Carex cumulata

Clustered Sedge

Cyperaceae

Carex cumulata by John Scholze, 2016

***Carex cumulata* 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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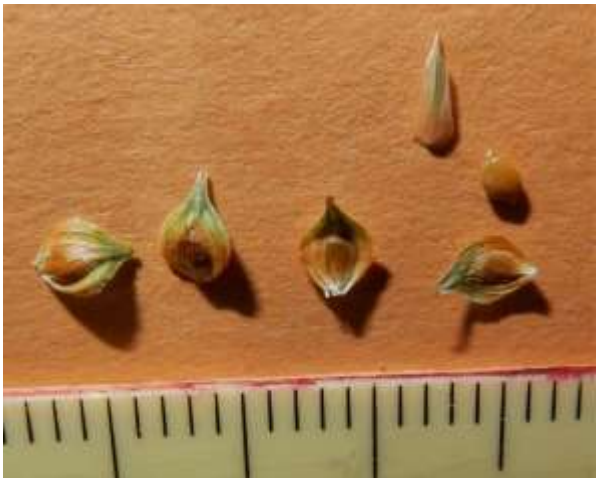
Life History

Carex cumulata (Clustered Sedge) is a rhizomatous perennial that grows in dense tufts. Stems usually range between 4–8 dm in height, having a waxy, whitish coating on the surface and sheaths that are green nearly to the top. The stems are stiff and bear 2–4 firm leaves which are 3–6 mm wide and shorter than the stems. *C. cumulata* plants may also have short, compact, vegetative stems at the base. The inflorescence is a crowded cluster of 3–10(–30) conic-ovoid spikes that are rounded near the base and pointed at the tip. Perigynia are greenish to dark brown, wide, and broadly winged with inconspicuous or absent veins on the upper (inner) side. Flowering and fruiting take place between June and September. (see Mastrogiuseppe et al. 2020, Arsenault et al. 2013, Gleason and Cronquist 1991, Fernald 1950).

C. cumulata falls within *Carex* section Ovales, which includes about 85 species worldwide (Weakley 2015) and has been described as having "*a deserved reputation for being taxonomically difficult*" (Rothrock and Reznicek 1996). *Carex cumulata* was initially considered a variety of *C. straminea*, and was later named as a variety of *C. albolutescens* (Britton and Brown 1913, Mackenzie 1922, Long 1924). On the basis of a number of differences from *C. albolutescens*—including presence/absence of ventral nerves on the perigynia, density and color of the spikes, and sheath characteristics— Mackenzie (1922) argued that *C. cumulata* should be ranked as a species. The suggestion soon received support (Long 1924), and later research by Rothrock and Reznicek (1996) further supported the split with the finding that *C. cumulata* and *C. albolutescens* had different chromosome numbers. Mature fruits are required for identification of the sedges in section Ovales, and Mastrogiuseppe et al. (2020) suggest using perigynia from about 1/3 of the spike length and looking at several samples for an accurate determination.

Despite the visual similarity of the species in section Ovales, *Carex cumulata* has some distinctive characteristics that may aid in identification. Standley (2011) emphasized the sedge's preference for dry habitats and its dense aggregation of spikelets, and Schori (undated) pointed out that the plant's stiffly upright habit combined with its rosettes of yellow-green basal leaves was unusual and eye-catching.

Plant habit (Deacon 2015).



Seeds (Scholze 2016).

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, Yano et al. 2015). 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 *Carex cumulata*, although no explicit studies were found.

In nearly all sedges, the female flowers develop before the male flowers (protogyny) and the lowest flowers on a spike 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* is an achene enfolded in a sac-like scale (perigynium) which is dispersed as a unit and hence may be treated as seed. The perigynia of *Carex cumulata* are flat and widest above the middle with winged margins and a distinct beak that ends in a pair of fine teeth. They are 3–4.2 mm long and 2–3.2 mm wide, and the enclosed achenes are 1.7–1.9 mm long and 1.1–1.3 mm wide (Arsenault et al. 2013).

No specific information was found about dispersal in *Carex cumulata*. 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). Żukowski et al. (2010) suggested that gravity was the primary dispersal mechanism for sedges. Some characteristics of *C. cumulata* seeds such as wings and a high surface:volume ratio are frequently indicative of wind dispersal (Howe and Smallwood 1982), and gravity dispersal may be supplemented by wind in open environments (Nathan et al. 2008). Animal-mediated dispersal is another possibility. 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).

The longevity and germination requirements of *C. cumulata* seeds are presently undocumented. Once the seeds have been dispersed, some extended persistence in the soil may be inferred from the species' rapid regeneration following disturbance (Lezberg et al. 2006, Schori undated).

Habitat

Carex cumulata most frequently occurs in habitats with an open canopy and a dry sandy or rocky substrate. Elevations range from 0–300 meters (Mastrogiuseppe et al. 2020). Throughout its

range Clustered Sedge has been reported from a wide array of natural communities including sandy dunes or barrens, sand flatwoods, rocky ridges, acid ledges, talus slopes and cliffs, open woodlands or wood edges, heathlands, and thickets (Arsenault et al. 2013, Campbell and Eastman 1980, Catling et al. 2008, Fernald 1921, Marcum et al. 2021, Nichols and Hoy 2014, NYNHP 2009, Phillippe et al. 2011, Rhoads and Block 2007). *C. cumulata* may also grow in disturbed sites such as abandoned railroad beds, roadsides, gravel pits, powerline corridors, or old agricultural fields (Arsenault et al. 2013, Campbell and Eastman 1980, Nichols 1995, Phillippe et al. 2011, Rhoads and Block 2007) and it has been noted in recently burned areas with shallow soils and exposed bedrock (NYNHP 2009). The sedge has sometimes been found in wetter situations including shrub swamps in New York (NYNHP 2009), wet to mesic sand prairies in Illinois (Phillippe et al. 2011), dry to wet acid barrens and glades in the southeastern United States (Weakley 2015), and the drier portions of a mossy bog border in Nova Scotia (Fernald 1921).

Few habitat details are available for New Jersey's historic occurrences, but two of them were noted as being on either damp soil or wet ground and another was associated with a railroad corridor. The state's extant occurrences are growing on thin, dry soils over bedrock, and the more vigorous of the two populations is located on a site that had been disturbed by the development of a utility right-of-way (NJNHP 2022).

Carex cumulata seems to rely on periodic disturbance to maintain the habitat conditions that it favors. When Nichols and Hoy (2014) relocated the sedge at a New Hampshire site where it had previously been collected by Fernald in 1931, the population was found in a Pitch Pine (*Pinus rigida*) rocky ridge community where the open canopy was maintained by periodic fires. *C. cumulata*'s positive response to fire indicates that fluctuations in population size should be expected for the species (NYNHP 2009). Although the plant is seldom abundant, populations have been known to increase very rapidly following a fire and then taper off as brushy cover becomes re-established (Schori undated). Clustered Sedge has also been reported to re-colonize an area following mechanical canopy disturbance (Lezberg et al. 2006).

Wetland Indicator Status

Carex cumulata is a facultative upland species, meaning that it usually occurs in nonwetlands but may occur in wetlands (U. S. Army Corps of Engineers 2020).

USDA Plants Code (USDA, NRCS 2022)

CACU3

Coefficient of Conservatism (Walz et al., 2018)

CoC = 8. 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 global range of *Carex cumulata* is restricted to North America (POWO 2022). The map in Figure 1 shows the extent of the species in the United States and Canada. Although the map indicates that *C. cumulata* is historic in New Jersey, it was recently (2014 and 2015) found at two new locations in the state (NJNHP 2022).

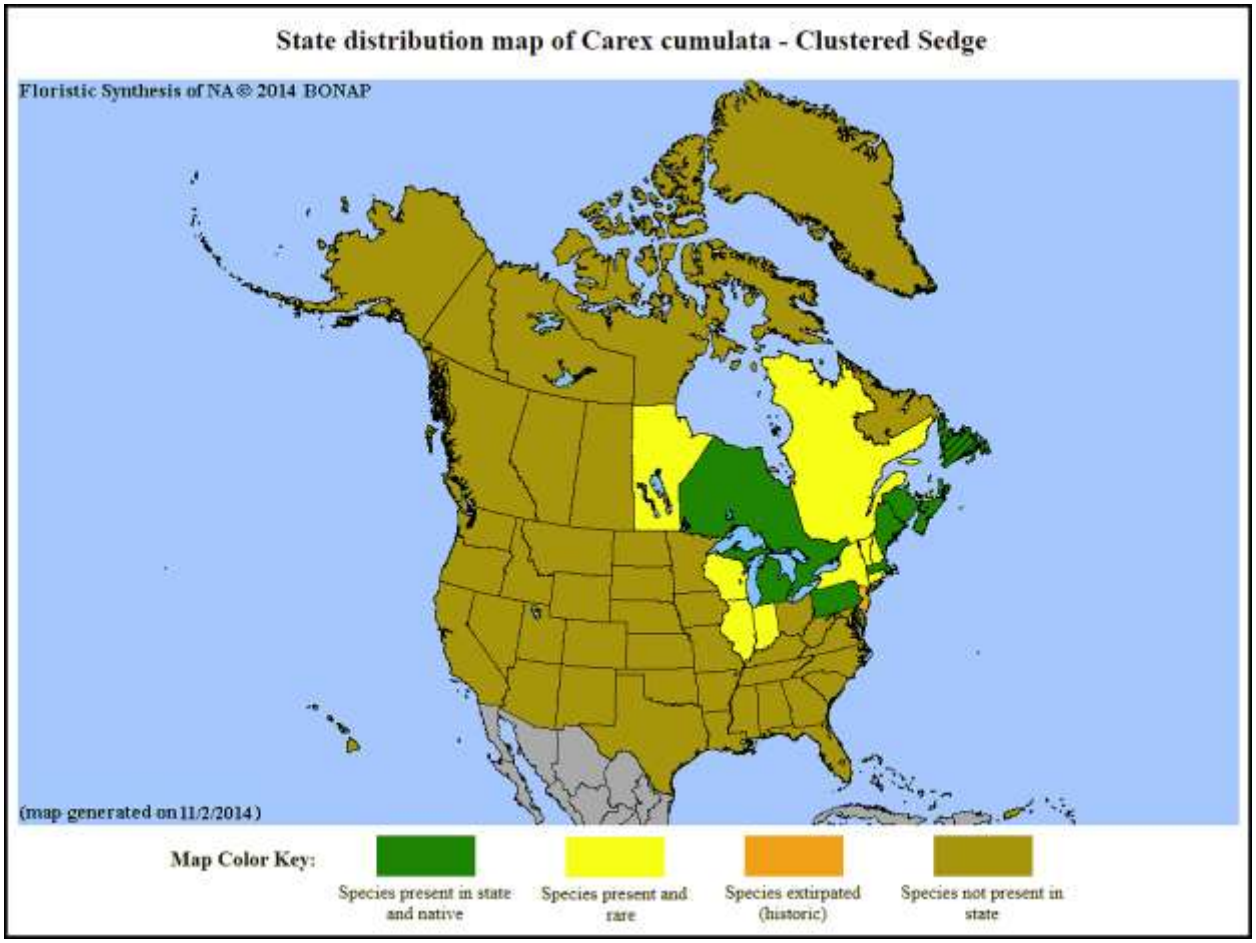


Figure 1. Distribution of C. cumulata in North America, adapted from BONAP (Kartesz 2015).

The USDA PLANTS Database (2022) shows records of *Carex cumulata* for three New Jersey counties: Atlantic, Camden, and Monmouth (Figure 2, below). The data are all based on historic observations and do not reflect the present distribution of the species. The two extant occurrences are located in Passaic County (NJNHP 2022).

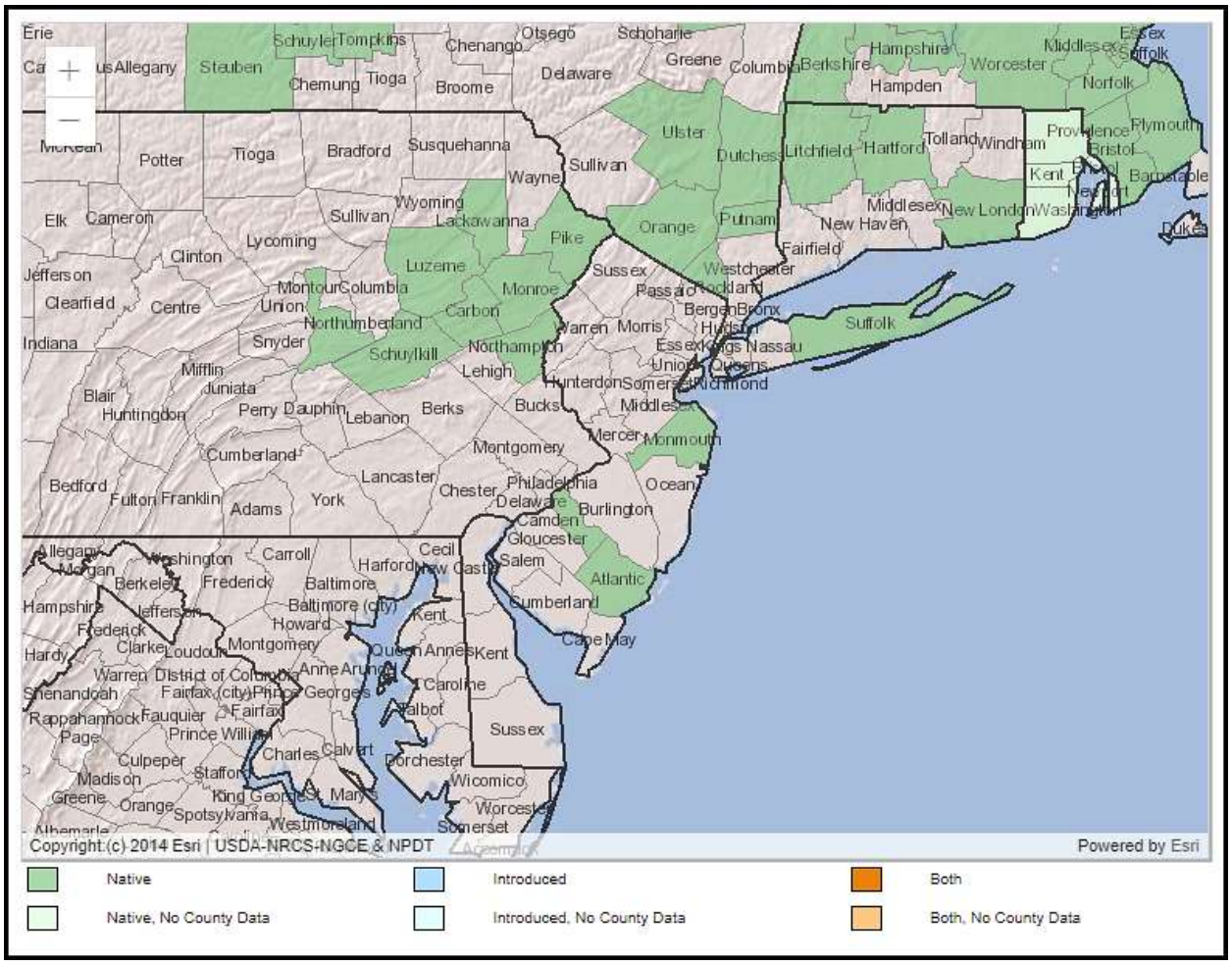


Figure 2. County records of C. cumulata in New Jersey and vicinity (USDA NRCS 2022).

Conservation Status

Carex cumulata 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. cumulata* throughout its range. The sedge is critically imperiled (very high risk of extinction) in five states and two provinces, imperiled (high risk of extinction) in four states, vulnerable (moderate risk of extinction) in one state, and possibly extirpated in Manitoba. *C. cumulata* is apparently secure in three provinces and one state, and is unranked in Pennsylvania. Although not shown on the NatureServe map, the species also occurs in Maine (Campbell and Eastman 1980, Arsenault et al. 2013).

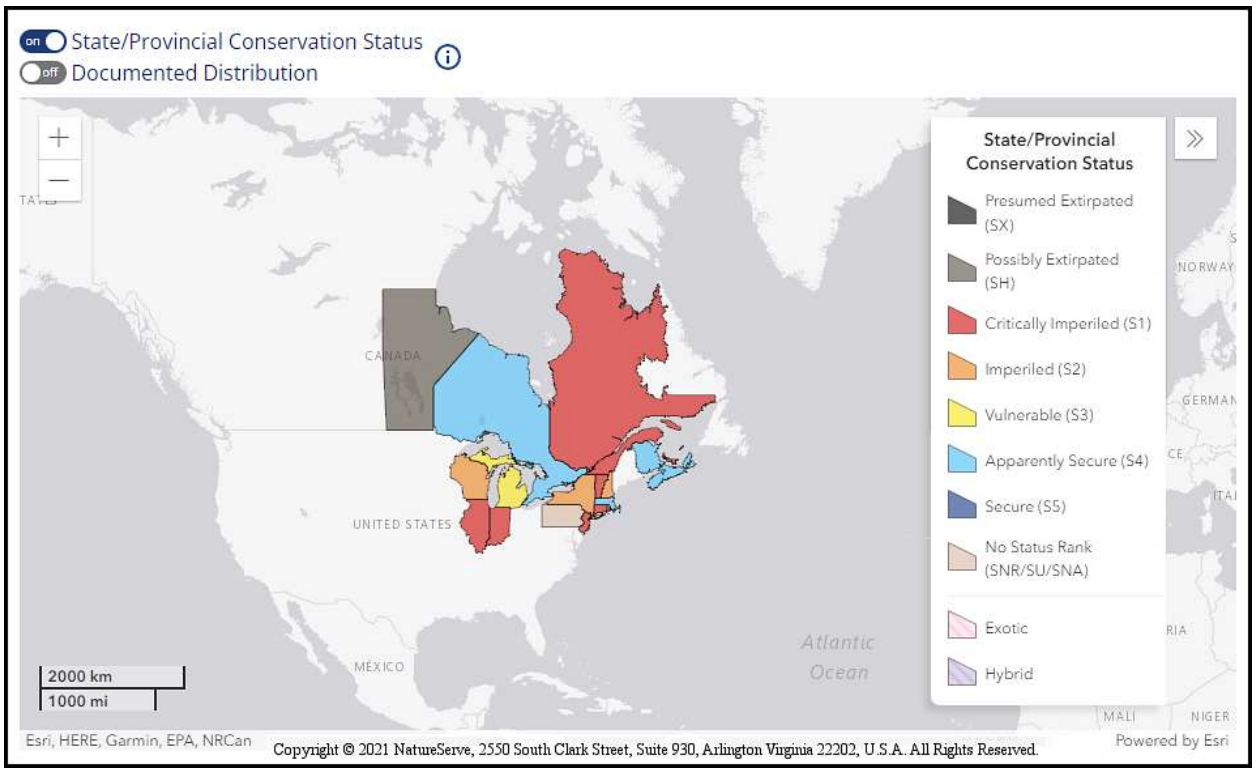


Figure 3. Conservation status of C. cumulata in North America (NatureServe 2022).

Carex cumulata is critically imperiled (S1) in New Jersey (NJNHP 2022). The 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. cumulata* 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 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 in the New Jersey Pinelands (LP) (NJNHP 2010).

Although *C. cumulata* was collected from several New Jersey locations during the early part of the twentieth century, the last documented occurrence from the southern part of the state was made in 1942 (NJNHP 2022). By 1984 the species was not known from any extant stations in the state (NJ ONLM 1984) and it was considered historic until two populations were discovered during the past decade. The extant occurrences have estimated viability ranks of 'Excellent' and 'Fair' (NJNHP 2022).

Threats

Plants like *Carex cumulata* that rely on disturbance to maintain open habitats are generally perceived as poor competitors, but it is unclear whether the sedge's persistence is limited by

competition for light or another resource. While succession evidently imperils individual occurrences, the long-range extent of the threat cannot be evaluated without a better understanding of the species' longevity in the seed bank. Suppression of natural disturbance regimes could interfere with the regular regeneration cycles of *C. cumulata*.

Depending on the location, upland habitats may be subjected to impacts from high levels of human activity. Trampling may directly damage plants or increase soil erosion, and litter was cited as a threat at a New Hampshire site particularly due to accumulations of broken glass in rock crevices (Nichols and Hoy 2014).

An assessment of rare species in Illinois, another state where *C. cumulata* is critically imperiled, concluded that the sedge is moderately vulnerable to climate change (Molano-Flores et al. 2019). A vulnerability score of Moderate indicates that the abundance or range of the species within that state is likely to decrease by 2050. In New Jersey, shifting weather patterns are expected to increase the intensity of both floods and droughts (USEPA 2016) so the impact on *Carex cumulata* may be site specific. Droughts may help to slow succession at some sites, but flooding may increase erosion or alter community composition at others.

Management Summary and Recommendations

Sedges in the genus *Carex* display a wide range of seed bank longevity and germination requirements (Leck and Schütz 2005, Schütz 2000, Żukowski et al. 2010), so reliable inferences cannot be made regarding *C. cumulata*. Because Clustered Sedge is at the southeastern edge of its range in New Jersey, a comprehensive understanding of the species' dispersal and establishment mechanisms is critical for preservation and management planning. Conservation of populations at the edge of a species' range is of particular importance because they may be more vulnerable to extinction due to higher rates of isolation (Bahn et al. 2006), and also because they may prove to be an important source of information regarding the plant's ability to adapt to changing conditions (Rehm et al. 2015).

Carex cumulata has been cited as a species for which human disturbances may play an important role in maintaining appropriate habitat (Phillippe et al. 2011). In New Jersey and other states or provinces where *C. cumulata* is a peripheral species, strategies to slow successional processes and maintain an open community could help to preserve extant populations of the imperiled sedge and buy additional time to learn more about the species ecological requirements. Regular monitoring of extant occurrences to evaluate the condition of both the species and its habitat are recommended.

Seed dispersal, longevity, and germination requirements are all important research topics for *Carex cumulata*. A better understanding of what limits the species' success in competitive environments would also be helpful. In the past, sedges were generally thought to be non-mycorrhizal but more recent investigations have shown that many are (Miller et al. 1999, Muthukumar et al. 2004) and it would be useful to know whether *Carex cumulata* relies on any such associations. Finally, while no specific reports of herbivory were found for the sedge it is a widespread problem for many native plant species in New Jersey and documentation of whether

or not browsing damage is observed during routine surveys could determine whether that is a subject requiring additional attention in the future.

Synonyms

The accepted botanical name of the species is *Carex cumulata* (L. H. Bailey) Fernald. Orthographic variants, synonyms, and common names are listed below (ITIS 2021, USDA 2022, POWO 2022, Arsenault et al. 2013, Schori undated).

Botanical Synonyms	Common Names
Carex cumulata (Bailey) Mackenzie	Clustered Sedge
Carex cumulata f. *soluta* Fernald	Piled-up Sedge
Carex albolutescens var. *cumulata* (L. H. Bailey) L. H. Bailey	Crowded Oval Sedge
Carex straminea var. *cumulata* L. H. Bailey	Dense Sedge

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