Carex meadii

Mead's Sedge

Cyperaceae

Carex meadii by Will Van Hemessen, 2020

***Carex meadii* 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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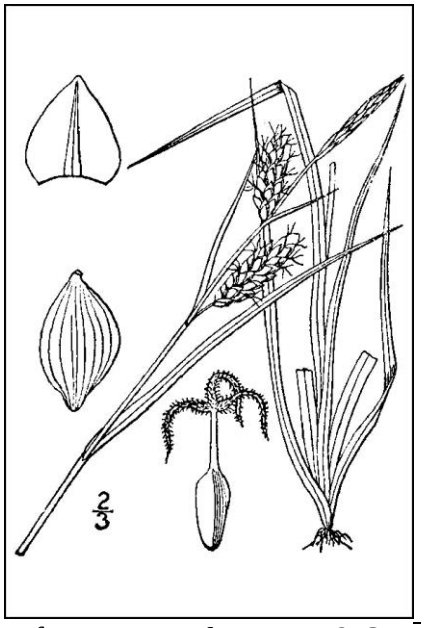
Life History

Carex meadii (Mead's Sedge) is a rhizomatous perennial sedge in *Carex* section *Paniceae*. The slender rhizomes of *C. meadii* are long and deeply set so the plants grow in loose colonies, sometimes forming large clonal patches. The leaves have a distinct blue-gray tint and range from 2.5–7 mm in width, and the sheaths of the basal leaves are usually brownish. The culms are 15–60 cm tall and mostly smooth although slightly rough near the top. The terminal spikelet is entirely staminate but the 1–2 pistillate spikelets occasionally have a few male flowers at the tip. The peduncle (stalk) of the lower spikelet is longer than that of the upper one, and both have a leafy, sheathing bract at the base. *Carex meadii* may produce 1–30 flowers on each pistillate spikelet. The pistillate flowers have three stigmas. The mature perigynia are yellow-green or brown, egg-shaped, broadest above the middle, and end in a tiny curved beak. The pistillate scales are green in the center and reddish-brown to purplish on the sides with clear edges. (See Dewey 1842, Britton and Brown 1913, Fernald 1950, Gleason and Cronquist 1991, Johnston 2001, Rothrock and Reznicek 2020, Weakley et al. 2022). In a South Dakota prairie, *C. meadii* plants flowered during the third week of May (Harvey 1908). The rate of flowering in a population appears to fluctuate from one year to the next (NJNHP 2022). The fruits of Mead's Sedge mature during late spring or early summer (Rothrock and Reznicek 2020, Weakley et al. 2022); June is typical in Pennsylvania and New Jersey (PANHP 2019, NJNHP 2022).

Carex meadii is most likely to be confused with *C. tetanica* (Rothrock and Reznicek 2020). In comparison to *C. tetanica*, *C. meadii* has stouter culms and wider, more densely flowered pistillate spikelets (Keller and Brown 1905, Mackenzie 1910). The perigynia of *C. tetanica* are dark green rather than yellow-green (Rhoads and Block 2007) and its leaves are pale green without a blue-gray tinge (Weakley 2022). *Carex tetanica* also has smaller achenes (1.2–1.8 mm) in comparison to those of *C. meadii* which are 1.7–2.5 mm wide (Rothrock and Reznicek 2020).



Left: Britton and Brown 1913, courtesy USDA NRCS 2022a. Right: Courtesy Pete Romfh, Lady Bird Johnson Wildflower Center.

A compound present in *Carex meadii* may prove to be useful for the development of new medical treatments, specifically those designed to protect brain cells from certain types of neurotoxins. Littleton et al. (2005) discovered that an extract from *C. meadii* completely prevented damage in the brain of a rat that had been exposed to a particular nerve toxin. The functional benefit of the compound in the ecological life of the sedge is not known.

Pollinator Dynamics

The majority of species in the sedge family are pollinated by wind, although there are a few notable exceptions in scattered genera including *Carex* (Goetghebeur 1998). Adaptations to wind pollination in the family include large anthers, long filaments, and prominent stigmas (Zomlefer 1994). Cruden and Lyon (1985) found that wind-pollinated species, including *Carex meadii,* make a significantly greater developmental investment in stamens than in pistils.

In nearly all sedges, the female flowers develop before the male flowers (protogyny) and the lowest flowers on a spikelet are the first to mature (Goetghebeur 1998). Both strategies have generally been interpreted as means of reducing the opportunities for self-pollination. However, experimentation to test that assumption showed that protogyny was not a particularly effective way of guaranteeing outcrossing in *Carex*, and the species in the study displayed a high degree of self-compatibility (Friedman and Barrett 2009). The authors concluded that protogyny gives wind-pollinated *Carex* species an opportunity to cross-fertilize while self-pollination assures reproductive success.

Seed Dispersal

The fruit of a *Carex* plant is a single-seeded achene that forms in a sac-like perigynium in which it is eventually dispersed. A broad range of dispersal strategies have been reported in the genus *Carex,* some of which were inferred from morphology (Leck and Schütz 2005, Newhouse et al. 1995). However, the perigynia of *C. meadii* have no evident structures to facilitate dispersal. Chen et al. (2002) characterized Mead's Sedge as a species that utilizes multiple means of dispersal but the particular mechanisms were not identified. One is likely to be gravity, which was suggested by Żukowski et al. (2010) to be the primary dispersal strategy for sedges. Monitoring notes for New Jersey's *C. meadii* population indicated that all of the fruits had "dropped" by mid-August (NJNHP 2022), inferring a role for gravity. Some animal-mediated dispersal may also occur. The fruits of various *Carex* species are consumed by game birds, songbirds, shorebirds and waterfowl as well as an assortment of mammals (Fassett 1957), and seed viability has been documented in a number of sedges dispersed by birds or hoofed mammals (Leck and Schütz 2005).

No information was found regarding seed longevity or the germination requirements of *C. meadii*. The majority of sedges are persistent in the seed bank, and in other species of *Carex* larger seed size has been associated with longer dormancy and more successful germination (Leck and Schütz 2005). The propagules of most *Carex* species require a period of stratification at either low or high temperatures (Żukowski et al. 2010) as well as sufficient light (Leck and

Schütz 2005) in order to germinate. *Carex* seeds typically sprout underground, producing their first leaf 4–5 days after germination (Alexeev 1988).

Carex meadii is able to propagate vegetatively (Harvey 1908), which may be an important means of maintaining established populations. It is not clear whether the sedge forms any fungal associations. Mycorrhizae were found in the closely related *C. tetanica*, but only in one of the two plants examined by Miller et al. (1999).

Habitat

Carex meadii can be found in a relatively broad range of habitats at elevations of 50–2400 meters (Rothrock and Reznicek 2020). One unifying feature of the communities where the sedge occurs is a relatively open canopy, as *C. meadii* is not tolerant of dense shade (Rhoads and Block 2003). The substrates are often rich in calcium, magnesium or iron (Rhoads and Block 2007, PANHP 2019, Weakley et al. 2022). At a site in southwestern Ontario, *C. meadii* was growing in fertile soils such as mesic sandy loam and wet loam (Faber-Langendoen and Maycock 1987). At another location a substrate pH range of 7.1–7.7 was recorded by Kirk (1994).

Wetter sites where *Carex meadii* has been reported include swamps, wet meadows, and marshes (Keller and Brown 1905, Taylor 1915, PANHP 2019, Rhoads and Block 2007), while habitats in the foothills and plains of the Rocky Mountains can be moist or dry (Johnson 2001). Mead's Sedge seems to do particularly well in locations where the moisture levels vary with the seasons (Rhoads and Block 2003). A New Jersey occurrence is growing in thin soils over rock outcrops on a steep slope that is seasonally influenced by downhill seepage (NJNHP 2022). In Kentucky the sedge grows in dry, rocky areas that are prone to seasonal flooding (Littleton et al. 2005). On an island in Lake Erie, *Carex meadii* was found at a site that is saturated and poorly drained during the spring but is subject to drying and often extreme drought later in the summer (Kirk 1994). Nekola and Lammers (1989) indicated that *C. meadii* can be an important component of wet prairies where moisture levels are cyclically high—often with standing water in the spring—but become low during dry periods.

Throughout much of its range *Carex meadii* is associated with open habitats such as prairies (Hermann 1936), especially with "high" or "tallgrass" prairies (Clapham 1936, Platt 1975, Gibson 1988). *C. meadii* has been documented in small remnants of prairie vegetation along railroads and in old cemeteries (Fay and Thorne 1953, Ruch et al. 2010). Fell (1956) reported *C. meadii* from a lightly shaded site where a prairie remnant was transitioning to mixed oak woodland. Mead's Sedge has also been found in similar habitats in managed grasslands. Kindscher (1994) noted it as an infrequent component of a prairie community that had previously been farmed but was later maintained by biannual spring burns. In native grasslands that were utilized for agriculture, *Carex meadii* was most likely to occur in warm-season hay meadows but the sedge was also found to a lesser extent in warm-season pastures, cool-season hay meadows, and cool-season pastures (Jog et al. 2006).

One exceptionally distinctive prairie type where Mead's Sedge is a significant component is *Sporobolus silveanus - Carex meadii* Herbaceous Grassland, which is limited to a small portion

of the Texas Blackland Prairie region in the northeastern part of the state. The underlying soils of the Blackland Prairie are calcareous clays derived from shale, marl and limestone (Locklear 2017). The *Sporobolus silveanus - Carex meadii g*rasslands formed on alfisols at locations where the average annual precipitation exceeds 90 cm (Diamond and Smeins 1985). The community is critically imperiled globally (G1), as many of the sites have been lost due to crop cultivation and the examples that remain are threatened by invasive plant species and by succession resulting from fire suppression (Weakley 1996).

In Mississippi, *Carex meadii* can be found in floristically unique communities associated with chalk outcrops and barrens (Morris et al. 1993). The sites are open with widely scattered trees (*Juniperus virginiana* and *Quercus* spp.) and the sedge is generally restricted to narrow bands of heavy clay mixed with chalk fragments or the chalky soils above outcrops (Naczi and Bryson 1990). An additional occurrence was reported from a less open site where the sedges were lightly shaded by the canopy of a *Carya-Juniperus virginiana-Quercus-Ulmus* woodland (Bryson et al. 1992).

Wetland Indicator Status

Carex meadii is a facultative species, meaning that it occurs in both wetlands and nonwetlands (U. S. Army Corps of Engineers 2020).

USDA Plants Code (USDA, NRCS 2022b)

CAME2

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

The global range of *Carex meadii* includes portions of Canada, the United States, and Mexico (POWO 2022). The map in Figure 1 depicts the extent of *C. meadii* in the United States and Canada.

The USDA PLANTS Database (2022b) shows records of *Carex meadii* in one New Jersey county: Hunterdon County (Figure 2). Mead's Sedge has also been documented in Somerset County (NJNHP 2022). The data include historic observations and do not reflect the current distribution of the species.

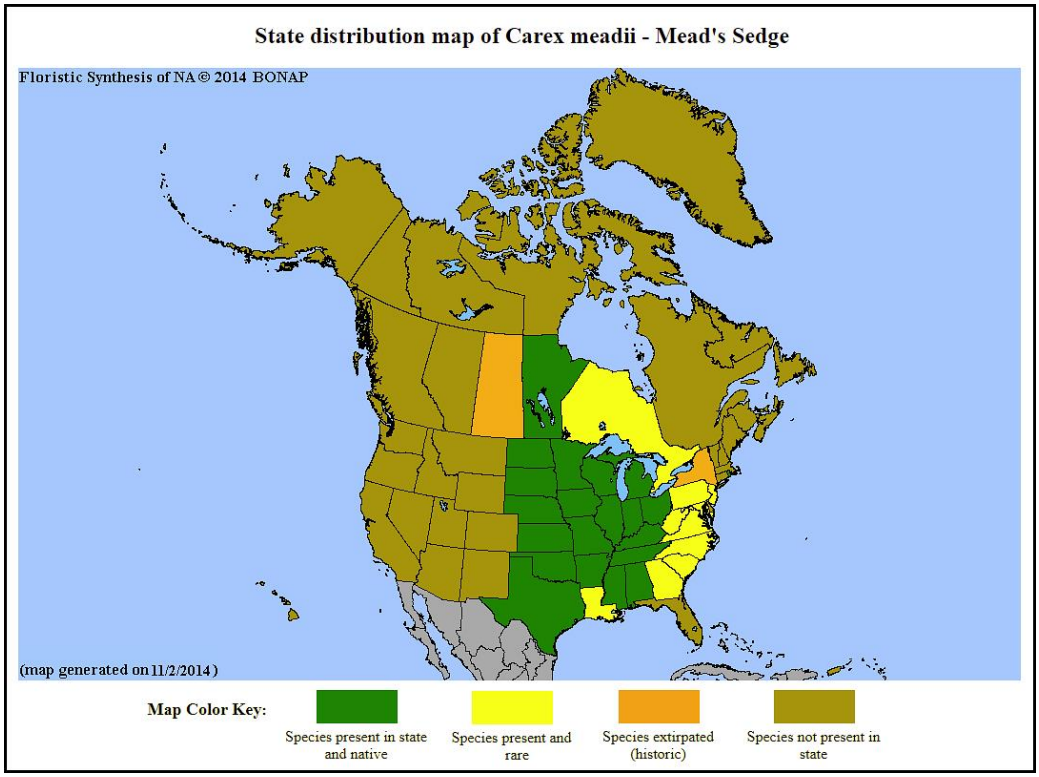


Figure 1. Distribution of C. meadii in Canada and the United States, adapted from BONAP (Kartesz 2015).

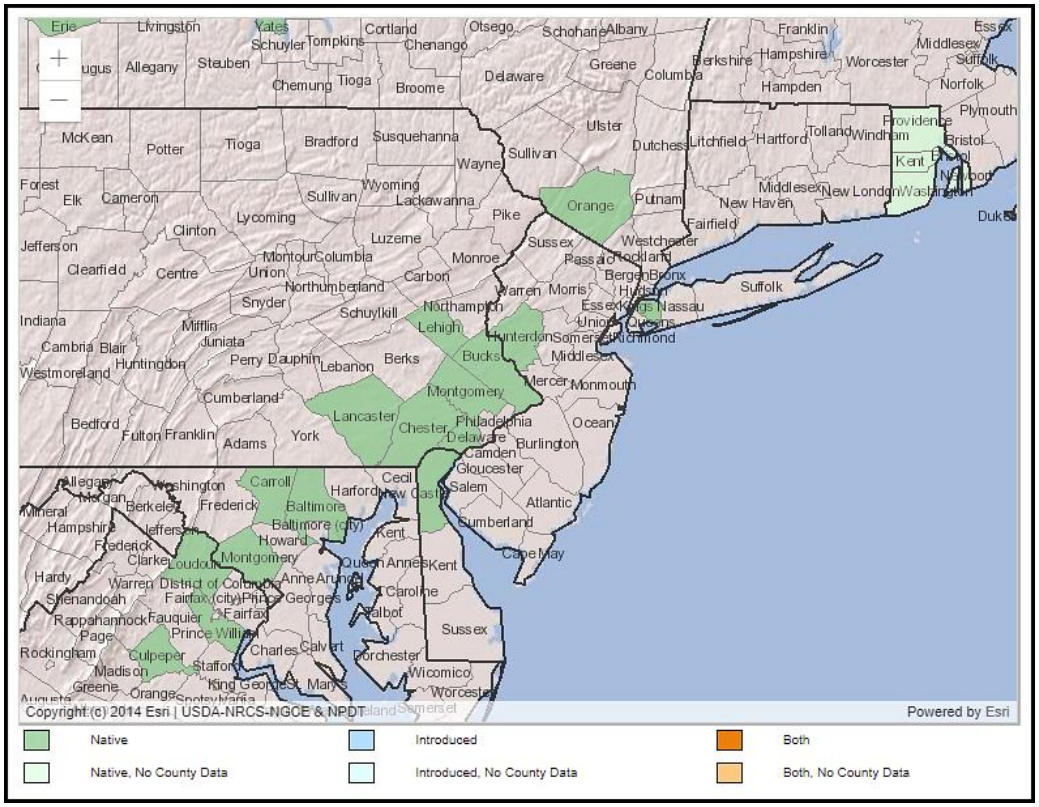


Figure 2. County records of C. meadii in New Jersey and vicinity (USDA NRCS 2022b).

Conservation Status

Carex meadii 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 2022). The map below (Figure 3) illustrates the conservation status of *C. meadii* throughout the United States and Canada. Mead's Sedge is critically imperiled (very high risk of extinction) in eight states and one province, imperiled (high risk of extinction) in one state and one province, vulnerable (moderate risk of extinction) in four states, and possibly extirpated in New York.

In North America, *Carex meadii* has also been identified as a species of highest conservation priority for the North Atlantic region, which includes four Canadian provinces and twelve U. S. states. *C. meadii* has a regional rank of R2 (imperiled), signifying a high risk of regional extinction (Frances 2017).

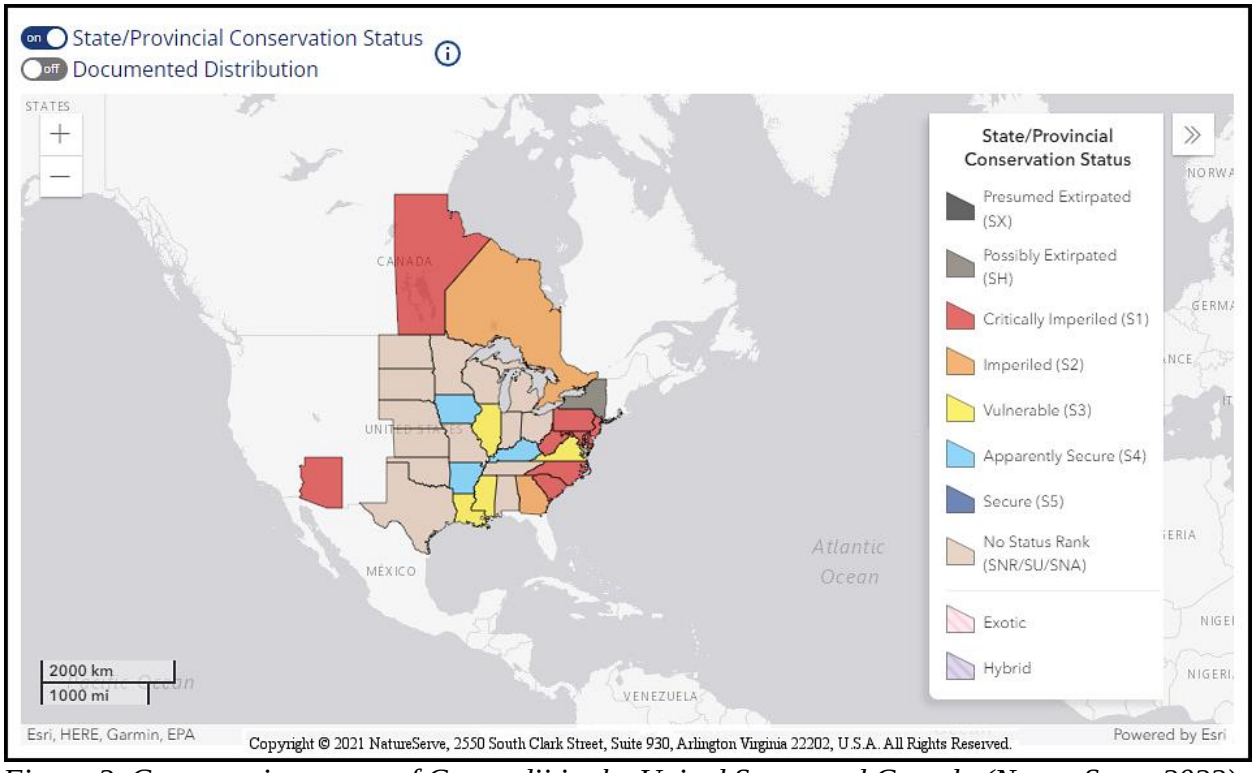


Figure 3. Conservation status of C. meadii in the United States and Canada (NatureServe 2022).

New Jersey is one of the states where *Carex meadii* 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. *C. meadii* 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).

Taylor (1915) reported a New Jersey occurrence of *Carex meadii* from western Hunterdon County in the Delaware River watershed and Hough (1983) cited a recent verified record for the same county. That population is now thought to be extirpated as no suitable habitat remains, and *C. meadii* is presently known from a single location in Somerset County (NJNHP 2022).

Threats

Habitat loss is probably the biggest range-wide threat to *Carex meadii*. The tallgrass prairie habitat favored by the sedge has declined faster than any other major ecosystem in North America, with loss estimates ranging from 82–99% preceding the turn of the century (Samson and Knopf 1994). Despite some recent initiatives to conserve temperate grasslands, only 1–3% of North American tallgrass prairies continue to support native communities and just 0.5% have been protected (Henwood 2010). While no studies have focused on the resilience of *Carex meadii*, anecdotal evidence suggests that the species may be slow to recover from disturbance. At the microsite level, *C. meadii* did not colonize vegetation gaps created by badger activity although it was present in the adjacent community (Platt 1975). On a wider scale, *C. meadii* was absent from old agricultural sites where attempts had been made to restore native flora. Despite its presence in patches of native grassland that were utilized for grazing or hay production, *C. meadii* did not appear in a former cropland that had been seeded with native grasses (Jog et al. 2006). Seabloom and van der Valk (2003) noted that the sedge was absent from restored wetlands that had been allowed to develop by natural processes although it was present in undisturbed wetlands, and the authors attributed the absence of *C. meadii* and other species that failed to establish at the restored sites to dispersal limitations.

In some locations, *Carex meadii* populations could be lost to natural successional processes. Rhoads and Block (2003) emphasized the importance of open habitat for the survival of the sedge. However, the most immediate threat facing New Jersey's sole population of *Carex meadii* is invasive plant species, particularly *Lonicera japonica* and *Microstegium vimineum*. Both of the exotic plants were noted as abundant at the site (NJNHP 2022). In open places, *L. japonica* can form a dense ground cover, competing with native plants both above ground and below. *M. vimineum* also competes with native species above ground, and decay of the annual grass can alter soil chemistry and nutrient cycling (Kaufman and Kaufman 2007).

Like many graminoid species, *Carex meadii* is susceptible to a smut fungus. Savchenko et al. (2013) described the fungus *Anthracoidea caricis-meadii* from *C. meadii* plants collected in Illinois, Iowa, and Wisconsin. *Anthracoidea* species parasitize several sedge genera and tend to be highly host-specific. In *Carex*, the sori occur in pistillate spikes or in the pistillate flowers of mixed spikes, forming hard bodies around the aborted achenes (Denchev et al. 2021). The fungal spores may be transmitted to nearby plants by wind or by insects (Ericson et al. 1993).

Smut fungi that attack the floral parts of graminoid species generally destroy the seeds entirely (Fisher 1953).

Although herbivory by deer poses a significant threat to many of New Jersey's rare plants it may not be a problem for *Carex meadii*. A study of how various plant species responded to grazing by bison and cattle found that *C. meadii* increased over time in response to grazing but decreased at ungrazed sites during the same period (Towne et al. 2005). Plants that are able to regrow from a basal meristem after they have been browsed have reduced susceptibility to herbivores (Begley-Miller 2014), and the sedge might benefit from the removal of other nearby vegetation. VanderWeide and Hartnett (2015) determined that grazing alone did not have a detrimental effect on Mead's Sedge, but plants that were simultaneously subjected to both browsing and drought produced fewer vegetative shoots.

Carex meadii may have some capacity to adapt to changing climactic conditions because the species apparently thrives in places where it is regularly exposed to both flooding and drought. However, the extent of the sedge's tolerance to extreme conditions has not been studied. While Diamond and Smeins (1985) indicated that the species was "positively correlated with precipitation and negatively correlated with temperature" no limits to those parameters were defined. If climate change renders some sites unsuitable for *C. meadii*, the species' ability to colonize new locations may be hampered by poor long-distance dispersal.

Management Summary and Recommendations

In the core of its range, *Carex meadii* is likely to benefit from the conservation of native prairie habitat although the species may need some assistance in order to reestablish at sites that have been restored. In peripheral parts of its range where the sedge is more likely to be imperiled (see Figure 3) and occurs in a wider variety of vegetative communities, active management may be required to maintain suitable habitat at some sites. In New Jersey, a site-specific plan for invasive species removal is needed. Additional strategies suggested for maintaining the appropriate successional stages in communities that support *C. meadii* include mowing or fire (PANHP 2019). Although Weakley (1966) identified fire suppression as a threat to communities in which *C. meadii* was dominant, Gibson (1988) conducted a tallgrass prairie management study and found no significant positive or negative relationships between the cover of the sedge and burning frequency.

The potential use of fire as a management tool for maintaining populations of *Carex meadii* is only one of the areas where species-specific research is needed. The sedge's ability to tolerate changing habitat and climactic conditions are poorly understood. While many studies have been conducted on early development in other *Carex* species (Alexeev 1988), no information was found regarding the germination and establishment requirements of *C. meadii*. Zimmerman (1972) included Mead's Sedge on a list of prairie plants for which special restoration techniques might be needed and—as discussed in the previous section—the sedge does not appear to readily reestablish on its own. An investigation of potential propagation methods for *C. meadii* using both seeds and vegetative material is recommended.

Synonyms

The accepted botanical name of the species is *Carex meadii* Dewey. Orthographic variants, synonyms, and common names are listed below (ITIS 2021, POWO 2022, USDA NRCS 2022b).

Botanical Synonyms	Common Names
Carex meadii var. *bebbii* Arthur	Mead's Sedge
Carex tetanica var. *meadii* (Dewey) L. H. Bailey	Mead Sedge
Carex douglasii f. *meadii* (Dewey) Kük.	Mead's Stiff Sedge
Carex panicea J. Care	

References

Alexeev, Yurii Evgeneevich. 1988. Ontogenesis in *Carex* species. Aquatic Botany 30(1–2): 39–48.

Begley-Miller, Danielle R., Andrew L. Hipp, Bethany H. Brown, Marlene Hahn, and Thomas P. Rooney. 2014. White-tailed deer are a biotic filter during community assembly, reducing species and phylogenetic diversity. AoB PLANTS 6: doi:10.1093/aobpla/plu030.

Britton, N. L. and A. Brown. 1913. An Illustrated Flora of the Northern United States and Canada in three volumes: Volume I (Ferns to Buckwheat). Second Edition. Reissued (unabridged and unaltered) in 1970 by Dover Publications, New York, NY. 680 pp.

Bryson, Charles T., Robert F. C. Naczi, and Sidney McDaniel. 1992. Notes on noteworthy records of *Carex* (Cyperaceae) from the southeastern United States. SIDA 15(1): 125–135.

Chen, Jiquan, Cynthia D. Huebner, Sari C. Saunders, and Bo Song. 2002. Plant distribution and diversity across an Ozark landscape. In S. R. Shifley and J. M. Kabrick (eds). Proceedings of the Second Missouri Ozark Forest Ecosystem Project Symposium: Post-treatment Results of the Landscape Experiment. General Technical Report NC-227. USDA Forest Service, North Central Forest Experiment Station, St. Paul, MN.

Clapham, A. R. 1936. Over-dispersion in grassland communities and the use of statistical methods in plant ecology. Journal of Ecology 24(1): 232–251.

Cruden, Robert William and David L. Lyon. 1985. Patterns of biomass allocation to male and female functions in plants with different mating systems. Oecologia 66(2): 299–306.

Denchev, Teodor T., Cvetomir M. Denchev, Jacob Koopman, Dominik Begerow, and Martin Kemler. 2021. Host specialization and molecular evidence support a distinct species of smut fungus, *Anthracoidea hallerianae* (Anthracoideaceae), on *Carex halleriana* (Cyperaceae). Willdenowia 51(1): 57–67.

Dewey, C. 1842. Article VIII. Caricography (Appendix, continued). The American Journal of Science and Arts 43: 90–92.

Diamond, David D. and Fred E. Smeins. 1985. Composition, classification and species response patterns of remnant tallgrass prairies in Texas. The American Midland Naturalist 113(2): 294–308.

Ericson, L., J. J. Burdon and A. Wennström. 1993. Inter-specific host hybrids and phalacrid beetles implicated in the local survival of smut pathogens. Oikos 68(3): 393–400.

Faber-Langendoen, D. and P. F. Maycock. 1987. Composition and soil-environment analysis of prairies on Walpole Island, southwestern Ontario. Canadian Journal of Botany 65: 2410–2419.

Faber-Langendoen, D. 2018. Northeast Regional Floristic Quality Assessment Tools for Wetland Assessments. NatureServe, Arlington, VA. 52 pp.

Fassett, Norman C. 1957. A Manual of Aquatic Plants. Second Edition. University of Wisconsin Press, Madison, WI. 405 pp.

Fay, M. J. and R. F. Thorne. 1953. Additions to the flora of Cedar County, Iowa. Proceedings of the Iowa Academy of Science 60(1): 122–130.

Fell, Egbert W. 1956. Notes on a new hybrid *Carex*. Rhodora 58(695): 318–320.

Fernald, M. L. 1950. Gray's Manual of Botany. Dioscorides Press, Portland, OR. 1632 pp.

Fischer, George W. 1953. Smuts that parasitize grasses. USDA Yearbook of Agriculture 1953: 280–284.

Frances, Anne (Principal Investigator). 2017. Prioritization and Conservation Status of Rare Plants in the North Atlantic - Final Report. Report prepared for NatureServe by the North Atlantic Landscape Conservation Cooperative, Hadley, MA. Available at https://www.natureserve.org/publications/prioritization-and-conservation-status-rare-plants-north-atlantic-final-report

Friedman, Jannice and Spencer H. C. Barrett. 2009. The consequences of monoecy and protogyny for mating in wind-pollinated *Carex*. New Phytologist 181: 489–987.

Gibson, David J. 1988. Regeneration and fluctuation of tallgrass prairie vegetation in response to burning frequency. Bulletin of the Torrey Botanical Club 115(1): 1–12.

Gleason, H. A. and A. Cronquist. 1991. Manual of Vascular Plants of Northeastern United States and Adjacent Canada. Second Edition. The New York Botanical Garden, Bronx, NY. 910 pp.

Goetghebeur, P. 1998. Cyperaceae. In Klaus Kubitzki and T. Stuzel (eds). The Families and Genera of Vascular Plants, Volume 4: Flowering Plants, Monocotyledons: Alismatanae and Commelinanae (Except Gramineae). Springer-Verlag, Berlin. 521 pp.

Harvey, LeRoy Harris. 1908. Floral succession in the prairie-grass formation of southeastern South Dakota. Botanical Gazette 46(2): 81–108.

Henwood, William D. 2010. Toward a strategy for the conservation and protection of the world's temperate grasslands. Great Plains Research 20: 121–134.

Hermann, Frederick J. 1936. The genus *Carex* in Kansas. The American Midland Naturalist 17(5): 849–865.

Hough, Mary Y. 1983. New Jersey Wild Plants. Harmony Press, Harmony, NJ. 414 pp.

ITIS (Integrated Taxonomic Information System). Accessed November 13, 2021 at http://www.itis.gov

Jog, Suneeti, Kelly Kindscher, Erin Questad, Bryan Foster, and Hillary Loring. 2006. Floristic quality as an indicator of native species diversity in managed grasslands. Natural Areas Journal 26(2): 149–167.

Johnston, Barry C. 2001. Field guide to sedge species of the Rocky Mountain region: The genus *Carex* in Colorado, Wyoming, western South Dakota, western Nebraska, and western Kansas. Publication R2-RR-01-03, USDA Forest Service, Rocky Mountain Region, Denver, CO. 319 pp.

Kartesz, J. T. 2015. The Biota of North America Program (BONAP). Taxonomic Data Center. (http://www.bonap.net/tdc). Chapel Hill, NC. [Maps generated from Kartesz, J. T. 2015. Floristic Synthesis of North America, Version 1.0. Biota of North America Program (BONAP) (in press)].

Kaufman, Sylvan Ramsey and Wallace Kaufman. 2007. Invasive Plants: Guide to the Impacts and Control of Common North American Species. Stackpole Books, Mechanicsburg, PA. 458 pp.

Keller, Ida A. and Stewardson Brown. 1905. Handbook of the Flora of Philadelphia and Vicinity. Philadelphia Botanical Club, Philadelphia, PA. 360 pp.

Kindscher, Kelly. 1994. Rockefeller Prairie: A case study on the use of plant guild classification of a tallgrass prairie. Proceedings of the Thirteenth North American Prairie Conference, Windsor, Ontario: 123–140.

Kirk, Donald A. 1994. Stone Road Alvar, Pelee Island: Management of an unusual oak savannah community type in the western Lake Erie archipelago. Proceedings of the Thirteenth North American Prairie Conference, Windsor, Ontario: 33–43.

Leck, M. A. and W. Schütz. 2005. Regeneration of Cyperaceae, with particular reference to seed ecology and seed banks. Perspectives in Plant Ecology, Evolution and Systematics 7: 95–133.

Littleton, John, Trent Rogers, and Deane Falcone. 2005. Novel approaches to plant drug discovery based on high throughput pharmacological screening and genetic manipulation. Life Sciences 78: 467–475.

Locklear, James H. 2017. Endemic plants of the central grassland of North America. Journal of the Botanical Research Institute of Texas 11(1): 193–234.

Mackenzie, Kenneth Kent. 1910. Notes on *Carex* - VI. Bulletin of the Torrey Botanical Club 37(5): 231–250.

Miller, Michael, Christopher I. Smith, Julie D. Jastrow, and James D. Bever. 1999. Mycorrhizal status of the genus *Carex* (Cyperaceae). American Journal of Botany 86(4): 547–553.

Morris, Michael Wayne, Charles T. Bryson, and Randy C. Warren. 1993. Rare vascular plants and associate plant communities from the Sand Creek chalk bluffs, Oktibbeha County, Mississippi. Castanea 58(4): 250–259.

Naczi, Robert F. C. and Charles T. Bryson. 1990. Noteworthy records of *Carex* (Cyperaceae) from the southeastern United States. Bartonia 56: 49–58.

NatureServe. 2022. NatureServe Explorer [web application]. NatureServe, Arlington, VA. Accessed November 23, 2022 at https://explorer.natureserve.org/

Nekola, Jeffrey C. and Thomas G. Lammers. 1989. Vascular flora of Brayton-Horsley Prairie: A remnant prairie and spring fen complex in eastern Iowa. Castanea 54(4): 238-254.

Newhouse, Bruce, Richard Brainerd, Keli Kuykendall, Barbara Wilson and Peter Zika. 1995. Ecology of the Genus *Carex* in the Eastside Ecosystem Management Project Area. Report prepared for the Eastside Ecosystem Management Project, USDA Forest Service, Walla Walla, WA. Available at https://www.fs.fed.us/r6/icbemp/science/newhousebruce.pdf

NJNHP (New Jersey Natural Heritage Program). 2010. Special Plants of NJ - Appendix I - Categories & Definitions. Site updated March 22, 2010. Available at https://nj.gov/dep/parksandforests/natural/docs/nhpcodes_2010.pdf

NJNHP (New Jersey Natural Heritage Program). 2022. Biotics 5 Database. NatureServe, Arlington, VA. Accessed February 1, 2022.

PANHP (Pennsylvania Natural Heritage Program). 2019. Species and Natural Features List. Fact sheet for *Carex meadii* available at https://www.naturalheritage.state.pa.us/factsheet.aspx?=15089

Platt, William J. 1975. The colonization and formation of equilibrium plant species associations on badger disturbances in a tall-grass prairie. Ecological Monographs 45(3): 285–305.

POWO. 2022. Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. Accessed November 22, 2022 at http://www.plantsoftheworldonline.org/

Rhoads, Ann F. and Timothy A. Block. 2003. Natural Resource Inventory and Management Recommendations, Whites Mill Property Salford Township, Montgomery County. Research Works (Botany). 3. Available at https://repository.upenn.edu/morrisarboretum_botanyworks/3

Rhoads, Ann Fowler and Timothy A. Block. 2007. The Plants of Pennsylvania. University of Pennsylvania Press, Philadelphia, PA. 1042 pp.

Romfh, Pete. 2016. Photo of *Carex meadii*. Courtesy of the Lady Bird Johnson Wildflower Center, https://www.wildflower.org/. Used with permission.

Rothrock, Paul E. and A. A. Reznicek. Page updated November 5, 2020. *Carex meadii* Dewey. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico [Online]. 22+ vols. New York and Oxford. Accessed November 22, 2022 at http://floranorthamerica.org/Carex_meadii

Ruch, Donald G., Byron G. Torke and Kemuel S. Badger. 2010. The vascular flora in three prairie cemeteries in Henry County, Indiana. Proceedings of the Indiana Academy of Science 119(1): 35–51.

Samson, Fred and Fritz Knopf. 1994. Prairie conservation in North America. Bioscience 44(6): 418–421.

Savchenko, Kyrylo G., Matthias Lutz, Marcin Piatek, Vasyl P. Heluta, and Eviatar Nevo. 2013. *Anthracoidea caricis-meadii* is a new North American smut fungus on *Carex* sect. *Paniceae*. Mycologia 105(1): 181–193.

Seabloom, Eric W. and Arnold G. van der Valk. 2003. Plant diversity, composition, and invasion of restored and natural prairie pothole wetlands: Implications for restoration. Wetlands 23(1): 1–12.

Taylor, Norman. 1915. Flora of the vicinity of New York - A contribution to plant geography. Memoirs of the New York Botanical Garden 5: 1–683.

Towne, E. Gene, David C. Hartnett, and Robert C. Cochran. 2005. Vegetation trends in tallgrass prairie from bison and cattle grazing. Ecological Applications 15(5): 1550–1559.

U. S. Army Corps of Engineers. 2020. National Wetland Plant List, version 3.5. https://cwbi-app.sec.usace.army.mil/nwpl_static/v34/home/home.html U. S. Army Corps of Engineers Research and Development Center, Cold Regions Research and Engineering Laboratory, Hanover, NH.

USDA, NRCS (U. S. Dept. of Agriculture, Natural Resources Conservation Service). 2022a. *Carex meadii* illustration from Britton, N. L. and A. Brown, 1913, An illustrated flora of the northern United States, Canada and the British Possessions, 3 vols., Kentucky Native Plant Society, New York, Scanned By Omnitek Inc. Image courtesy of The PLANTS Database (http://plants.usda.gov). National Plant Data Team, Greensboro, NC.

USDA, NRCS (U. S. Dept. of Agriculture, Natural Resources Conservation Service). 2022b. PLANTS profile for *Carex meadii* (Mead's Sedge). The PLANTS Database, National Plant Data Team, Greensboro, NC. Accessed November 23, 2022 at http://plants.usda.gov

VanderWeide, Benjamin L. and David C. Hartnett. 2015. Belowground bud bank response to grazing under severe, short-term drought. Oecologia 178(3): 795–806.

Van Hemessen, Will. 2020. Cover photo of *Carex meadii* from Ontario. Shared via iNaturalist at https://www.inaturalist.org/observations/48065142, licensed by https://creativecommons.org/licenses/by-nc/4.0/

Walz, Kathleen S., Linda Kelly, Karl Anderson and Jason L. Hafstad. 2018. Floristic Quality Assessment Index for Vascular Plants of New Jersey: Coefficient of Conservativism (CoC) Values for Species and Genera. New Jersey Department of Environmental Protection, New Jersey Forest Service, Office of Natural Lands Management, Trenton, NJ. Submitted to United States Environmental Protection Agency, Region 2, for State Wetlands Protection Development Grant, Section 104(B)(3); CFDA No. 66.461, CD97225809.

Weakley, A. S. 1996. *Sporobolus silveanus - Carex meadii* Grassland conservation status factors. NatureServe, Arlington, VA. Accessed November 27, 2022 at https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.689422/Sporobolus_silveanus_-_Carex_meadii_Grassland

Weakley, A. S. and Southeastern Flora Team. 2022. Flora of the Southeastern United States. University of North Carolina Herbarium, North Carolina Botanical Garden, Chapel Hill, NC. 2022 pp.

Zimmerman, James H. 1972. Propagation of spring prairie plants. In J. H. Zimmerman (ed.). Proceedings of the Second Midwest Prairie Conference, University of Wisconsin Arboretum and Institute for Environmental Studies, Madison, WI.

Zomlefer, Wendy B. 1994. Guide to Flowering Plant Families. University of North Carolina Press, Chapel Hill, North Carolina. 430 pp.

Żukowski, Waldemar, Agnieszka M. Bogdanowicz, and Marlena Lembicz. 2010. Seed germination in sedges: A short review. Biodiversity Research and Conservation 19(1): 15–22.