris* species were mixed up in the state for a long period of time it is possible that there are additional historic records of *X. caroliniana* that are not currently tracked by the Natural Heritage Program.

## Synonyms and Taxonomy

The accepted botanical name of the species is *Xyris caroliniana* Walter. There was a great deal of confusion around the name for the better part of two centuries. When Walter (1788) first published the appellation he only included a single species of *Xyris* in his flora and no specimen was designated. His vague description and the lack of documentation became problematic as more *Xyris* species were described. The name *X. caroliniana* was frequently applied to other yellow-eyed-grasses, particularly to *X. torta*, *X. difformis*, and *X. jupecai*, until the early 1900s. Harper (1905) cleared up part of the misunderstanding but rejected the name *X. caroliniana* based on the absence of a specimen, instead using the name *X. flexuosa* that had been published by Elliott (1821). Kral (1966b) tracked down what appeared to be the material examined by

Walter when he published *X. caroliniana* so the original name was reinstated and *X. flexuosa* was synonymized. Ward (2007) expressed some dissatisfaction with Kral's designation but accepted it for lack of a better alternative.

Due to the absence of clarity prior to Kral's work on the genus, it is not always possible to tell whether earlier information published about "*Xyris caroliniana*" or "*Xyris flexuosa*" actually referred to Sand Yellow-eyed-grass. Consequently, references that cited occurrences of *X. caroliniana* outside of the accepted range (depicted in Figures 1 and 3) were not used in the preparation of this profile. However, it is worth noting that some of the other species with a similar distribution pattern (See Sorrie and Weakley 2001) have been found farther north along the coastal plain in eastern New York or southern New England.

Some orthographic variants, synonyms, and common names are listed below (ITIS 2025, POWO 2025, USDA NRCS 2025b). *Xyris pallescens* (and other synonyms with a var. *pallescens*) refer to the white-flowered form of *X. caroliniana*, which might warrant some level of taxonomic recognition (Weakley et al. 2024).

**Botanical Synonyms**

*Xyris arenicola* Small
*Xyris canadensis* Schnizl.
*Xyris caroliniana* f. *flaccida* Fernald
*Xyris caroliniana* f. *phyllolepis* Fernald
*Xyris caroliniana* var. *scabra* Engelm. & A. Gray
*Xyris conocephala* C. Wright
*Xyris conocephala* var. *pallescens* (C. Mohr) Malme
*Xyris flexuosa* Muhl. ex Elliott
*Xyris flexuosa* var. *pallescens* (Small) Barnhart
*Xyris glabra* Engelm. ex Ries
*Xyris graminifolia* Chapm. ex Ries
*Xyris indica* Pursh
*Xyris pallescens* (C. Mohr) Small
*Xyris scabra* Engelm.
*Xyris torta* var. *pallescens* C. Mohr
*Kotsjiletti flexuosa* (Muhl. ex Elliott) Nieuwl.
*Ramotha floridana* Raf.

**Common Names**

Sand Yellow-eyed-grass
Carolina Yelloweyed Grass
Pineland Yellow-eyed-grass
Twisted Yellow-eyed Grass

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